This plan combines the Regional Plan, the Metropolitan Transportation Plan (MTP), and the Comprehensive Economic Development Strategy (CEDS) into one integrated plan.

For a healthy, inclusive, and prosperous community.

Chapter 2.2

This plan can be found online at: www.ecosproject.com/plan
2.2 NATURAL SYSTEMS

**Broad Goal:** Design and maintain a strategically planned and managed green infrastructure network composed of natural areas, working lands, wildlife habitat, scenic views and air quality that help to conserve ecosystem values and functions (including climate change adaptation and mitigation), and provide associated benefits to our community.

**INTRODUCTION:** A sustainable community preserves natural systems in order to maintain quality of soil, air and water and because they offer a richness that nurtures the human spirit. Healthy landscapes are necessary to sustain the complex myriad of plant and animal species that share our habitat. We are dependent on the surrounding landscapes for many resources such as food, water and fuel; for recreational opportunities and aesthetic values; and for vital natural processes such as water retention and recycling, air cleansing, carbon sequestration, and nutrient cycling. Preservation of our natural systems can help guide new growth into existing developed areas. In addition, a network of healthy natural systems and green infrastructure can make very important contributions to the overall prosperity of the region.

As a result of our topography and historic development patterns the eastern side of Chittenden County contains large intact habitat blocks, while the western side does not; however many important habitats exist throughout the entire County. Therefore, this plan calls for efforts to maintain the existing natural systems throughout the County, and minimize fragmentation of habitats and maintain wildlife corridors. The *Conserving Vermont’s Natural Heritage Guide* (Vermont Fish and Wildlife Department and the Agency of Natural Resources, 2004) identifies the following seven mechanisms by which current development patterns degrade Vermont’s natural heritage: 1. direct loss of diversity; 2. destruction of habitat; 3. habitat fragmentation; 4. disruption of movement, migration, and behavior; 5. introduction of invasive exotic species; 6. degradation of water quality and aquatic habitat; and 7. loss of public appreciation for the environment. Methods to combat or mitigate these mechanisms are crucial to the sustainability of the County as we continue to grow.

This section also touches on the local impacts of a changing climate. Our region’s climate is already changing; warmer, wetter conditions are expected to increase this century (*Chittenden County Climate Change Trends and Impacts*). These changes will adversely impact forest and aquatic communities, water quantity and quality, public health, agriculture, winter sports businesses, and buildings and infrastructure in flood and fluvial erosion hazard areas. Curbing climate change will require planet-wide actions to reduce greenhouse gas emissions; and preparing locally so that we can be resilient in light of these changes is imperative.

This Plan uses a multidisciplinary, holistic ‘ecological systems’ 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 whole ecosystem. In that same way, we must look beyond our municipal, county and state political boundaries to understand the impacts, both positive and negative, we have on each other. We need to collaborate with each other and adjust our actions in a measured fashion in support of ecosystem health.
2.2.1 Ecological Systems

**Goal:** Conserve, protect and improve the health of native species habitats, water quality and quantity, and air quality.

Key Issues/Trends/Insights
[Data for this section drawn from Natural Systems Analysis Report and Lake Champlain Basin Program's State of the Lake Reports]

- **Wildlife and Native Species** Chittenden County continues to see fragmentation and loss of *habitat* and connectivity largely due to mounting development pressures. Increasing land parceling and subsequent habitat conversion, lack of local regulations responsive to wildlife habitat concerns, and construction of transportation infrastructure (including roads and trails) continue to adversely impact habitat 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.

- **Water Quality** Vermont water bodies continue to face mounting pressures from unsustainable development, farm and forest activities. Cumulative impacts from these land use activities have degraded water quality, aquatic habitat and altered the stability of river corridors and lakeshores. Issues that predominate in the County include disappearing wetlands, increasing impervious surfaces, steady high pollutant loads (mainly from nonpoint sources such as unmanaged stormwater), that result in nutrient enrichment and sedimentation, as well as other impairments. In addition, aquatic nuisance species continue to enter our waterways, contributing to the degradation of both habitat and recreational opportunities. Climate change is expected to bring us more intense storms at a higher frequency, which will only exacerbate the problem.

- **River Corridors** *River corridor resilience* is also critical to the health of our ecological systems as well as protection of nearby infrastructure. Channelization of streams and rivers, reduction and alteration of natural floodplains, river corridor encroachment, stormwater runoff and reduction and elimination of vegetative buffers are practices that lead to river corridor instability causing excessive erosion of river channels, pollution and additional fluvial erosion hazards. Of the river miles assessed in Vermont, 74% have become confined to deeper, straighter channels and no longer have access to historic floodplains essential to stable streams and sustainable water quality management.

- **Groundwater** As of 2005, 22,120 residents of Chittenden County (almost 15% of the population) rely on *groundwater* sources for their drinking water (Source: USGS Water Use Compilation – completed every 5 years). Protection of groundwater resources from failing septic systems and petroleum spills/leaks is critical.

- **Regulations** *Local zoning lags behind town plans*. There is a disconnect between the vision for natural systems as expressed in Municipal Plans, and the Zoning Regulations that implement those plans. In addition, many zoning regulations have vague review standards and definitions, a situation that complicates enforcement and opens the town to due process legal challenges. Conversely, local bylaws protect the majority of Fluvial Erosion Hazard areas in the County with stream setbacks and floodplain regulations from new development. However, agriculture and forestry practices are exempt from local review and without State enforcement
of accepted agricultural practices fluvial erosion hazard areas are subject to degradation.

- **Air Quality** Outdoor air pollution in significant concentrations can raise aesthetic and nuisance issues such as impairment of scenic visibility, unpleasant smoke, or odors; and can also pose human health problems, especially for more sensitive populations like children, asthma sufferers, and the elderly. While Chittenden County’s air quality meets current National Ambient Air Quality Standards (NAAQS), we are close to the standards for ground-level ozone and fine particulate. We are also subject to pollution from the mid-west that we cannot control. If the NAAQS are revised to be more stringent - or air pollutant levels increase - so that we exceed the NAAQS, additional and costly environmental regulations will apply to our region (Source: http://www.anr.state.vt.us/air/).

**Key Indicators**

- **Chittenden County Land Cover Losses (Source: USGS 2001 and 2006 National Land Cover Data):**
  - .19 net acres of agricultural land and natural resource land lost annually to development per new resident between 2001 and 2006.
  - 210,619 acres or 61% of the land are covered by forest.
  - Between 2001-2006, 241 acres or .11% of barren land, deciduous forest, evergreen forest, mixed forest, shrub, grassland, woody wetlands, and emergent herbaceous wetlands were converted to development. These land cover categories are being used a surrogate for wildlife habitat as there is currently a lack of a better, more accurate data source.
  - In particular, 55 acres or .5% of wetlands were developed in Chittenden County.
Number and Length of Degraded Rivers/Streams (See the Water Quality and Safety Map with Strategy 3.2.3 in Chapter 3):
  o 8 miles or 1% of all stream miles and Shelburne Pond, and Lake Champlain (Mallets Bay, Northeast Arm, Shelburne Bay, and Burlington Bay) are considered impaired for a variety of reasons (Source: Vermont Dept. of Environmental Conservation, 303d List Part A, August 2012 USGS, Vermont Hydrography Dataset, 2001-2004) and require a total maximum daily load management strategy.
  o The 2012 Vermont List of Priority Surface Waters also includes:
    - 8 miles or 0.53% of all stream miles and Burlington Bay, Muddy Brook and Unnamed Tributary of Winooski River are impaired and do not require development of a total maximum daily load (TMDL) because attainment expected in a reasonable time (Part B).
    - 26 miles or 2% of all stream miles are in need of further study to confirm the presence of a violation of one or more criteria of the Vermont Water Quality Standards (Part C).
    - 93 miles or 6% of all stream miles and Lake Champlain (Burlington Bay, Mallets Bay, and Shelburne Bay) and Arrowhead Mountain Lake have completed and approved TMDLs in place, though they are not meeting water quality standards yet (Part D).
    - 41 miles or 3% of all stream miles and Lake Champlain (Burlington Bay, Mallets Bay, and Shelburne Bay), Arrowhead Mountain Lake, and Lake Iroquois are altered by invasive aquatic species (Part E).
    - 15 miles or 1.03% of all stream miles are altered by flow regulation (e.g., Dams) (Part F).

Phosphorus level concentrations in several areas of Lake Champlain have remained relatively steady since 2007; however the non-point loads are consistently above the target in the Main Lake and Mallets Bay. Non point phosphorus loading from streams to the main section of Lake Champlain are recorded at 3.3 times the target of 51.3 metric tons, and to Mallets Bay almost twice the target of 25.4 metric tons. Though it is important to note that the Lamoille River drains to Mallets Bay and is located largely outside of Chittenden County. (Source: State of the Lake and Ecosystem Indicators Report 2012, Lake Champlain Basin Program).

Percent of Impervious Surface by Watershed (Source: 2008 Impervious Surface Data, ANR):
  o 8,267 acres or 7% of the Lake Champlain Direct Watershed is impervious.
  o 3,145 acres or 3% of the Lamoille River Watershed is impervious; and within Chittenden County 3.6 % impervious.
  o 7,779 acres or 6% of the Winooski River Watershed is impervious; and within Chittenden County 5.6% impervious.
  o Chittenden County is 5.63% impervious.

Chittenden County's Air Quality close to National Ambient Air Quality Standards (NAAQS) for ground-level ozone and fine particulate:
- Ozone air quality samples taken since 1995 consistently show the County being below (though often close to) National Standards.
2.2.2 Scenic, Recreational, and Historic Resources

Scenic and Recreational Resources Goal: Conserve, protect and improve valued scenic, recreational, and historic resources and opportunities.

Key Issues/Trends/Insights
[Data for this section drawn from Natural Systems Analysis Report]

- Chittenden County is rooted in its scenic, recreational, and historic resources. These provide residents a place to relax, play, gather, and learn about nature, conservation, and our heritage. They also provide important ecological functions including wildlife habitat, and water and air quality protection. These are supplemented by indoor and outdoor recreation facilities. An extensive system of shared-use paths, on-road bike lanes, and off-road trails connect the County’s recreational facilities and areas (this data can be found under the Natural Systems section of the online map located here: http://maps.ccrpcvt.org/ChittendenCountyVT/).

- 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.

- Historic resources include buildings, structures, landscapes, and archeological sites, both on land and under water. There are over 4,400 designated historic sites in Chittenden County and over 80 designated historic districts (this data can be found under the Natural Systems section of the online map located here: http://maps.ccrpcvt.org/ChittendenCountyVT/).

- The recreational value of our water bodies (swimming, fishing, boating, etc.) is critically dependent on water quality. E-coli and algal blooms lead to beach closures, while invasive species threaten our native fish populations. Events and encroachments such as these are exacerbated by the effects of climate change.

- As we work toward encouraging future development in areas planned for growth to maintain VT’s historic settlement pattern of villages and urban centers, surrounded by rural countryside, access to valued scenic, recreation and historic resources should also be maintained and improved for all residents and visitors.

- Eight of the County’s municipalities (Milton, Colchester, Essex Junction, Winooski, Burlington, South Burlington, Shelburne and Charlotte) are member communities of the Lake Champlain Byway, a State-designated Scenic Byway that extends from Alburg in the Champlain Islands through Chittenden County on U.S. 7 and south into several towns in Addison County. Since 2002 these communities have secured competitive grants from the National Scenic Byway Program to improve the visitor experience by implementing projects such as wayfinding signage, interpretive panels, brochures, kiosks, and other amenities. In particular, the Byway focuses on improving interpretation and information about municipal and non-profit intrinsic resource sites such as parks, town forests, natural areas, trails and smaller museums.
- 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. Further, there are often contradictory goals within municipal plans regarding natural and scenic preservation and new infrastructure for energy generation and transmission. Reconciliation of these are necessary to meet community visions and bring predictability to the development process.

**Key Indicators**

- **50,789 acres or 15% of Chittenden County’s land area is protected from development.** Source: UVM SAL Conserved Land Database and municipalities.
- **56,450 acres or 17% of Chittenden County’s land area is available for recreation in the form of town & state parks, athletic fields, and natural areas.** Source: CCRPC
- **Local Zoning Lags behind Plans** (Source: ECOS Natural Resources Analysis Report, Landworks). Municipal Zoning Regulations vary.
  - 16% of towns provide specific standards and guidelines for protecting identified scenic resources.
  - 68% of towns provide general recommendations for protecting scenic resources (e.g., views and landscapes along scenic roads should be protected).
  - 16% of towns reference scenic resources but provide no goals, standards, guidelines, or recommendations.
  - 57% of scenic resources identified are of roads or views from roads.
  - The majority (74%) of towns reference scenic resources in relation to their value as open space.
  - 42% of towns recognize that woodlands provide scenic as well as ecological values.
  - About 40% of towns consider historic structures and settlement patterns a scenic resource.
  - 21% of towns have a scenic overlay/preservation district.
2.2.3 Climate Change

**Climate Change Goal:** Reduce greenhouse gas emissions contributing to climate change and adapt to become more resilient to a changing climate.

**Key Issues/Trends/Insights**
[Data for this section drawn from *Chittenden County Climate Change Trends and Impacts*. Another reference that is currently under development is the *Chittenden County Regional Climate Action Plan*.]

- Temperature and precipitation records for the latter half of the 20th century show that Chittenden County’s climate has changed: winters became warmer and summers became hotter. Lake Champlain freezes over later and less frequently and the growing season lasts longer. Annual precipitation has increased, but more falls as rain instead of snow.
- Scientists overwhelmingly agree that changes in climate worldwide are a result of human activities, mainly the burning of fossil fuels. Climate model forecasts for the Northeast US predict that during this century temperatures will continue to increase, as will extreme heat days and heat waves. More precipitation and extreme precipitation events are expected to increase, although short-term summer droughts may also become more frequent.
- These current and predicted changes in climate have broad implications for our region.
  - **Environmental Quality** - Summer air quality will deteriorate, as warmer temperatures promote the formation of smog. More intense rainfall will increase storm water runoff and the potential for flooding. Increased rain and runoff will wash pollutants into our waterways, and warmer waters and nutrients will encourage growth of bacteria and blue-green algae.
  - **Natural Communities** - Cold-water aquatic species, such as brook trout, will struggle to survive in warmer waters and in competition with better-adapted species. Our forests will change: maple, beech and birch trees will gradually be replaced by oak and hickory trees that are better adapted to warmer, wetter conditions. Invasive species, like the hemlock wooly adelgid, will further affect change in forest composition.
  - **Public Health** - Warmer temperatures allow the spread of insect-borne diseases, such as West Nile virus and Lyme disease. Air pollution and higher pollen production will increase problems for people with allergies, chronic respiratory diseases and asthma. High temperatures and heat waves will increase the risk of heat stress for the elderly, very young children and other vulnerable populations.
  - **Built Environment** – Flooding will put homes, businesses and public infrastructure in flood-prone areas at risk. Flooding may impact the safety of the water supply; droughts will also threaten water supplies. Although warmer winters will require less fuel for heating, hotter summers will increase electricity demands for cooling.
  - **Local Economy** - Warmer temperatures will hurt maple sugar production. Farmers can expect declining yields for cool-weather crops and depressed milk production from heat-stressed dairy cows. Less-colorful foliage seasons
will hurt fall tourism. Less predictable snow will jeopardize winter sports and recreation and compromise Vermont’s image as a winter sports destination.

- We can respond to climate change in two different ways.
  - **Climate mitigation** strategies will reduce the region’s contribution of greenhouse gases. Although Chittenden County may be a small part of global greenhouse gas emissions, it is important that Chittenden County do its part to help solve the problem.
  - **Climate adaptation** strategies help individuals, businesses and communities be able to withstand and bounce back from – or even take advantage of – the impacts of climate change.

**Key Indicators**

**Greenhouse Gas Emissions.**

In 2010, Chittenden County emitted approximately 1,177,000 metric tons of carbon dioxide equivalents (MTCO\(_2\)e).
**Vegetated Landscapes.** Vegetated landscapes are an important supporting indicator for both climate mitigation and climate adaptation. Plants are able to remove carbon from the atmosphere and store it in biomass and soils—a process called carbon sequestration. Maintaining forests, wetlands, agricultural lands and vegetated spaces in developed areas is important for ensuring current and future carbon sequestration. Vegetated landscapes are also important for the natural absorption of stormwater, reducing runoff and the potential for flooding. In 2006, Chittenden County was 95% vegetated, approximately equal to the vegetated area in 2001. This indicator is related to the impervious surface indicator in Ecological Systems. Based on 2001 landcover data, the carbon sequestration rate was about 761,000 MTCO₂e.

**Climate-Related Infectious Diseases.** Increased transmission of vector-borne diseases is a key supporting indicator associated with climate change. The Health Department tracks the number of new Lyme disease, West Nile virus (WNV) and Eastern Equine Encephalitis (EEE) cases each year. From 2003 to 2009, Chittenden County had one case of WNV and no cases of EEE. Data for Lyme disease are presented below.
Vermont Residents Discharged from Vermont, NH, NY, and MA Hospitals
Hospital Visits for Primary Diagnosis of Lyme Disease: Years of Admission 2003-2009

<table>
<thead>
<tr>
<th>Year of Admission</th>
<th>Statewide</th>
<th>Chittenden County</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>17</td>
<td>6</td>
<td>35%</td>
</tr>
<tr>
<td>2004</td>
<td>17</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>49</td>
<td>6</td>
<td>12%</td>
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<tr>
<td>2006</td>
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<td>11</td>
<td>10%</td>
</tr>
<tr>
<td>2007</td>
<td>52</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>100</td>
<td>9</td>
<td>9%</td>
</tr>
<tr>
<td>2009</td>
<td>82</td>
<td>**</td>
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</tbody>
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* all inpatient and outpatient visits.* Visits less than 6. Source: The Annual Vermont Uniform Hospital Discharge Data Sets (VUHDDS), inpatient and outpatient. VUHDDS does not include Emergency Department data prior to 2003. Data for 2010 is not available at this time.

FIGURE 17 - NUMBER HOSPITAL VISITS FOR LYME DISEASE

Heat Stress Hospitalizations

FIGURE 18 - HEAT STRESS HOSPITALIZATIONS