FINAL: Chittenden County, VT Natural Resources Analysis

On January 25, 2012 the Steering Committee accepted these Analysis Reports with the understanding that that as a part of the final ECOS product they remain open for amendment until the whole product is finalized.

1/25/2012

An ECOS Analysis Report

This report provides an analysis of the natural resources of Chittenden County, the trends that have emerged, and recommendations for actions related to natural resource management and protection that support the sustained long term health, function and value of these resources.

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FINAL: Chittenden County, VT Natural Resources Analysis

AN ECOS ANALYSIS REPORT

I. INTRODUCTION

The ECOS Project Steering Committee is a broadly-based 60+ member partnership committed to implementing strategies to improve Chittenden County's long-term sustainability: economically, environmentally and socially. The Steering Committee has committed to a five-phase project:

- Adopt common goal statements.
- Analyze reports regarding economic development, housing, energy, land use and transportation, natural resources and health/human services/education.
- Develop indicators tied to the goal statements.
- Prioritize implementation actions for the next five, ten and twenty years.
- Invest in high priority implementation actions.

The results will inform regional, municipal and other plans as they are updated.

This report is part of ECOS' Phase Two and provides an analysis of the natural resources of Chittenden County and the trends that have emerged. It reflects mapped natural resource layers and includes an examination of available data resources, reports and studies that help quantify the status of natural resources in the County. The resources are discussed and grouped in four categories: 1) Ecological Systems and Biodiversity, 2) Air Quality, 3) Working Landscapes, and 4) Scenic Resources.

This report provides a baseline of information and understanding for identifying action items and preparing indicators that will help gauge our progress. The action items and indicators developed for natural resources will be geared toward nine goals that have been established for the ECOS project:

- Conserve, protect and improve the health of native plant, fish, and wildlife habitats.
- Conserve water resources and aquatic ecosystems; use clean water appropriately; protect and improve water quality, addressing Federal and State-identified pollutants of concern.
- Decrease materials consumption and increase the use of renewable resources, resource recovery and recycling.
- Enable equitable access to and appropriate use of open land and recreational resources, both public and private.

- Improve collaboration with neighboring communities, counties, and state regarding protection of important natural features and environmental systems.
- Preserve native soils and clean up contaminated soils.
- Protect and enhance working landscapes specifically sustainable agricultural (including local food production) and forestry land uses.
- Protect the valued scenic and recreational resources of the mountains, forests, lakes, rivers, and other natural areas.
- Reduce emissions of Federal and State-identified local and global air pollutants, and greenhouse gases.

The ECOS Working Group in Natural Resources identified a number of concerns and areas of focus in relation to natural resources and the health of the overall Lake Champlain watershed within which the region is located. One key consideration, and relevant for overall sustainability, is the interconnectedness of human actions, natural forces and ecological health. The severity and impact of recent storm events in 2011 has highlighted this relationship. Weather and climate could pose new challenges for managing the interface between the built and natural environments. Another key consideration for this effort was to include quantifiable measurements or data as an important basis for developing action items to assess overall progress.

II. REPORT HIGHLIGHTS

The Natural Resource Analysis includes sections on Ecological Systems & Biodiversity, Air Quality, Working Landscape, and Scenic Resources. These areas of focus are interrelated in a number of ways, but the primary connectivity between these categories is that they all affect and operate within the local and regional landscape. Each of these categories have economic, ecological and cultural values, and yet ultimately are interconnected by virtue of their relationship to human activities on the landscape.

There are a number of examples of the interrelationships. Where scenic resources are related to the natural and settled landscape, it is most often the case that ecological systems (unfragmented forests or higher elevation habitats and ecologies) or working landscape conditions (agricultural lands, managed forests) are present and operant as well. Air quality is influenced in part by landscape conditions. When lands are protected and preserved, roads and corresponding development sprawl is prevented. Less sprawl equals fewer vehicular trips with the corresponding impact on air quality. In Vermont, air quality is often affected by emissions from fossil fuel powered vehicles. Air quality and acid rain, although generated outside of the region, have also affected high elevation forest health in the Green Mountains, which form the eastern boundary of Chittenden County.

Another relationship exists between working landscapes and environmental quality. For example, phosphorous runoff from the fertilization of croplands must be reduced substantially if not eliminated to improve the water quality of Lake Champlain and to end algal blooms, which affect recreational use of such waters. Stormwater runoff and lake water quality also can impact drinking

water taken from the lake, requiring specific types of chemical treatment. Zebra mussels have affected freshwater intake systems, and lamprey eels have impacted native fisheries. Thus, the elimination of invasive species by promoting healthy, native populations and ecological systems reduces aesthetic, economic and quality of life impacts. These examples readily indicate that there is an ongoing relationship between the working landscape, ecological health, scenic resources and air quality.

The following list provides a summary of the key data and trends identified for each resource type, which are discussed in the sections that follow. For source information and additional information about the data or trend, please refer to the corresponding section of this report.

A. ECOLOGICAL SYSTEMS & BIODIVERSITY

1. WATER QUALITY DATA/TRENDS

- Phosphorus levels in Lake Champlain have remained constant although still high. Phosphates in major tributaries are decreasing.
- Non point phosphorus loading from streams to the main section of Lake Champlain are recorded at 139 metric tons (2002-2007) far above the target of 51.3 metric tons indicating unsustainable land use practices, planning goals and regulations.
- Nonpoint source runoff loads are increasing while loads from wastewater treatment plants have improved.
- Impervious cover has increased.
- Reduced forest land cover and unsustainable agriculture and stormwater practices are the most significant contributors to phosphorus and sediment runoff into surface waters
- Tons of refuse disposed in Chittenden County has been declining over the last 5 years, while the amount of recycled materials has increased.
- Other pollutants like mercury and chloride are increasing, and new generation contaminants continue to be detected.
- Unbuffered shoreline and edge stream development is a significant stressor on water quality and habitat.
- Most rivers (75% of Vermont streams) have deeper, straighter and armored channels and no longer have access to historic floodplains.

2. FOREST COVER & FRAGMENTATION DATA/TRENDS

- Subdivision, parcelization, fragmentation and conversion of forestland are the biggest threat to water quality, habitat, working landscapes and overall health of Chittenden County's natural systems.
- Over three-quarters of land in Chittenden County is in private ownership, with more than half associated with a dwelling.

- 17% of Chittenden County is conserved land, 87% of which is available for public access.
- Chittenden County has lost over 25% of its core forest, which provides ideal habitat for wildlife species that are particularly sensitive to human disturbance, such as bear or moose.

3. HABITAT & BIODIVERSITY DATA/TRENDS

- Invasive species have dramatically increased.
- The impact of climate change on natural systems is an emerging issue, but more research is needed to understand the specifics of what, where and how.
- Temperature and precipitation levels are steadily increasing.
- All towns in Chittenden County have a municipal plan that highlight the general importance

1959 AERIAL VIEW OF WHERE EXIT 16 AND I-89 ARE NOW LOCATED. THE DRIVE-IN THEATER ON THE LEFT IS WHERE MCDONALD'S AND BURGER KING ARE NOW. THE SAND OR GRAVEL PIT ACROSS THE ROAD IS NOW THE QUARRY. THE HOUSE IN THE CENTER STILL STANDS AT THE CORNER OF RTE 7 AND LOWER MOUNTAIN VIEW DRIVE, IN FRONT OF THE HAMPTON INN. THE LANDSCAPE HAS CHANGED SIGNIFICANTLY IN 50 YEARS WITH SUBSTANTIAL NEW DEVELOPMENT.

(SOURCE: UVM LANDSCAPE CHANGE PROGRAM, EVERETT D. TUCKER, VERMONT DEPARTMENT OF HIGHWAYS)

of natural and scenic resources. However, there is little specificity and little or no recognition of climate change and its effect on water quality, working landscapes or aquatic and terrestrial ecosystems.

B. AIR QUALITY

- Air quality monitoring confirms that Chittenden County's air quality meets the National Ambient Air Quality Standards (NAAQS), the federal regulations that set the maximum acceptable pollutant levels. But ground-level ozone levels are close to the current national standard and fine particle pollution (PM2.5) has approached the standard in recent years. Current ozone levels exceed the stricter standard recently proposed by the US Environmental Protection Agency.
- Transportation is the single largest source of greenhouse gas emissions in the state (44%).
- 71% of Chittenden County household trips are made by car.
- Over 75% of employees residing in the Chittenden County drive alone to work.

C. WORKING LANDSCAPE

- The conversion of farms and forestland for development has increased dramatically, far outpacing population growth.
- Although the number of farms has increased, the amount of acres in farmland has significantly decreased. This is attributable to the rise in local food production.
- Chittenden County lost nearly half its dairy farms in a 10-year period (1997-2007).
- The way land is owned and managed has changed. The number of parcels has gone up, while their size has gone down, contributing significantly to parcelization and fragmentation. The average parcel size in Chittenden County is 6.93 acres, while the parcel size that occurs most frequently (or mode) is 1 acre. The number of parcels greater than 50 acres (a size considered economically and ecologically viable) decreased by 1% between 2003 and 2009.

D. SCENIC RESOURCES

- While about 85% of Chittenden County municipalities recognize the importance of scenic resources, only 16% provide specific guidelines and standards for protecting identified resources.

- There is low compatibility between municipal plan recommendations for natural and scenic resources and the implementation of those recommendations through zoning bylaws and subdivision regulation.

III. ECOLOGICAL SYSTEMS & BIODIVERSITY

Ecological systems thinking is a multidisciplinary, holistic approach to understanding our natural and built environment, in which we look at the complex relationships between living elements (such as vegetation and soil organisms) and nonliving elements (such as water and air) of a particular area to understand the aggregate whole or ecosystem. In turn, we can expand our understanding

A Note Regarding Climate Change

There is no question among most scientists and governmental authorities that climate change will have an effect on the natural resource base and its function in Chittenden County and the state as whole. Weather patterns are becoming less predictable based on historic averages and temperature regimes are being affected as a result of climate change. These conditions, in turn, have a direct or indirect impact on a range of natural resource factors including, for example: 1) impacts from major storm events (and their frequency) on streams, lakes and Lake Champlain from increased runoff volume, velocity and the suspended pollutants and sediments it carries; 2) shifting in vegetation patterns and local species diversity from warmer temperature regimes; and 3) a consequent increase in threats to both forest and aquatic ecology from warmer temperatures. For example, September 2011 registered temperatures 3.5 degrees above the norm in Burlington. Rainfall (including melted snow) thus far in 2011 has substantially exceeded yearly amounts for the region, and studies conducted by climate scientists are finding that the extent of snowpack and ice cover on lakes in Northern New England has been steadily reduced (a reduction of 4 weeks in ice cover on some lakes being monitored). These conditions affect everything from the duration of the maple-sugaring season to the demonstrated success of invasive species in taking hold in some habitats in the state and county.
(Sources: Vermont Agency of Natural Resources. *The Climate Connection*. (Summer 2011) www.anr.state.vt.us/anr/climatechange/Newsletter.html and Betts, Alan, K. (2011) *Climate Change in Vermont*. Air Pollution Control Division, State of Vermont).

Climate change also has a direct affect on air quality from the increase in atmospheric warmth and moisture and as a result of ongoing increases in carbon dioxide and airborne pollutants. Greenhouse gas emissions and sources are being monitored by Northeast Climate Impact Assessment and have been inventoried as of 2010 by the Vermont Agency of Natural Resources in the *Vermont Greenhouse Gas Emissions Inventory Update 1990-2008*. Unless we are prepared to live with the impacts that elevated greenhouse gas emissions will have, these trends must be addressed in multi-faceted ways that include lifestyle changes, built environment conditions and how energy is produced and consumed. Thus, it is clear that climate change must be considered as a background dynamic to understanding, analyzing and addressing natural resource data and trends for future sustainability.

by looking at the relationships or connectivity between different ecosystem types within a broad landscape.

This systems approach helps us to identify and measure the impacts of large-scale ecosystem(s) changes, such as climate change or air or water pollution. It can also help us to pinpoint more precisely the source of such adverse changes. With these insights we, as the dominant species responsible for many significant landscape-wide changes, can consciously adjust our actions in a measured fashion in support of ecosystem health.

A. WATER QUALITY

Water is a limited resource that is essential to life. While Vermont supports a scenic network of freshwater lakes, rivers, streams, and wetlands, pollution from multiple sources continue to compromise both surface and groundwater water quality.

In general, water is compromised by human created contaminants, such as petroleum hydrocarbons or automobile fuels, or natural contaminants, such as algae blooms. Pollution, discharged into water bodies, originates from identifiable or “point” sources (such as a sewage treatment plant or storm drain), and “non-point” sources or diffuse contamination originating from a non-discrete source (such as agricultural field or road runoff). Water is referred to as polluted when it is deemed non-drinkable or is unable to support organisms suitable to the ecosystem.

Water quality is defined as the ability of a water body to support all appropriate beneficial uses, such as drinking, swimming, or fishing, without harming human or aquatic life. Physical, chemical and biological measurements are used to quantitatively assess water quality. Water quality standards, are based upon maximum levels for pollutants, such as bacteria, and minimum levels for necessary substances, such as dissolved oxygen, according to its beneficial use. Mandated by the Clean Water Act, water quality standards are vital for regulating water pollution, and ensuring access to clean water.

Management of water quality and achieving identified water quality standards in the region’s lakes, rivers and streams includes 4 primary areas of focus:

- **Water Quality Standards** are set for streams, ponds and lakes to ensure that surface waters are improved in their ability to support biological diversity, sustainable fisheries, water based recreation, and to continue to serve as a source of drinking water for the region’s population.
- **Watershed Management** in the basin/county to address water quality concerns at a watershed scale. Critical areas for watershed management include: A) control of development footprint to reduce sprawl and the consequent dilution and degradation of landscape functions which contribute to and aid in the maintenance of environmental and population health, B) reduction of impervious cover to allow stormwater sufficient areas for absorption capacity and filtration, and the impacts of treatment on unregulated stormwater; and, C) management and improvement of agricultural practices.
- **Flood Hazard Areas and River Geomorphology**. Given the recent impact of floodwaters from extreme storm events, the stable geomorphological and riparian conditions of streams and

lakeshores have become even more critical in terms of ensuring the maintenance of their functions and values. Avoidance of human encroachment in riparian areas enable natural stream flows, which result in reduced erosion and increased capacity to absorb the natural forces of floodwaters. Narrow or channelized sections/reaches increase risks and frequencies of flooding and consequent damage to the natural and built environment.

- **Wetlands Protection.** Maintenance and enhancement of wetland ecosystems including the identification of groundwater conditions and threats. If land use/resource management is to be sustainable over the long term, wetland acreage must be maintained, increased and connected to replace capacities lost to development and to provide improved capabilities and capacities for wetland functions.

1. WATER QUALITY DATA/TRENDS

- The impact of climate change on water quality is an emerging issue. Climate change can impact air and water temperatures and precipitation patterns. This can cause alterations to water quality, hydrology, stream morphology and water availability, resulting in impacts to ecological integrity and human infrastructure.[1]
- 30.64 miles or 24% of shorelines of named water bodies/lakes/ponds in Chittenden County are conserved (including Lake Champlain).[(2)(3)]
- 280.63 miles or 18% of rivers/streams in Chittenden County flow through conserved land.[(2)(3)]
- 382.21 miles or 25% of rivers/streams in Chittenden County flow through cultivated land.[(2)(3)]
- 813.12 miles or 53% of rivers/streams in Chittenden County flow through forested land.[(2)(3)]
- 60.13 miles or 4% of all streams miles within Chittenden County are considered impaired – 10.89 miles or 18% of impaired streams flow through conserved land.[(2)(3)]
- Mapped wetlands in Chittenden County decreased by approximately 4,954 acres or 1.25% from 1992 to 2006 based on USGS National land cover data.[2]
- Impervious cover in Chittenden County increased by approximately 17,094 acres or 4.3% from 1992 to 2006 based on USGS National impervious surfaces data.[2]
- Average phosphorus levels have remained constant in recent years in Lake Champlain but are still very high, and are deteriorating water quality and aquatic ecosystems in some areas (e.g. Mallets Bay).[4]
- Non point phosphorus loading from streams to the main section of Lake Champlain are recorded at 139 metric tons (2002-2007) far above the target of 51.3 metric tons indicating unsustainable land use practices, planning goals and regulations.[4]
- Development is the most significant contributor to phosphorus and runoff.[4]
- Beach closure days, being an indicator of lake health, have been low overall but high in some areas (e.g. Mallets Bay) – no trend data available.[4]

- The level of cyanobacteria, or blue-green algae, in the lake has been rated fair based on alert level averages and a 3 tiered ranking scale of poor-fair-good – no trend data available.[4]
- New generation contaminants or chemicals have been detected in the lake at low levels and more research is needed.[4]
- Fish consumption advisories due to toxins (i.e. mercury) have been ranked 'fair' in each of the 5 major segments of Lake Champlain. A ranking of 'fair' indicates a lakewide contaminant advisory that affects a segment (versus a 'poor' ranking which includes an additional advisory that is specific to the lake segment or an area within the lake segment). A regional TMDL of 98% was approved in 2001 to reduce contamination in the Northeast.[4]
- Deposition of pollutants (mercury and low pH) from the atmosphere is principally responsible for the impairment of fish consumption uses.[1]
- Mercury has increased in the environment by a factor of 2 to 4 as a consequence of human activities. Much of the mercury in the Lake Champlain watershed is airborne from coal-fired power plants in the Midwest.[5]
- Of the nearly 1,400 assessed river miles in Vermont through Ecosystem Restoration Program, nearly 75% are incised or confined to deeper, straighter channels and no longer have access to historic floodplains.[1]
- Without sufficient functioning floodplains and enough river meander length, lakes and reservoirs receive the bulk of the water, woody debris, eroded soil and nutrients. This [i]ncreases eutrophication and algae along the shores and bays such as that seen in Lake Champlain while decreasing instream biological conditions and local watershed recharge rates.[1]
- Other than Act 250 development permit conditions, there are no statewide vegetated buffer requirements as there are in all other New England states. As a result, many miles and acres of surfa[c]e waters are negatively influenced by developed land runoff, sediment, increased temperature, fertilizers, manure, and other pollutants.[1]
- Of the 19 municipalities that comprise Chittenden County, 14 have zoning regulations that include completed mapped fluvial erosion hazard (FEH) [ar]eas as of May 2010. Each of these municipalities have wetland and surface water setbacks, and 13 contain a floodplain district. As a result, the FEH areas in the southern portion of Chittenden County are currently 'covered' either by water quality setbacks or floodplain districts. But only two towns specifically regulate FEH areas (see Table 1 and 2 that follow).[7]
- Unbuffered lakeshore development is a significant stressor in Chittenden County - when greater than 49% of the shoreline of a lake is unbuffered, a lake is considered to be in poor condition (using thresholds developed by EPA in the 1990s EMAP survey of Northeastern Lakes). When 25-49% of the shore is unbuffered, a lake is said to be in fair condition and when 25% or less of the shore is unbuffered a lake is said to be in good condition.[1]

- Chloride is not usually a pollutant of concern in freshwater, but emerging data suggests chloride concentrations may be elevated above acceptable levels and is steadily increasing, primarily in urban environments – available data are limited and monitoring of urban streams, Lake Champlain, and lake tributaries should be continued.[8]
- Deicing road salt, industrial effluents, landfill leachate, municipal wastewater, agricultural wastes, septic system effluent, and household water softeners are all sources of chloride that contribute to overall loading.[5]

TABLE 1. MUNICIPAL ZONING WATER QUALITY PROTECTION AREAS [7]

Municipality	Bylaw Date	Surface Water Setback	Wetland Setback	Flood Hazard Regulation	Fluvial Erosion Hazard Overlay
Bolton	2005	Y	Y	Y	N
Burlington	2010	Y	Y	Y	N
Charlotte	2010	Y	Y	Y	N
Colchester	2011	Y	Y	Y	N
Essex	2011	Y	Y	Y	N
Essex Junction	2007	Y	Y	Y	N
Hinesburg	2011	Y	Y	Y	Y
Huntington	2011	Y	Y	Y	N
Jericho	2010	Y	Y	Y	Y
Richmond	2010	Y	Y	Y	N
Shelburne	2011	Y	Y	Y	N
South Burlington	2011	Y	Y	Y	N
St. George	2010	Y	Y	N	N
Williston	2009	Y	Y	Y	N
Winooski	2010	Y	NA	Y	N

TABLE 2. FEH OVERLAP WITH WATER QUALITY PROTECTION AREAS [7]

CONTAINS FEH AREA				
Municipality	**Surface Water Setback**	**Wetland Setback**	**Flood Hazard Regulation**	**Fluvial Erosion Hazard Overlay**
Bolton				
Joiner Brook	Y	Y	N	N/A
Mill Brook	Y	Y	N	N/A

CONTAINS FEH AREA				
Municipality	**Surface Water Setback**	**Wetland Setback**	**Flood Hazard Regulation**	**Fluvial Erosion Hazard Overlay**
Burlington				
Winooski River	Y	Y	Y	N/A
Charlotte				
LaPlatte River	Y	Y	N	N/A
Kimball Brook	Y	Y	N	N/A
Thorp Brook	Y	Y	N	N/A
Colchester				
Winooski River	Y	Y	P	N/A
Sunderland Brook	Y	Y	P	N/A
Essex & Essex Junction				
Winooski River	Y	Y	Y	N/A
Hinesburg				
LaPlatte River	Y	Y	Y	Y
Huntington				
Huntington River	P	P	P	N/A
Richmond Trib	P	P	N	N/A
Shelburne				
Muddy Brook	Y	Y	Y	N/A
Monroe Brook	Y	Y	Y	N/A
LaPlatte River	Y	Y	Y	N/A
LaPlatte River Trib	P	P	N	N/A
South Burlington				
Potash Brook	Y	Y	N	N/A
Muddy Brook	Y	Y	P	N/A
Lower Winooski	Y	Y	P	N/A
Allen Brook	Y	Y	P	N/A
Centennial Brook	Y	Y	N	N/A
St. George				
LaPlatte River	Y	Y	N/A	N/A
Williston				
Muddy Brook	Y	Y	Y	N/A
Winooski				
Winooski River	Y	Y	Y	N/A

2. WATER QUALITY TRENDS SUMMARY

Vermont water bodies continue to face mounting pollution pressures from increased development and agricultural activities. Cumulative impacts from disappearing wetlands, channelization of streams and rivers, reduction and alteration of natural floodplains, increasing impervious surfaces, steady high pollutant levels and increasing nonpoint pollution sources, nutrient enrichment and sedimentation, reduction and elimination of vegetative buffers and climate change all threaten to further impair Vermont's waterways. If these trends continue, unabated, the range of beneficial uses for select water bodies will be further limited. This includes decreased opportunities for

recreational activities such as swimming and fishing, which will adversely impact Vermont's tourism industry. Further impairments could cumulatively have significant consequences for the health, stability and diversity of Vermont's aquatic life, as polluted water bodies become less hospitable to native species and invite the migration and colonization of invasive species. Changes in species composition will have broader implications for the native food chain for both aquatic and terrestrial species. Perhaps the most immediate, dramatic, and costly consequences of increasing physical impairment to our waterways will be the arrival of more frequent and more destructive flood events across the state, the magnitude of which we have seen in recent years.

3. PRELIMINARY RECOMMENDATIONS FOR WATER QUALITY

- Surface waters and Lake Champlain serve the population of Burlington and Chittenden County in multiple ways - as a water source, as disposal areas for sewage treatment, as recreational amenities and as living ecosystems. Land use actions and development strategies and outcomes need to be further examined to ensure that all practical and available measures are being taken to reduce the loading of pollutants and excess runoff into these waterbodies as well as cleaning up existing impairment. This could include the identification of certain areas to be "off-limits" to development (such as wetlands, reaches of streams in adjustment, etc.). The efficacy of zoning and development review needs to be monitored and addressed on an ongoing basis as appropriate to reduce or eliminate identified impacts and to respond to changes in water quality.

- The Lake Champlain Basin Program, The University of Vermont Rubenstein School of Environment and Natural Resources, land trust and watershed organizations, and local municipalities are key entities involved in the stewardship of Lake Champlain. The development of regional planning goals, actions and indicators need to be coordinated and confirmed with these groups in collaboration with other federal, state, regional and local government officials. The ECOS Project could provide a model and serve as a springboard for such a consortium and coordinated effort.

- Historic development patterns, natural land cover change and alterations of in stream geomorphology coupled with climate change have led to increased damage and impacts to the built environment and infrastructure, including private and public property losses. Redevelopment and new development scenarios need to be revisited on a regional as well as a town by town basis to determine cost and benefits of land use and development decisions in light of the more severe impacts that are occurring, as recently exemplified by Tropical Storm Irene.

- The status of riparian buffers need to be monitored on a regular basis, building on work and data already developed by the Agency of Natural Resources and the Laboratory for Spatial Analysis at the University of Vermont, where research topics entitled "Linking Land Use Change, Stream Geomorphology, and Aquatic Integrity in Changing Forested Landscapes" and "Identifying Candidate Sites for Riparian Buffers" which may offer insight into future management strategies.

- The results of riparian buffer monitoring and a comprehensive review of current data and buffer status should provide a point of departure for developing preliminary action steps where geographically appropriate. These steps include protecting intact and effective buffers in place, and enhancing, restoring or establishing riparian buffers along streams, rivers and lakeshores. This can be accomplished in part through local buffer ordinances and municipal development review standards and through cooperation with and support for the Vermont and U.S. Departments of Agriculture in working with individual farmers to address riparian buffers and farming methods.
- Establish and continue education efforts aimed at homeowners and developers that focus on 1) maintaining riparian area functions and or establishing strategic landscape buffers, 2) reduction of lawn areas and the corresponding use of pesticides and fertilizers as well as consideration of sustainable landscaping alternatives, 3) promoting lifestyle changes such as managing dog waste, proper disposal of hazardous wastes, and the avoidance of household products and chemicals that contribute to degraded water quality, and 4) supporting development alternatives that a) reduce impermeable surfaces and slow stormwater flows, b) focus on cluster or infill development, c) reduce the consumption of greenfields for new development, and d) stress the adoption of Low Impact Development (LID) strategies, e) improving road rights of way to restore wildlife connectivity, geomorphic compatibility and aquatic organism passage.
- Stream restoration methodologies must be further studied and addressed so as to ensure appropriate long-term strategies that restore stream ecologies and characteristics to desirable conditions that prevent rather than contribute to additional impacts and are more suited to absorbing extreme storm events.

4. ADDITIONAL ANALYSES TO BE COMPLETED

- Estimation of riparian buffer extent and integrity along region streams and rivers using stream geomorphic assessment (SGA) conducted by VT DEC ANR and the UVM Spatial Analysis Lab.
- Overlay of wetlands: Wetlands that are unprotected and proximate to development areas or future development areas as identified in local and regional plans (e.g. growth centers).
- Identification of current impervious cover and trends in the reduction of corresponding previous cover conditions. A corollary to this are canopy cover studies that have been done for Burlington and St. Albans. (check with UCF)

5. OTHER REFERENCES AND SOURCES TO BE RESEARCHED OR MONITORED

- ANR river basin/watershed plans
- Watershed Association data (i.e. Lewis Creek and LaPlatte watershed analyses as available through the RPC or LCA)
- Relevant hydrological studies as part of local and regional planning initiatives or development studies

B. FOREST COVER & FOREST FRAGMENTATION

While Vermont as a whole has become more forested over the last half century, some areas in Vermont have seen notable forest loss over the past two decades. Alongside the loss of forest cover, increased forest fragmentation has resulted in notable changes to the character and health of Vermont's forests. Forest fragmentation is the splitting up of large areas of contiguous native forest into smaller more isolated remnant forest patches. This phenomenon and forest cover loss is the result of increasing development demands on the land, including expanding suburban and urban fringe residential and commercial development, and increased road construction and service facilities.

Forest fragmentation can lead to many adverse ecosystem impacts. These include a direct loss of species, as forests are cut, and increasing susceptibility of forest interiors to exotic and threatening species. This destruction and alteration of native wildlife and plant habitat leads to a subsequent loss of biodiversity. (See Habitat & Biodiversity). Other potential impacts include loss of recreational opportunities, reduction in air pollutant filtration, and reduced opportunities for forest carbon sequestration or the capture and storage of atmospheric carbon associated with global warming.

In addition to loss of forest cover and fragmentation, climate change may pose potential threats to native forest composition affecting vulnerable species such as spruce and fir, which would, in turn, have impacts on plant and wildlife diversity (See Air Quality).

Management of the region's forest cover includes 4 primary areas of focus:

- **HABITAT CORRIDORS.** Identification and establishment of forest habitat corridors in strategic locations necessary to support species diversity and overall forest health.
- **CONTIGUOUS FOREST.** Control of development footprints to reduce sprawl and protect areas of contiguous forest of a sufficient size and in strategic locations to support species diversity and overall forest health.
- **FOREST BUFFERS.** Establish and protect forest buffers from development to maximize resistance from future development threats and enhance ecosystem resiliency.
- **FOREST MANAGEMENT PRACTICES.** Establishment of forestry maintenance practices which focus on protecting and enhancing species diversity and overall forest health.

1. FOREST COVER & FRAGMENTATION DATA/TRENDS

- Subdivision, parcelization, fragmentation and conversion of forestland have significant impacts on habitat, water quality, biodiversity and overall health of an ecosystem.
- 53% of Chittenden County is forested based on USGS National land cover data. Forest cover in Chittenden County has decreased by 4,666 acres or 1.17% between 1992 and 2006 based on USGS National land cover data.

- 28% of Chittenden County has been identified as core forest (forest that is located more than 100 meters from a built structure, road, driveway, or anthropogenic forest edge boundary; and includes ideal habitat for wildlife species that are particularly sensitive to human disturbance, such as bear or moose); 34% of core forests are on conserved lands.[2] Between 1978 and 1993 Chittenden County lost 37,307 acres or 25% of its core forest.[9]
- 17% of Chittenden County is in federal, state, local or non-profit conservation.
- As of 1997, Vermont was estimated to be 78% forested; however, this varies greatly by biophysical region, ranging from 94% forested in the Southern Green Mountains to 40% in the Champlain Valley (Frieswyk and Widmann 2000). [15]
- Land conversion of farms and forests from 1982 to 1997 in Vermont reveals an increase of 74,800 acres of land developed for building sites (Bolduc, et al., 2008). Of these an estimated 68%, or nearly 51,000 acres, came from forest land. Estimates from the Natural Resource Conservation Service's Natural Resource Inventory reveal that developed land in Vermont, not including land in rural transportation uses, increased from 158,900 acres in 1982 to about 254,200 acres by 2003, a significant increase of 60% over two decades; far outpacing Vermont's population growth.[10]
- It is probable that the changing climate will affect biodiversity, productivity, forest structure and ecosystem services. There will be initial short- term impacts as forests try to adapt to environmental change and long- term impacts as a new forest evolves. [10]
- Between 1895 to 2007, the temperature in Burlington has averaged 44.7° Fahrenheit (F), but has been increasing by about one tenth of a percent per year for the last 50 years. Among the warmest ten years in Burlington since 1892, four have occurred since 1990. These changes, though they seem small, can be significant from a meteorological standpoint and can produce dramatically different climate results.[5]
- Burlington precipitation data (including all forms of precipitation measured on a liquid basis) from 1884 to 2007 show an increase of 5.4 inches, from an average of 30.7 inches to 36.1 inches. Average snowfall for that same period shows an increase of 24.5 inches from 60.2 inches to 84.7 inches. For the last twenty years, Burlington snowfall has increased by 8.0 inches, from an average of 69.3 inches to 77.3 inches. [5]
- The threat posed by acid deposition to forest sustainability is widely recognized. Although impacts can affect all parts of the forest system (i.e., increased winter injury on red spruce trees), impacts of acid deposition on soil productivity is of particular concern to forest health.[10]
- Based on available zoning data providedby the CCRPC, 54,752 acres or 14% of Chittenden County has been designated in a conservation/forestry district.
- 76% of land in Chittenden County is privately owned; 54% of privately owned land is associated with a dwelling.[12]

- In Chittenden County 26% of towns have a forestry district in their zoning. Of this 26% the average minimum lot size is 16.75 acres with the largest being 25 acres in Bolton and Huntington and the smallest is 10 acres in Jericho and Westford.[13]
- 58% of towns have a conservation district in their zoning. Of this 58% the average minimum lot size is 11.33 acres with the largest being 25 acres in Bolton and Huntington and the smallest .23 acres in Colchester. [13]
- 68,787 acres or 17% of Chittenden County has been identified as Most Suited for Natural Areas[14] as part of CCRPC's open space planning project; of that 37,747 acres or 55% are on conserved lands.

2. FOREST COVER AND FOREST FRAGMENTATAION TRENDS SUMMARY

Chittenden County continues to see forest fragmentation and loss of forest habitat largely due to mounting development pressures. Increasing incidences of land parcelization and subsequent forest conversion, lack of consistent subdivision regulations responsive to wildlife habitat concerns, and construction of transportation infrastructure including roads and trails continue to adversely impact forest integrity. In addition, acid deposition from air pollution, migration of invasive species including destructive insect species, and climate change continues to threaten native forest plant and animal habitat.

If these trends continue, Chittenden County will see an even greater loss of forest biodiversity including loss of animal and bird breeding habitats sensitive to disturbance, and an overall shift in forest plant species composition. These changes have larger implications for Vermont's forest based economy including maple sugaring and wood forest products (See Working Forests). In addition, if changes in the county's forest cover and composition are not monitored and forest habitat is not actively managed, forest health cannot be detected in a timely manner and species diversity cannot be regionally protected. Finally, a reduction in forest cover within the county will result in a reduction in air pollutant filtration and carbon sequestration potential.

3. FOREST COVER AND FOREST FRAGMENTATION PRELIMINARY RECOMMENDATIONS

- Continue to incorporate current and ongoing research into the nature and extent of forest fragmentation, and as related to parcelization, in Northern Vermont and Chittenden County. Continue to identify and incorporate new research and information being developed by local, regional, state and national agencies and organizations.
- Coordinate with state, regional and local efforts at forest protection and management, and ecological systems identification and protection:
    - Follow the recommendations and use the tools as outlined in the Natural Areas Planning Guide, as prepared by CCRPC, and monitor over time to gauge how individual towns are implementing
    - Current local plans are not currently sufficient or as effective as they could be in protecting core forests, ecological systems and habitat connectivity. Low density

residential and non-residential development continue to erode forests and impact core forests - thus more effective efforts and initiatives to address ongoing land use trends must be developed, either through more intensive or targeted local plans and ordinances, requiring municipalities to develop zoning that addresses wildlife migration and habitat conservation in subdivision regulations, or via other means such as education and conservation. Monitor VNRC's Winooski Fragmentation Project, *Reducing Forest Fragmentation Through Land Use Planning*, which includes conducting realtor and engineering trainings as well as providing technical assistance to towns. For this project, VNRC will distribute a planning and zoning guide that explains different regulatory and non-regulatory tools, as well as model language, that towns can use to protect core forests, ecological systems, and habitat connectivity.

- Continue to monitor and map changes to forest cover, and forest quality and overlay key areas of primary suitability in comparison with land use threats. This would include analyzing biodiverse "hot spots", natural communities, invasive species, identified habitat areas (core forests), and landscape linkages and connectors for wildlife to ensure synchronicity between healthy forest, forest connectivity, and habitat. Compare these geographic and physiographic areas to current and future development trends in the town, as promoted or permitted by the land use ordinance.

4. ADDITIONAL ANALYSES TO BE COMPLETED

- Map zoning districts in the County that are designated either floodplain, forest conservation or conservation. Identify density requirements and whether they provide enough acreage for ecological value and function.
- Analyze with conserved lands overlay through either easement or purchase. How more extensive is zoning?
- Analyze average parcel size compared to zoning district, conserved land, and most suited natural areas.
- Compare zoning, subdivision bylaws, conserved lands, open space agreements, forest cover areas and most suited natural areas at the town level (no distinction between conserved forest and working forest - assume habitat and functional value for both is high).
- Analyze urban tree canopy loss/increase and impacts on natural systems
- Assess how goals for Chittenden county parallel or diverge from statewide goals.
- Analyze Chittenden County trends from the database that is part of the report: *Wildlife Considerations in Local Planning* – Vermont Natural Resources Council, February 2011
- Analyze how zoning strategies are influencing subdivision rates in Chittenden County towns.

5. OTHER REFERENCES AND SOURCES TO BE RESEARCHED OR MONITORED

- Jericho Forest UVM Research Studies
- Wildlands and Woodlands: A Vision for the New England Landscape, Harvard Forest, May 2010
- Vermont Natural Resources Council Forest Program
- Ecological Conservation Analysis of the Lewis Creek Watershed, Addison and Chittenden Counties, Vermont, Lapin and Engstrom 2003
- Vermont Natural Resources Council Forest Program and Forest Roundtable
- U.S. Forest Service Forests on the Edge publications – http://www.fs.fed.us/openspace/fote/. These publications provide analysis regarding projected housing densities on forestland in Chittenden County and the Winooski Watershed.

B. HABITAT & BIODIVERSITY

Vermont hosts a rich diversity of both flora and fauna. This biodiversity is largely a result of the state's varied geography, ranging from the Green Mountain summits to the Champlain lowlands, each with its own geology and climate. Within these geographies, distinct, identifiable natural communities have evolved over time. Each community is an assemblage of animals, plants and other organisms, their physical environment and the processes that affect them. From northern hardwood forests to white cedar swamps, these communities provide unique habitats for many plants and animals, including rare and endangered species.

Species diversity is important because it is an indicator of ecosystem health. By making more resources available for other species within an ecosystem, greater species diversity may cause ecosystems to function more productively and efficiently thereby increasing an ecosystem's stability and resilience.

Unfortunately, a number of frequently occurring threats to species diversity exist, such as loss of sensitive habitat and habitat fragmentation due to parcelization, subdivisions and associated transportation and site development; the colonization of invasive species due to the denigration of native habitats; direct effects of water pollution; and indirect effects of air pollution including climate change (see Forest Cover & Fragmentation, Water Quality, and Air Quality).

Protection and management of wildlife and plant habitat requires 3 levels of conservation planning focus:

- **LANDSCAPE-LEVEL CONSERVATION.** Identify, conserve and foster stewardship of larger landscapes to provide habitat for wide-ranging, migrating species that need large contiguous forest areas, connecting lands and/or enduring landscape features.
- **NATURAL COMMUNITY-LEVEL CONSERVATION.** Identify and conserve groups of species and their associated physical settings such as wetlands, riparian areas and aquatic features, and vernal pools.

- **SPECIES-LEVEL CONSERVATION.** Identify and protect specific rare, threatened and endangered species and specific species related habitat such as deer stands, bat habitats, and grassland bird habitat.

1. TERRESTRIAL HABITAT DATA/TRENDS

- Twenty- two major categories of threats to wildlife were identified in the Vermont Wildlife Action Plan for the State; the top six threats were habitat loss, impacts of roads and trails, pollutants and sedimentation, invasive species, climate change, and data gaps and information needs (Vermont Department of Fish and Wildlife, 2005).[10]
- Vermont's forests provide breeding habitat to over 70 different neo- tropical birds. However, many common species are in decline or threatened by a variety of causes. For example, population levels of wood thrush and the Canada warbler have declined at rates of 63% and 55% respectively (Audubon Vermont, 2010).[10]
- Non- native invasive species cause irreversible impacts on tree health and biodiversity. Three non- native insect species currently threatening the health of Vermont forests are the emerald ash borer, Asian longhorned beetle and hemlock wooly adelgid. The emerald ash borer and asian longhorned beetle currently present themselves as the biggest threat to Chittenden County.[10]
- All invasives play a role in regeneration failures of native tree species and can lead to loss of native flora and fauna. [10]
- Literature on the ecological effects of rural development is limited but what exists does indicates that the impacts of a dwelling on biodiversity may be substantial. In the short-term, these are likely to include a decrease in native species and an increase in non-native species. Researchers have found that biodiversity changes resulting from a new home in an undeveloped area were measurable 330 m away, although they were more evident within 100 m. Assuming a circle with a radius of 100 m or 330 m, a dwelling would alter biodiversity in 8 acres, yet some changes would be noticeable in an area of 84 acres. [12]
- In Vermont a parcel size of 50 acres has been determined as viable for sustaining wildlife and is used for studies dealing in this subject. 50 acres was also chosen because it is the size allowed in order to enroll in the UVA (Use Value Appraisal) program. The UVA Program records separate the value of the enrolled land from the value of any excluded land, such as the two acres surrounding a dwelling.[12]
    - 1,102 parcels in Chittenden County are 50 acres or more in size. [12]
    - 57% of acreage in private land in Chittenden County is on parcels >50 acres. [12]
    - 38% of that land is associated with a dwelling.
    - Of all parcels in Vermont that were larger than 50 acres in 2003, the parcels not appraised at use value were twice as likely to be subdivided into a parcel smaller than 50 acres than those enrolled in the program.
    - Between 2003 and 2009, due to subdivision, the State of Vermont had a 1% loss of acres on parcels >50 acres.

- Statewide, most residential development is occurring at low densities in rural areas rather than in compact existing centers or planned growth centers.[12] Municipal planning and zoning becomes more important in Chittenden County to ensure that the remaining forest habitat is not fragmented by scattered development.

- If municipalities have not defined the wildlife resources they are trying to protect, overly broad regulations supporting wildlife habitat protection may not be enforceable or sufficient to protect the resource (as held in the Vermont Supreme Court case In re Appeal of JAM Golf, LLC).[11]

- Subdivision regulations are an effective tool for conserving habitat, but are underutilized. 18 out of 19 towns in Chittenden County have Subdivision Regulations. Of the 18 towns that have subdivision regulations 16 of them mention wildlife habitat but do not necessarily have specific standards to regulate or protect. [11]

- Throughout Vermont there is a sharp disconnect between municipal plan recommendations for wildlife and the implementation of those recommendations through zoning bylaws and subdivision regulation.[11] Out of the 51% of municipalities in Vermont that have adopted subdivision regulations, less than half have specific policies for wildlife habitat. This changes for Chittenden County where 18 of 19 towns have subdivision regulations and 16 of those mention wildlife habitat.

Local Zoning Lags Behind Plans[8]

Of 211 zoning bylaws reviewed in VT:

- ***88%** include conditional use standards (17% of which mention wildlife habitat)*
- ***75%** include site plan requirements (18% of which mention wildlife habitat)*
- ***51%** included some form of conservation district (49% of which mention wildlife habitat)*
- ***39%** include explicit riparian buffers (the average buffer width was 42 feet)*
- ***22%** include a forest reserve district (40% of which specifically mention wildlife habitat)*
- ***2%** of the municipalities include a specific definition of "wildlife habitat" in their zoning bylaws.*
- ***1%** (3 municipalities) include a wildlife habitat overlay district*

- Municipal plans in the State of Vermont typically acknowledge in text the important role of wildlife habitat and recognize the public benefits that are achieved from this. A noticeable increase in awareness over the past decade can be seen through the higher number of municipal plans with wildlife habitat mentioned in the text. [11]

- The inclusion of mapped data in Vermont's local plans increased by almost 40%.[11]

- 87% of Vermont's municipalities recommend the protection of wildlife habitat in their town plans, with regulatory and nonregulatory policies increasingly adopted since 2000. [11] However, there is little recognition in Vermont's town plans of climate change and its effect on habitat and wildlife. [11]

- Even though a number of municipalities in Vermont have established conservation districts (approx. 32% in Chittenden County) and forest reserve districts (approx. 26% in Chittenden County), many do not have explicit policies for wildlife habitat. Furthermore, municipalities commonly allow single-family homes within those districts without requiring conditional use or site plan review. Municipalities are also requiring minimum lot sizes in these districts of, on

average, only 11.33 acres for Chittenden County. This can exacerbate habitat fragmentation because parcels of such acreage may be too small to manage for many important ecological functions.[11]

- Biodiversity is a major component in maintaining healthy, resilient forests and is connected to forest sustainability, wildlife habitat quality and forest health. Given decreasing amounts of forestland habitat, it will become more important to monitor overall species composition to detect forest changes due to climate change and other disturbances.[10]
- Vermont has more forest today (78%) than it had in the mid-1800s (25%), and the effect of this change on wildlife has been dramatic.[15]
- Though many agencies and organizations work diligently to conserve important wildlife habitats, Vermont continues to lose approximately 525 acres of significant habitat each year to regulated development alone, an area roughly the size of the City of Rutland. [15]
- In the last quarter of the 20th century, Vermont expanded its road system by an average of 26 miles per year to a total of about 14,251 miles. [16]
- In Vermont, 171 species are known to use beech or oak stands as habitat (DeGraaf et al., 1992) including 16 amphibian, 9 reptile, 102 bird, and 44 mammal species. These include species on federal and state endangered/threatened species lists, permanent residents, and migratory birds. [16]

2. AQUATIC HABITAT DATA/TRENDS

- The status of aquatic invasive species, an indicator of lake health, has dramatically increased since the 1990's - there are currently 48 recorded aquatic invasive species in Lake Champlain.[4]
- In parts of the lake where blue-green algae has been increasing, phytoplankton has also changed, which can affect food chain dynamics and the presence of fish species.[4]
- Invasive fish like white perch and alewives are increasing in the lake and impacting the diversity of native fish species.[4]
- The Lake Champlain sport fishing industry is dependent on management strategies that include lampricide treatments in Lake Champlain basin streams. Native sea lamprey populations prey on sport fish and are claimed to be excessive and problematic to the sport fishery economy, with high wounding rates on lake trout and salmon.[4] We do not know how today's native lamprey populations compare to levels 200 years ago. The long term lampricide program is very costly, dependent on federal funds, and appears to be having a negative cumulative impact on non target native species in streams.[6] More research is needed prior to the continuation of the lampricide program.
- Erosion and sedimentation have been listed as the number one cause of stress and impairment of aquatic life use support sin[c]e Vermont began reporting the impacts of nonpoint source pollution.[1]

- Just within the past 20 years, seven non-native fishes have shown up in state and interstate waters. Two viral diseases have also recently appeared in Vermont waters. Largemouth bass virus was first detected in Lake Champlain in 2002 and a year later in Lake St. Catherine; and esocid lymphosarcoma infecting Lake Champlain northern pike in 2002 (http://www.vtfishandwildlife.com/fisheries_health.cfm).[15]
- The most frequently identified habitat related problems impacting aquatic systems are habitat alteration, habitat fragmentation, habitat conversion, invasive non-indigenous species, and climate change.[15]
- Beaver are a keystone species that provides habitat for many other wildlife species. Loss of beaver and beaver created wetlands in the 1600s through the 1700s probably resulted in the decline of otter, moose, a variety of invertebrates, brook trout, and associated songbirds. The reintroduction and subsequent trap and transfer program funded by hunters and trappers and implemented by the Fish & Wildlife Department in the 1920s through the 1950s, resulted in the reestablishment of beaver in Vermont. Since then, otter populations have recovered and moose, once extirpated, now exist through the State. [15]
- It is estimated that less than 5% of Vermont is currently wetland and that nearly 50% of Vermont's historic wetland area has been lost or severely impaired due to draining, dredging, filling, or excavation activities associated with industrial, residential, and agricultural activities. Since 1995, the current rate of regulated wetland loss in Vermont is estimated at 20 acres per year. [16]

3. ANALYSES TO BE COMPLETED

- See also Section III.A.4 and III.B.4 for analyses related to habitat and biodiversity.

4. OTHER REFERENCES AND SOURCES TO BE RESEARCHED

- Vermont Natural Resources Council Forest Program and Forest Roundtable
- Contiguous Wildlife Habitat – Lewis Creek and LaPlatte River Watershed Region, Royar, Austin, Behm, 2003
- Wildlands and Woodlands: A Vision for the New England Landscape, Harvard Forest, May 2010
- See also Section III.A.5 and III.B.5 for resources related to habitat and biodiversity.

5. PRELIMINARY RECOMMENDATIONS

- Work with towns, local, regional and state agencies (e.g. VT Fish & Wildlife Department) to implement the recommendations of the *Vermont Wildlife Action Plan*.
- Develop strategies that address problems at each of the three levels (species, habitat, and landscape) as well as the regional/state levels (e.g. to address habitat loss along migration routes, which extend beyond town boundaries and regional boundaries).

- Ensure habitat concerns are addressed early during the development project planning process, including assessment of direct and indirect impacts, avoidance and minimization of impacts and appropriate mitigation.
- Work with towns, local, regional and state agencies to develop a coordinated monitoring program to collect and maintain new data and provide an ongoing assessment of the impact and effectiveness of conservation strategies. Ensure regular communication and coordination with conservation planning groups and agencies (e.g. engage local conservation commissions, land trusts, or VT ANR).
- See also Section III.A.3 and III.B.3 for recommendations related to habitat and biodiversity.

IV. AIR QUALITY

Air quality is a measure of the condition of air relative to animal and human purpose. Air quality reflects the amount of hazardous air pollutants or toxins (HAPs) present in the air. These toxins are unhealthy airborne wastes from many sources such as industrial processes and car emissions, and long-term breathing of these substances can increase the risk of serious health problems such as cancer, asthma, and allergies. The elderly, young children, and people with respiratory issues are particularly at risk. The Environmental Protection Agency (EPA), directed by the Clean Air Act, identifies and sets standards for pollutants, and requires each state to measure the air for specific pollutants such as ozone, carbon monoxide and lead. Currently, the EPA has identified 188 hazardous pollutants, seven of which exceed health-based standards nationwide.

While visitors travel far and wide to Vermont to get away from urban congestion in favor of fresh and clean country air, Vermont faces it's own air quality challenges. Vermont's air monitoring program shows "air toxics" are within federal standards, however, they exist in the air at potentially unsafe levels. These pollutants come from a variety of sources including automobiles and diesel trucks, gas stations, home heating, dry cleaning, lawn mowers and industrial sources. In Chittenden County, ground-level ozone and fine particulates are of particular concern. In response, Vermont has implemented several reduction efforts to control emissions including low emissions vehicle, gasoline vapor recovery, and inspection and maintenance programs. Vermont also has an air pollution-permitting program that regulates manufacturing sources and utilities and requires most point source polluters to register their annual emissions.

In addition to polluting the air we breathe, air toxins affect our atmosphere in the form of acid rain. Acid rain occurs when emissions of sulfur oxide and nitrogen react in the atmosphere to form various acidic compounds, which then fall to the earth as gas and particles or rain, snow and fog. Prevailing winds can transport these compounds across state and national borders. Notably pollutants from industrial Midwest contribute to damages in the Northeast. Acid rain causes acidification of lakes and streams. It can damage trees at higher elevations and decay building materials and paints including historic structures.

Climate change is also attributed to human produced air pollution. Specifically, climate changes are in large part caused by an increase in carbon dioxide levels due to heat trapping or "greenhouse gas" emissions from such sources as fossil fuel combustion, aerosols, ozone

depletion, animal agriculture, and deforestation (See Climate Change insert). Current emissions trends suggest climate change may impact Vermont's climate significantly over the next century with potentially substantial impacts on the state's economy and character.

Management of the region's air quality includes a focus on 4 primary areas of focus:

- **AIR QUALITY STANDARDS.** Implement strict air quality standards, focusing local efforts on air pollutants of most concern.
- **AIR QUALITY MANAGEMENT.** Monitor emissions, implement emission reduction measures, and address the most important local emissions sources.
- **TRANSPORTATION EFFICIENCY.** Influence the efficiency of transportation via land-use planning, emphasizing accessibility, public modes of transportation, biking and walking. Provide infrastructure and incentives to encourage a "drive less" culture. Encourage car-pooling, telecommuting, car share programs, walking, biking, and use of public transportation. Educate and encourage fuel-efficient driving and automobile maintenance. Provide incentives for driving low-polluting vehicles.
- **ENERGY EFFICIENCY & RENEWABLE REGENERATION.** Increase home and business heating efficiency via upgrades, encourage or require new construction to achieve designated energy efficiency levels, and invest in non-clean renewable energy development.

A. AIR QUALITY DATA/TRENDS

- Air quality monitoring confirms that Chittenden County's air quality meets the National Ambient Air Quality Standards (NAAQS), the federal regulations that set the maximum acceptable pollutant levels. But ground-level ozone levels are close to the current national standard and fine particle pollution (PM2.5) has approached the standard in recent years. Current ozone levels exceed the stricter standard recently proposed by the US Environmental Protection Agency. [17]
- 71% of Chittenden County household trips are made by car. The percentage of commuter trips by car is even higher, with 89% of commutes occurring by driving and only 5% by riding with someone else. [17]
- The average Vermonter drives 17,000 miles annually. With a little planning this could easily be reduced 10% or more, resulting in lower costs, less wear and tear on the car, and fewer emissions. [17]
- Fifty years ago, 70% of children in Chittenden County walked or biked to school; today about 13% walk or bike to school. [17]
- Chittenden County is often described as the economic engine of Vermont. In 2006, 31% of all jobs in the state were located in the County1. As shown in Figure 3-1, over 75% of employees residing in the County drive alone to work. [17]

- Rail freight is three times more fuel efficient than trucks: a gallon of diesel fuel can move a ton of freight 457 miles by rail. [17]
- The Chittenden County Transportation Authority (CCTA) provides bus transit service to member municipalities in the county. CCTA partners with transit agencies in adjacent counties to offer the LINK Express commuter routes to and from Montpelier, Middlebury and St. Albans. The LINK Express commuter routes are very successful: in 2008, LINK Express ridership increased 44% to Montpelier, 41% to Middlebury and 31% to St. Albans. [17]
- Petroleum used for transportation fuels and residential use accounts for over 80% of Vermont's energy use. [17]
- The average annual vehicle miles traveled (VMT) in Chittenden County increased steadily between 1990 and 2002, declining slightly through 2005 before increasing again. [17]
- Transportation is the single largest source of greenhouse gas emissions in the state (44%). Transportation and fossil fuel combustion sources combined account for 77% of Vermont's greenhouse gas emissions. [17]

B. AIR QUALITY TRENDS SUMMARY

While residents and tourists seeking fresh mountain air and solace in nature flock to the state of Vermont, the state's air quality is far from pristine. Air quality is of particular concern for densely populated and urbanized areas, including Chittenden County. Fine particulate and ground ozone sources are of particular concern in the county. Transportation and other fossil fuel combustion sources have been identified as the main culprits. Increasing car-pooling and use of commuter bus routes are helping to reduce overreliance on private automobile transportation, however, use remains relatively low. Other combustion sources include residential heating systems such as wood stoves and oil burners. The state continues to develop and implement targeted emissions reduction measures as well as programs for improving home and business heating efficiency, however, increasing development in the county equate to increasing air quality challenges.

Compromised air quality adversely affects the health of residents. With increased emissions, the county may see increased health risks associated with air pollution such as asthma and allergies. Restricting and closely monitoring recreational activity during high pollution days will be necessary for those most at risk.

Climate change associated with greenhouse gas emissions may have even larger implications for the region's economy and character. These may include higher summer temperatures and associated droughts, milder winters, damaging rainfall events including flooding, and impact on winter recreation including skiing, snowmobiling and ice fishing. Other impacts may include changes in forest compression, animal and plant species distribution and diversity, and impacts to forest based products such as maple sugaring (See Forest Cover & Fragmentation and Working Landscapes).

C. OTHER REFERENCES AND SOURCES TO BE RESEARCHED OR MONITORED

- Special studies, reports, data and trends as published by:
  - Vermont Department of Environmental Conservation, Air Pollution Control Division
  - Vermont Department of Health
  - United States Environmental Protection Agency (EPA)

D. AIR QUALITY PRELIMINARY RECOMMENDATIONS

- Implement the goals and strategies as outlined in *Keeping Our Air Clean, Local and Regional Strategies to Improve Air Quality in Chittenden County*, Chittenden County Metropolitan Planning Organization and Chittenden County Regional Planning Commission, February 2010, including but not limited to:
  - Work with VTrans, employers and TDM and transit service providers to expand and enhance Transportation Demand Management services in Chittenden County.
  - Develop and implement a regional Energy and Climate Action Plan that includes air quality strategies as well as energy and climate strategies.
  - Develop and implement a regional education and outreach program to increase understanding and change behaviors that adversely affect air quality.

V. WORKING LANDSCAPE

Across generations Vermonters have lived off the land, sculpting the landscape through agricultural and sivicultural practices to give rise to the unique, rural countryside we see today. Vermont's "working landscape" describes the ways in which Vermonters have historically interacted with and manipulated the land for their livelihood. While few Vermonters earn their living off of the land today, productive use of the land for food, fiber, and wood products, and recreation still defines and shapes Vermont's landscape and culture. Working landscapes include such landscapes as croplands, orchards, woodlots, sugarbushes, pastures, plant nurseries, and recreation lands.

Today, protecting Vermont's working landscape is becoming even more important due to renewed interest in rural and urban agriculture, including community supported agriculture, and the continued use of forest products for fuel, maple sugaring, and construction material. While Chittenden County once had an abundance of open, or undeveloped, forest and agricultural lands, the last half-century has seen significant parcelization, subdivisions, and associated residential and commercial site development and transportation related development, including construction of road and parking lots. In addition to adverse impact associated with land development including habitat loss and water and air pollution, conversion of these open, often scenic landscapes reduces land-based production opportunities. Tourism may also suffer as the historically, rural character of the region gradually disappears. In addition, environmental changes brought about by climate change may also impact the productivity of working forestlands for such products as maple syrup. (See Sections in this report for Water Quality, Air Quality, Habitat & Biodiversity, and Forest Cover & Fragmentation).

Management of the region's working landscapes includes 4 primary areas of focus:

- **RURAL ECONOMIC DEVELOPMENT.** State and local investment in working lands enterprises including developing programs, technical and financial support to the agriculture, forestry, and value-added business sectors.
- **LAND PROTECTION.** Strategic conservation of working lands including farms and forestlands through conservation easements and open space tax incentives.
- **LAND-BASED PRODUCT PROCESSING & MANUFACTURING.** Increase opportunities for and access to manufacturing and processing for land based products.
- **LAND-USE PLANNING.** Through careful community based land-use planning, work to identify and protect open spaces which support land-based production opportunities.

A. Working Landscape Data/Trends

- Since 1964, Vermont has lost roughly one-third of its farms and half of its farming acreage (Pers. Comm. Vermont Dept of Agriculture 2005).[15]
- Working landscapes (farming, forestry, sand and gravel) comprise up to 25% of Chittenden County's land area, a decrease of 5% since 2003 due to residential development. [9]
- In 2008, 21.7% of land in Chittenden County was used for farming. Cropland decreased by over 40% in a 20 year period (1987-2007), but the number of farms has increased by 189 due to the increase of smaller farms dedicated to local food production. [9]
- The average size of farms in Chittenden County decreased 13% in 5 years from 162 acres in 2002 to 141 acres in 2007. [19]
- In 2009, 34% of privately owned land in Chittenden County was enrolled in Use Value Appraisal (UVA—a program allowing land to be taxed based on its income producing potential from agriculture or forestry); of that, 54% was on land >50 acres. [12]
- The average parcel size in Chittenden County is 6.93 acres, while the parcel size that occurs most frequently (or mode) is 1 acre.
- Dairy continues to dominate Vermont's agricultural land use and production, but multiple indicators show many dairy farms are in significant danger of failure. [19]
  - From 1947 to 2010, the number of dairy farms in Vermont has plummeted from 11,206 to 1,00712 – a dairy farm has been lost in each of the last 19 years; however, dairy farms that remain are getting bigger.[5]
  - Chittenden County lost nearly half its dairy farms between 1997 and 2007. [20]
  - Milk and dairy products account for 77% of total 2007 farm income, and much more when hay, beef and sugaring connected to dairy farms is included. [18]
  - In 2008, milk sold in stores at an average of $3.12 per gallon, but dairy farmers received only $.99 cents – $.66 less than the cost of production. [18]

- Per capita, Vermont has more local and organic farms, CSAs and farmers markets than any other state in the country. [18]
- Vermont has an ideal climate to produce maple syrup, but output varies significantly by year depending on precipitation, daily temperature swings, and atmospheric levels. In 2008, Vermont accounted for approximately 31% of the total maple syrup output crop, (500,000 gallons), the most for any state in the country. [5]
- 28,211 acres or 7% of Chittenden County has been identified as Most Suited Agricultural Land[15] as part of CCRPC's open space planning project; 5,382 acres or 19% are located on conserved lands.
- There has been a significant decline in the use of land in Vermont for agricultural and forestry purposes and changes in the way the land is owned and managed. [18]
  - Fifty years ago, half of the state's land was in farms. That number has dropped by almost 60% – today, only 1/5 of Vermont's land is being farmed.
  - Forest fragmentation and increased parcelization have meant that the number of parcels has gone up, while their size has gone down, diminishing their economic viability and the ecological services they provide.
  - While the number of farms in Vermont is increasing, almost 60% of them reported annual sales under $10,000 in 2007.
  - 62% of farms in Chittenden County reported annual sales of under $10,000. [19]
- One measure of forest productivity is the volume of trees, expressed as cubic feet, board feet, cords or tons. Tree volume in Vermont has increased, though recently at a decreasing rate. At the same time tree mortality has increased as well as "removals." [10]
- The Vermont forest products industry is in slow decline resulting in dramatic reductions in wood processing and manufacturing. [18]
  - Nearly 80% of Vermont's 6 million acres of land are forested and more than 80% of these lands are privately owned.
  - In 2000, Vermont forest products businesses processed 927,811 cords of wood; in 2008 they processed 584,150, a 37% drop in 8 years.
  - The number of mills in Vermont has declined 43% from 185 in 2002 down to 105 in 2008.
  - Mill production also dropped in half over the past decade, going from a high of 260,855 thousand board feet (Mbf) in 1999 to just 133,814 Mbf in 2008.

THIS 1927 AERIAL PHOTOGRAPH PROVIDES A BIRD'S EYE VIEW OF FORT ETHAN ALLEN AND LAKE CHAMPLAIN BEYOND. THE CITY OF WINOOSKI IS AT THE LEFT OF THE IMAGE. MOST OF THE LANDSCAPE HAS BEEN CLEARED FOR FARMING.

THIS 2005 AERIAL PHOTOGRAPH OF THE SAME LOCATION SHOWS A CONSIDERABLE AMOUNT OF NEW DEVELOPMENT. ROUTE 15 HAS BEEN PAVED AND WIDENED, AND THE INTERSTATE HAS BEEN CONSTRUCTED. FARMS HAVE BEEN ABANDONED AND THE LANDSCAPE HAS REFORESTED, PARTICULARLY ALONG THE RIPARIAN CORRIDOR.

(SOURCE: UVM LANDSCAPE CHANGE PROGRAM, SUBMITTED BY ELIZABETH STANLEY MANN)

B. WORKING LANDSCAPES TRENDS SUMMARY

While farm and forestlands continue to characterize the Vermont landscape, development pressures in Chittenden County and throughout Vermont has resulted in a growing loss of open, working landscapes. In Chittenden County, working landscapes are under considerable pressures as open land continues to be parcelized, subdivided into small lots and transformed into residential and commercial developments. Development pressures are outcompeting the economic viability of some land-based production enterprises such as small dairy farms and firewood and milled lumber production. While, the growing success of other enterprises such as small organic farms, including community-supported agriculture, may begin to challenge these pressures, failure to actively

protect and conserve working landscapes in perpetuity may result in the loss of a scenic, rural landscape that draws visitors from far and wide. Future land-based opportunities, for farming and forest based products in particular, may become more limited as suitable open land becomes less available. This has far reaching consequences for the future of Vermont's local economy.

C. Additional ANALYSES TO BE COMPLETEd

- Assess presence and effectiveness of overlays and agricultural/forestry districts in each town.
- Do visual (overlay on an aerial) of a section of Chittenden County to show components of a dynamic landscape and landscape change.
- Identify and assess urban agricultural initiatives

D. OTHER REFERENCES AND SOURCES TO BE RESEARCHED OR MONITORED

- VT Land Trust acreage conserved - and trends 1990-2010
- Aerial photographs from 1990/2000
- 2004 CCMPO .16m Orthos
- Lake Champlain Basin Program enhanced NLCD and NOAA C-CAP imagery
- Intervale Center Master Plan
- Maple syrup production in Chittenden County over last two decades
- Jericho Forest UVM Research Studies/Rubenstein Lab for Spatial Analysis data and studies
- Wildlands and Woodlands: A Vision for the New England Landscape, Harvard Forest, May 2010
- Vermont Monitoring Cooperative

E. WORKING LANDSCAPES PRELIMINARY RECOMMENDATIONS

- The working landscape is a critical component of the local, regional and state economy. Continued promotion of sustainable practices in both agriculture and forestry through education, demonstration programs should be a priority for the region.
- Support investment in and development of markets and new products (related to agriculture and forestry) and markets for agriculture and forestry products and byproducts. Consider a range of economic incentives and tax reform or abatement that will support and promote sustainable working landscapes and employment in industries dependent upon the working landscape.
- Each town in the region has acreage that has been designated for agricultural or forestry use in perpetuity via conservation easements; the use and status of these lands should be monitored

on a regular basis to ensure maximum economic and ecological benefits are being achieved, and that the land is continuing to be productive.

- Encourage development of local land trusts and engage local and statewide land trusts and conservation organizations in a common approach and effort to oversee the continued use of the working landscape, including local food production.
- Work with the Vermont Council on Rural Development Working Landscape Partnership to coordinate development and management initiatives and to promote the viability of the working landscape in Burlington and Chittenden County.
- Identify land use and transportation impediments and opportunities that may affect the maintenance and growth of sustainable and economically productive working landscapes and the products of those landscapes.
- Support enrollment in the Current Use Program if easements are not a viable option for landowners.

VI. SCENIC RESOURCES

Scenic resources represent an important element of the region's landscape and contribute directly to sense of place, quality of life and economic vitality through tourism and by attracting new residents and businesses. The Lake Champlain Byway is one example of a grassroots community based initiative that recognizes the value of the county's landscapes and visual resources, as well as recreational opportunities. The scenic economy is one part of the region's overall attraction and generates significant local revenues. Locations with scenic beauty are also often places that display high values for ecological systems and intact landscapes. Thus such lands may be more sensitive and more vulnerable when and if development changes are proposed.

We cherish our mountain, field and lake vistas - yet these are places where new subdivisions, energy development and second homes are often sited. Ironically, scenic resources are often undervalued and unprotected, although when projects are proposed that might impact or alter vistas and scenery there is often strident and vocal opposition to change, even if a project is proposed for lands under private ownership. This paradox needs to reconciled if, for example, the region continues to develop new infrastructure for energy generation and transmission, or if communities want to effectively balance scenic resource protection with growth and land based economic development.

While there are many state and local initiatives, regulations and tools in place, there is more work to be done in identifying, protecting and managing scenic resources. This analysis provides only a partial point of departure; there is much work to be done and most of it via community engagement and participation in decision-making that addresses the means by which to identify, delineate, manage or protect scenic resources.

A. SCENIC RESOURCES DATA/TRENDS

- 16% of towns provide specific standards and guidelines for protecting identified scenic resources. [13]
- 68% of towns provide general recommendations for protecting scenic resources (i.e. views and landscapes along scenic roads should be protected). [13]
- 16% of towns reference scenic resources but provide no goals, standards, guidelines, or recommendations (i.e. scenic views are important). [13]
- 57% of scenic resources identified are of roads or views from roads (see Table 3).[13]
- The majority (74%) of towns reference scenic resources in relation to their value as open space (see Table 4).[13]
- 42% of towns recognize that woodlands provide scenic as well as ecological values. [13]
- About 40% of towns consider historic structures and settlement patterns a scenic resource. [13]
- 21% of towns have a scenic overlay/preservation district. [13]

TABLE 3. INVENTORY OF SCENIC RESOURCES SPECIFICALLY IDENTIFIED IN MUNICIPAL PLANS

TOWN	RESOURCE OF SCENIC SIGNIFICANCE
Bolton	Bolton Valley Road
Bolton	Duxbury Road
Bolton	Honey Hollow Road
Bolton	Notch Road
Bolton	Stage Road
Burlington	Burlington's harbor and downtown waterfront
Burlington	North Side of Riverside Avenue
Burlington	Lake Champlain
Burlington	Winooski River
Charlotte	Cedar Beach
Charlotte	Lewis Creek Road
Charlotte	Roscoe Road
Charlotte	Monkton Road (between Spear Street and Lewis Creek Road)
Charlotte	Mt. Philo
Charlotte	Scenic stretches of Lewis Creek
Charlotte	Scenic overlook (N11): panoramic view of Adirondack High Peaks and Champlain Valley
Charlotte	South of the Town recreational area to Wings Point
Charlotte	Thompson's Point
Charlotte	View Northwest to southwest from Mt. Philo State Park (V1)
Charlotte	View West off Mt. Philo Road, south of the base of Mt. Philo State Park (V2)
Charlotte	View West off Route 7, vicinity of the north end of Old Route 7 (V3) Town scenic

TOWN	RESOURCE OF SCENIC SIGNIFICANCE
	overlook)
Charlotte	View East and north off Route 7, north of Nordic Farm (V4)
Charlotte	View West off Lake Road at the Town beach (V5)
Charlotte	View Southeast off Mt. Philo Road, north of Spear Street (V6)
Charlotte	View Southeast off lower Spear Street, north of the covered bridge (V7)
Charlotte	View Southeast at the intersection of Greenbush Rd. and Thompson's Pt. Rd. (V8)
Charlotte	View Guinea Road near the intersection with Bingham Brook Road (360 degrees) (V9)
Charlotte	View East and north on Spear Street, west of the covered bridge (V10)
Charlotte	View South off of Spear Street on the south side of Mt. Philo (V11)
Charlotte	View East on Hinesburg Road, near Dorset Street and Bean Road (V12)
Charlotte	View East off Mt. Philo Road, just north of One Mile Road (V13)
Charlotte	View West on Lake Road, descending towards Orchard Road (V14);
Charlotte	View East on Prindle Road between Spear Street and Bean Road (V15)
Charlotte	View North on Roscoe Road, vicinity of Lewis Creek Road (V16)
Charlotte	View from Both sides of Spear Street, between Hinesburg Road and Prindle Road (V17)
Charlotte	View East on Ferry Road, near Lake Road (V18)
Charlotte	View West on Garen Road at top of the hill (V19)
Charlotte	*Resources identified on Map 13: Public Roads With High Scenic or Conservation Values*
Colchester	East Lakeshore Drive
Colchester	Lake Champlain
Essex	Alder Brook Valley – Old Stage Road East
Essex	Alder Brook Valley – Chapin Road West
Essex	Allen Martin Drive
Essex	Brigham Hill Road/Lane
Essex	Browns River Floodplain – Bixby, Osgood Hill, Browns River Road, Ellis Road, Hanley Lane, Weed Road, VT Route 15
Essex	Browns River Road
Essex	Circumferential Highway (proposed)
Essex	Chapin Road
Essex	Essex Center Commons
Essex	Farms and adjacent landscape – Whitcomb Farms (Village and Town); Hunter Farm – Robert Lemire; Earl Mathews; Holmes; and others
Essex	Fort Ethan Allen - The Parade Ground
Essex	Fort Ethan Allen Stone Tower
Essex	Hanley Lane (Osgood Hill)
Essex	VT Route 15 – Between Essex Junction and Essex Center; Winooski Valley Park District Overlook across from Fort Ethan Allen
Essex	Old Stage Road East
Essex	Osgood Hill East and West
Essex	River Road (select points particularly near the North Williston Road Bridge)
Essex	The Saxon Hill areas extending from the Jericho Town line to Sand Hill Road
Essex	Saxon Hill Fire Tower Site (no longer standing)
Essex	Sleepy Hollow Road

TOWN	RESOURCE OF SCENIC SIGNIFICANCE
Essex	Towers Road
Essex	Weed Road
Essex	Winooski River
Essex Junction	The northeasterly section of the Village, between Upper Main Street and the Countryside development
Essex Junction	The river crossing on Park Street
Essex Junction	The westerly end of Pearl Street
Jericho	Bolger Hill Road
Jericho	Fitzsimmonds Road
Jericho	Hanley Lane
Jericho	Nashville Road
Jericho	Old Pump Road
Jericho	Lee River Road
Jericho	Sections of Orr Road
Jericho	Sections of Route 15
Jericho	Sections of Browns Trace Road
Jericho	The section of the Browns River from the Old Red Mill to Old Pump Road
Jericho	The section of Mill Brook that travels along Tarbox Road
Milton	Arrowhead Mountain
Milton	Cobble Hill
Milton	Georgia Mountain
Milton	High elevations in eastern Milton near the Westford boundary
Richmond	The Checkered House Bridge
St. George	Shelburne Pond
St. George	Views of Lake Champlain and Lake Iroquois as visible from public property and travel corridors
St. George	Structures listed on the State Register of Historic Places
Shelburne	*Resources identified on the Significant Views Map (Map 16)*
South Burlington	Six view protection zones are established in the City, predominantly in the Southeast Quadrant
South Burlington	The City has protected what are deemed to be the most important public views from existing and proposed public properties through the View Protection Overlay Zone (VPZ).
South Burlington	Views south of Swift Estates and extending southward a short distance
South Burlington	Views east of Dorset Street and south of Swift Street and also aligned in a north-south direction
South Burlington	Views north-west of the intersection of Hinesburg and Van Sicklen Roads
South Burlington	Views on Hinesburg Road south of Interstate 89
South Burlington	Views along Old Farm Road
Underhill	Mount Mansfield Scenic Preservation Zoning District
Williston	The Brennan field, south of Mountain View Road
Williston	Brownell Mountain

TOWN	RESOURCE OF SCENIC SIGNIFICANCE
Williston	The fields — which were designated as open space in the development review process—that provide an open view up to the homes of the South Ridge Subdivision, north of Rt. 2;
Williston	The former Mahan Farm fields, south of Route 2,
Williston	The LaCasse fields along South Brownell Road
Williston	The Martel Hill, located north Mountain View Road

TABLE 4. ELEMENTS ADDRESSED IN MUNICIPAL PLANS IN RELATION TO SCENIC RESOURCES

CATEGORY	PERCENT OF TOWNS THAT REFERENCE
Building Heights	21%
Conservation District	16%
Dirt/Gravel Roads	11%
Forest/Conservation District	11%
Gateways	42%
Historic Structures as Scenic Resource	42%
Historic Development Patterns	32%
Lake Champlain/Shoreline	26%
Land Conservation/Preservation	26%
Natural Resource Conservation	11%
Night Sky/Light Pollution	32%
Open Land/Open Space	74%
Overhead Utilities	37%
Renewable Energy (Impacts to Scenic Views)	37%
Ridgeline Protection	47%
Scenic Overlay/Preservation District	21%
Scenic Roads	26%
Sprawl	32%
Surface Water	68%
Telecommunication Facilities	42%
Wetlands	53%
Wooded Areas/Woodland Management/Fragmentation	42%

B. SCENIC RESOURCES TRENDS SUMMARY

The prospect for continued scenic resource protection would be greatly affected if no further action towards this goal were to be taken by the region as a whole or individual municipalities. Scenic resource impacts occur at two levels: 1) local, small scale, incremental changes (such as subdivisions on a hillsides) which collectively, over time, affect scenic resources and 2) regional impacts that accrue from large scale and/or highly visible projects such as cell towers, wind farms or transmission lines. These large scale projects not only have potential for local impacts to adjacent neighborhoods or public open spaces and parklands, but due to their configuration can affect a whole region physically and aesthetically (a transmission corridor has this effect) or visually (a wind farm or cell tower).

In order to address scenic resource deterioration, municipalities and regional government and NGOs need to further identify and implement means of management and protection for critical viewsheds, vantage points, scenic landmarks and sensitive areas. It is important to note that sensitive environments and natural resource areas such as steep hillsides, intact woodlands and habitat areas as well as undeveloped shorelines often reflect valued aesthetic qualities as well. This approach requires a corresponding identification of areas where growth and development can occur. Lacking this type of initiative and without active monitoring or enforcement of provisions already in place for scenic protection, there will be a slow but steady decline in scenic qualities and the integrity of the local and regional landscape which is so highly valued for both quality of life and tourism. This condition, if allowed to occur over time, will undermine the region's scenic landscape in an irreversible manner, and result in unwarranted and economic and aesthetic impacts.

C. ADDITIONAL ANALYSES TO BE COMPLETED

- Review each towns zoning in relation to scenic resource protection – do towns implement the goals and policies identified in the municipal plan? Are regulations specific enough so as to be clearly interpreted during permitting?
- Overlay conserved land with identified resources to understand the extent to which these areas are already protected

D. OTHER REFERENCES AND SOURCES TO BE RESEARCHED OR MONITORED

- *Landscape Aesthetics, A Handbook for Scenery Management*, US. Department of Agriculture, December 1995
- America's Byways
- Vermont Byway Program
- *Conserving Our Treasured Places: Managing Visual Quality on Scenic Byways,* Scenic America
- *The Roadscape Guide, Tools to Preserve Scenic Road Corridors,* Champlain Valley Greenbelt Alliance for the Vermont Forum on Sprawl*,* 2006
- Views to the Mountains: A Scenic Protection Manual, Towns of Essex and Jericho
- The View from the Road, Patterns, Principles & Guidelines for Roadscape Design, Champlain Valley Greenbelt Alliance
- Vermont's Scenic Landscapes: A Guide for Growth and Protection, Vermont Agency of Natural Resources

E. PRELIMINARY RECOMMENDATIONS

- Identify and delineate key regional viewsheds of local, regional, or statewide significance, building on local programs and the Natural Areas Suitability Maps as developed by CCRPC.
- Encourage local communities to develop standards that identify, delineate and value scenic resources and the incorporation of common standards into local plans and ordinances. Several towns including Charlotte scenic road designations, Jericho and Essex, with the "Views to the Mountain" project and Shelburne with its current Built Environment Study designed to identify and protect high value scenic, historic and cultural landscapes.
- Support and increase efforts to work both on a local level and collaboratively on a regional level to develop scenic resource management tools that are both regulatory and non regulatory.
- Overlay scenic resource areas or areas known for scenic value with the CCRPC's Natural Areas Suitability Map to identify areas where these values overlap, thus reinforcing and elevating the value of such landscapes.
- Continue to develop educational tools such as *Vermont's Scenic Landscapes - A Guide to Growth and Protection* (published by the Vermont Agency of Natural Resources) and the Champlain Valley Greenbelt Alliance's *Roadscape Guide* and *View to the Road* publications.

VII. SOURCE/NOTES

1. *State of Vermont 2010 Water Quality Integrated Assessment Report*, VT DEC Water Quality Division, August 2010
2. Based on Chittenden County Regional Planning Commission GIS Data
3. Both sides of the river/stream are protected
4. *State of the Lake: An Ecosystem Indicators Report*, Lake Champlain Basin Program, 2008
5. *Vermont in Transition: A Summary of Social, Economic and Environmental Trends*, Center for Social Science Research at Saint Michael's College, December 2008
6. State of Vermont Endangeres Species Committee, Species Status Review, June 2011
7. Needle, Melanie, Chittenden County Regional Planning Commission. Memo to Rick Hopkins, Vermont Agency of Natural Resources, Winooski, VT, 2004
8. *Environmental Implications of Increasing Chloride Levels in Lake Champlain and Other Basin Waters*, VT DEC Water Quality Division, February 2008
9. *2013 Draft Chittenden County Regional Plan*
10. *2010 Vermont Forest Resources Plan* – Vermont Department of Forests, Parks and Recreation, June 2010
11. *Wildlife Considerations in Local Planning* – Vermont Natural Resources Council, February 2011

12. *Informing Land Use Planning and Forestland Conservation Through Subdivision and Parcelization Trend Information* – Vermont Natural Resources Council, September 2010
13. Based on a review of zoning regulations of all the towns in Chittenden County.
14. Natural Areas are rated by their ability to perform the following functions: exemplary natural communities; unfragmented landscape; refuge and habitat for rare and threatened species; lands with restoration potential; significant habitats for terrestrial wildlife; contribution to overall and representative biotic and physical diversity; water quality and aquatic habitats; and, stable rivers and subsurface water systems.
15. *Vermont's Wildlife Action Plan*, Vermont Fish & Wildlife Department, Waterbury, VT, November 2005
16. *Conserving Vermont's Natural Heritage, A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife, and Biological Diversity*, Vermont Fish & Wildlife Department and Agency of Natural Resources, Waterbury, VT 2004
17. *Keeping Our Air Clean, Local and Regional Strategies to Improve Air Quality in Chittenden County*, Chittenden County Metropolitan Planning Organization and Chittenden County Regional Planning Commission, February 2010
18. *Vermont's Working Landscape, Investing in our Farm and Forest Future: The Action Plan of the Vermont Working Landscape Partnership*, Vermont Council on Rural Development, September 2011
19. USDA Census of Agriculture, 1997 and 2007
20. Agricultural Lands were rated based on the following functions; prime farm and statewide soils; soil potential for crop productivity; access to surface water; adjoining land use; and, municipal zoning.

Maps

Existing/available maps and data used in this analysis include:

1. 1992 USGS National Land Cover Dataset
2. 2006 USGS National Land Cover Dataset
3. 1992 USGS National Impervious Surfaces Dataset
4. 2006 USGS National Impervious Surfaces Dataset
5. Maps and data from *State of the Lake: An Ecosystem Indicators Report*, Lake Champlain Basin Program, 2008
6. Maps and data from *Linking Land Use Change, Stream Geomorphology, and Aquatic Integrity in Changing Forested Landscapes*, University of Vermont

8. Maps and data from *2010 Vermont Forest Resources Plan* – Vermont Department of Forests, Parks and Recreation, June, 2010
9. Maps and data from *Informing Land Use Planning and Forestland Conservation Through Subdivision and Parcelization Trend Information* – Vermont Natural Resources Council, September 2010
10. GeologicOther_AGGRES data layer available from VCGI
11. Parcel data layers for each town available from VCGI
12. Draft 2012 Regional Plan Maps and related GIS data from the Chittenden County Regional Planning Commission, including the following:
    - Map 3-1 Surface Waters
    - Map 3-2 Wetlands
    - Map 3-3 Impaired Waters
    - Map 3-7 Forest Cover
    - Map 3-8 Core Forests
    - Map 3-9 Natural Areas
    - Conserved Lands Data Layer
    - Zoning Districts Data Layer
    - Working Agricultural Lands Map (from the open space planning project)