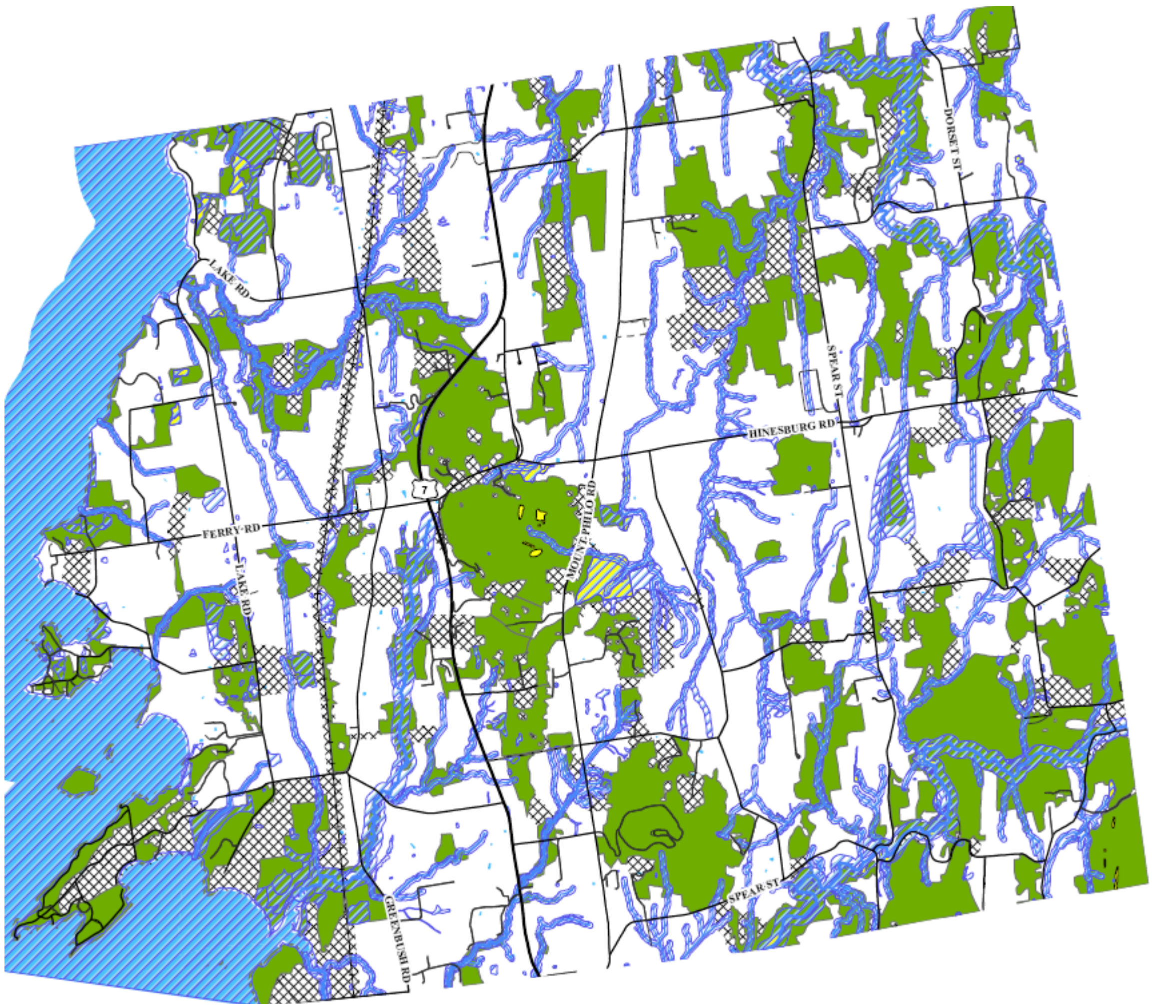
Technical Guide to Classifying, Identifying, and Justifying Significant Wildlife Habitat in Charlotte, Vermont



By
Jesse Mohr (Native Geographic, LLC),
Matthew Kolan (University of Vermont) and
The 2008 Charlotte Significant
Wildlife Habitat Working Group

During the late 1990s, the Charlotte Conservation Commission carried out a project to map and assess critical wildlife habitat and natural communities in the Town. The *May 2000 Critical Habitat Map* was a product of this effort and is acknowledged in the Town Plan and proposed Land Use Regulations as having high public value. While the current map is used as a reference by the Planning Commission, mapped areas are currently being eaten away by development due to lack of justification to protect them and/or lack of buffers.

As a result, the Charlotte Conservation Commission seeks to refine and strengthen the current map to include clear justification and detailed information about mapped significant wildlife habitat areas. The following is an attempt to create a framework for classification, identification and justification of Charlotte's Significant Wildlife Habitat. From this framework, we hope to create a standardized protocol addressing wildlife habitat concerns to be followed during the development review process.

Conserving the many facets of Charlotte's natural heritage

The following plan for identifying, mapping, and justifying significant habitat is designed to ensure the maintenance of viable wildlife populations in the Town by protecting the many facets of Charlotte's natural heritage, including the full range of conditions and natural processes that elucidate biotic response. To do so, we draw upon two complementary themes of conservation work: coarse- and fine-filter approaches to maintaining wildlife.

The plan is largely a habitat-based, or coarse filter, approach to maintaining viable animal and plant populations in the Town and surrounding area[1]. Here, animal and plant species of conservation need are not singly protected. Instead, the habitats and natural communities these species are associated with are the priorities for conservation. Such a strategy often has three distinct advantages: the species-specific data needed to track and protect single occurrences of species of conservation need are usually not available; whole suites of plant and animal species, often including multiple species of conservation need, are protected as a result; and many times the unforeseen ecological processes or currently unknown wealth of fungi and macroinvertebrates that often sustain many species of conservation need are afforded some level of protection as well

The second, albeit smaller, element of this plan is a fine-filter strategy[2]. Ideally, all of the documented occurrences of endangered, threatened, or significant species in the Town will be protected by well-buffered and largely intact habitat. This may not, however, always be the case. In instances were documented endangered, threatened, or significant species occur outside of an area otherwise designated significant habitat, these occurrences or populations will be buffered and singly protected. This is a fine-filter, or species-by-species, strategy.

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[1] Six of the eight landscape ecology principles introduced in Level-II of this plan address coarse-filter conservation needs, with rare and high public value species protection being the exceptions.
[2] Principle six, or rare species protection, addresses fine-filter conservation needs.

Level I: Classification and Description

In considering the unique features of Charlotte's landscape we have identified four habitat classifications for the 2008 iteration of the Charlotte Significant Wildlife Habitat Map. These classifications are descriptive in nature and represent very broad habitat types. Definitions for each of these habitats are provided below.

Forest habitat

Forests and woodlands are upland habitats where trees are the dominant life form. In forests, trees create a continuous canopy cover of 60% or more, while woodlands are defined by a continuous canopy cover of 25-60%. Forests and woodlands provide essential functions and services to many of Vermont's wildlife species – including food and water sources, protection, and sites for reproduction. Forest and woodland communities are widely diverse and can take many forms as a result of disturbances, successional stage, topography, substrate, bedrock, glacial history, climate, and past land use.

Throughout the last 250 years, the mosaic of upland habitat available to Vermont's wildlife has changed dramatically. The distribution, abundance, quality, and relatively proportion of different age classes have significantly changed since settlement. Before European settlement, it is estimated that forests covered 95% of the state, and up to 80% of this area would have been occupied by late successional, or old-growth, forests (Lorimer and White, 2003). At the peak of the sheep boom in the mid-1800's forests covered less than 25% of Vermont, while today forests cover over 75% of the state (Johnson, 1980).

Persistent shrubland habitat

Early successional habitat is characterized by young trees (continuous canopy cover of less than 25%) and shrubs that occupy frequently or recently disturbed sites. Early successional habitat, including sapling development up to 15 years in age, historically occupied from 1-3% of our New England landscape at any given time (Lorimer and White, 2003). This type of habitat was sustained by natural disturbances such as fire, floods, wind storms and beaver dams. Additionally some of this early-successional habitat was maintained by the browsing of large herbivore species. However, the relatively recent suppression of many of these natural disturbances, combined with the extinction and extirpation of many of New England's large herbivore species and the regeneration of forests in New England has resulted in a marked decrease of early-successional habitat (DeGraaf et al., 2005). As a result, many mammals, birds and herpetofauna that require this habitat to survive are declining in the northeast region (Litviatus, 1999).

Early successional shrubland provides important habitat for many wildlife species. In fact, Vermont's Wildlife Action Plan list of Species of Greatest Conservation Need (Kart et al., 2005) contains relatively few species requiring mid-successional forests and more that thrive in early and late-successional representations. Work by DeGraff and Yamasaki (2001) suggest that early-successional shrubland habitat supports a diverse assemblage of birds (37% of

New England species), amphibians, (13% of New England species), reptiles (62% of New England species), and mammals (72% of New England species). Additionally, a study by Wagner et al. (2003) suggested that shrubland is the most important habitat type for rare and endangered Lepidoptera in Massachusetts. Over the past 15 years, researchers have become widely concerned about birds that breed in early-successional shrubland habitats. In fact, these shrubland species are exhibiting more consistent declines than species that breed in mature forest (Askins 1993). Rare species associated with early-successional shrublands in New England have been shown to occur more often in enduring shrub habitats as opposed to ephemeral shrub habitats (Latham 2003). Currently in Vermont, enduring early-successional habitat can be found along power line and railroad right-of-ways and airports, while many old pastures and fields provide a less enduring shrubland habitat.

Aquatic habitat

Aquatic habitats include streams, rivers, lakes, wetlands, and their associated uplands that are directly affected by surface water, including floodplains and riparian areas (Verry et al., 2000). For the purpose of this project, surface water influenced uplands adjacent to streams/rivers (riparian zones) and lakes/ponds, wetlands, and the aquatic habitats found within the Town's various water bodies will be discussed and classified together as they are inextricably linked and interdependent.

Riparian zones are essential to the health of many terrestrial and aquatic wildlife species. Healthy riparian and wetland habitats provide a wide range of ecological functions including flood and erosion protection, water protection (via nutrient and pollution filtration, groundwater recharge, filtering overland runoff, stabilizing river and streambanks) and providing downed wood, leaves and other organic material that contribute to the food base and structure of adjacent waterways (Austin et. al. 2006). Additionally, vegetated streambanks provide terrestrial wildlife with cover and corridors for travel and dispersal as well as other special habitat features (such as food, nesting, perching, or basking sites).

Riparian ecosystems are unique in their high biological diversity (Austin et al., 2006). Veery et al. (2000) describes them as being characterized by "frequent disturbances that…create habitat complexity and variability...resulting in ecologically diverse communities." Yet despite the many essential ecological functions they provide, it is estimated that 70-90% of natural riparian vegetation has been lost or degraded nationwide (Doppelt et al., 1993).

Linkage Habitat

Linkage habitat provides for safe animal movement and plant dispersal between habitat patches, partially isolated populations or subpopulations, and across entire landscapes. It is important to recognize that connectivity is not only species-specific, but also species function or process specific (Jensen and Bourgeron, 2001). Connectivity needs for seasonal migration, for example, are far different than connectivity needs for daily foraging activities. Corridors, habitat stepping stones, and favorable matrix land use are few ways to improve habitat connectivity.

When surrounding, or matrix, land use results in conditions similar to protected area habitat conditions, wildlife can easily disperse through non-protected areas (Franklin, 1993). For maintenance of grassland species, connectivity and linkage habitat can best be provided by favorable agricultural land use or lawn maintenance. Agricultural land use, however, becomes a connectivity barrier to dispersing forest species. The small amount of forest management in the Town may provide limited opportunities to enhance and maintain connectivity for dispersing forest species.

In the Champlain Valley, connectivity and linkage habitat for forest species can best be provided by corridors and habitat stepping stones. While corridors are often applied to discrete, or even linear, structures (such as riparian areas or hedgerows), this project defines corridors as any areas likely to support movement between habitat patches or other important wildlife areas or resources regardless of cover (Forman, 1985). A broad definition like this encompasses all concentrated areas of wildlife movement, including habitat stepping stones, riparian zones, and hedgerows.

Ideally, features or areas enhancing/maintaining connectivity are also a usable and important habitat in their own right, such as riparian corridors. For this project connectivity and linkage habitat will be mapped as a hollow cross-hatch symbol, often mapped on top of other Level-1 habitat classifications (forest, grassland, early successional, and aquatic). Because intensive agricultural use and residential development of the Town has created a highly dissected landscape, connectivity will also be mapped over additional areas not otherwise designated significant habitat.

All land that fits into one of the above categories is not necessarily considered significant habitat. To provide adequate and defensible justification for significant habitat each area will be assessed according to seven ecological principles for habitat protection (level II).

Level II: Identification and Justification of Significant Wildlife Habitat Using Landscape Ecology Principles

Effective conservation planning involves applying scientific knowledge to complex regional situations for purposes of identifying those areas of land and habitat that are essential for the long-term conservation of biodiversity and natural heritage values (and related public interests) within the area of interest. The following seven ecological principles have been identified and accepted as a basis for habitat protection in developing areas (adapted from Duerksen et al., 1997). For the purposes of this framework, we further define significant wildlife habitat as: ***land that supports one of more of the following seven ecological principles that have been identified and accepted as a basis for habitat protection in developing areas.***

1. Maintain large, intact patches of native vegetation. ***(Core Habitat)***

2. Protect habitats that are key to the distribution and abundance of priority species (priority species habitat is based on the 2006 Vermont Wildlife Action Plan). ***(Priority Species Habitat)***

3. Protect exemplary natural communities and aquatic features ***(Rare Landscape Features)***

4. Maintain connections among wildlife habitats for movement and geneflow ***(Connectivity)***

5. Maintain significant ecological processes (such as those associated with wetlands and floodplains for recharging groundwater and filtering surface water). ***(Maintenance of Ecological Process)***

6. Contribute to the regional persistence of rare species by protecting their habitat locally. ***(Rare Species Protection)***

7. Represent the full diversity of Charlotte's ecosystems. ***(Representation)***

Each of these principles is supported by a large body of scientific literature and evidence). Within the context of the Charlotte Significant Wildlife Habitat Map update process, these principles will be utilized in five ways:

- To **evaluate** the current habitat map (are polygons providing these services?).
- To **strengthen** and **justify** habitat map (for each polygon list the principles that support its conservation).
- To aid in **detection** of areas that may have been overlooked in earlier mapping efforts.
- Encourage common conservation approaches between Charlotte Conservation Commission (CCC), Lewis Creek Association (LCA), Vermont and Charlotte

Land Trusts, The Nature Conservancy, other Towns, and the Vermont Fish and Wildlife Department.

- To **articulate** a series of ecological questions which should be addressed by site specific field assessments as a part of proposed development of land designated as "significant wildlife habitat."

By applying each of the seven ecological principles to the broad habitat categories described above (level I), we will provide the Town of Charlotte with a scientifically sound framework for identifying and justifying significant wildlife habitat.

During the current phase of this project, we will use the ecological principles framework to begin a preliminary desk-top assessment of each area (utilizing the rich history of inventory and assessment work that has been completed in Charlotte) and to identify additional data that will be needed to evaluate the given area. From that data we will be able to identify which landscape ecology principles are being represented and maintained in each area.

Additionally, these ecological principles naturally lead to a series of questions which should be addressed by site specific field assessments as a part of proposed development of land categorized as or adjacent to "significant wildlife habitat."

Level III: Detection and Site-specific Application of Landscape Ecology Principles

At this level of the classification, identification, and justification scheme, the previously mentioned landscape ecology principles are tested for and applied to individual habitat polygons. A single principle or multiple principles can be assigned to each "significant habitat" polygon based on prior work at the state-, regional-, town-, or site-scales, work completed during the 2008 Significant Wildlife Habitat Revision process, or a combination of past and current work. Table 1 highlights prior work and the principles they will be applied to. Additionally, table 1 highlights the work to be completed under this project, the Charlotte Wildlife Habitat Revision Process. The specific methods for detecting each of the landscape ecology principles, brief explanations of relevant prior work, and how previous work was incorporated into the process are extensively outlined in Appendix A Detection Methods. When detection is based on work to be completed during the 2008 Significant Wildlife Habitat Revision process, specific methods are also included in Appendix A

	Core Habitat	Priority Species Habitat	Rare Landscape Features	Connectivity	Maintenance pf Ecological Proces	Rare Species Protection	Representation
Town of Charlotte							
Charlotte Wildlife Habitat: A Framework For Protection	X	X	X	X	X	X	
2008 Charlotte Wildlife Habitat Revision Process ***(expected work to be completed under this project)***	X	X	X	X	X		X
Lewis Creek Association							
Contiguous Wildlife Habitat -- Lewis Creek and LaPlatte				X			
Lewis Creek Association Trackers				X			
Ecological Conservation Analysis of the Lewis Creek Watershed			X				X
Thompson, Elizabeth Consulting Ecologist							
A Report on the Ecological Significance of Pease Mountain		X	X			X	
Significant Natural Communities of Charlotte			X				
Report Thorp Brook and Lower Kimbal Brook Wetlands		X	X			X	
Burleigh Property Site Assessment Report		X	X			X	
University of Vermont							
Bobcat and Landscape Ecology of the Champlain Valley				X			
Vermont Biodiversity Project							
Core Habitat	X						
Exemplary Aquatic Features		X					
Mast Stands (part of the DFW Bear data set)		X					
Complementary Landscapes							X
Vermont Department of Fish and Wildlife							
Vermont Wildlife Linkage Habitat Analysis				X			
Vermont's Wildlife Action Plan		X					
Vermont Nongame and Natural Heritage Program							
Biological Natural Areas of Chittenden County			X				
Biodiversity Tracking and Conservation System						X	
Champlain Valley Clayplain Forests of Vermont			X				
Hardwood Swamps of Vermont		X	X				
Significant Limestone Bluff Cedar-Pine Forests of Vermont			X				
The Nature Conservancy							
Matrix Blocks				X			
Portfolio Database			X			X	
Land Type Association Data and Descriptions							X

Figure 1: Applicability of Prior and Anticipated Work to Landscape Ecology Principles. The major sources of prior work (highlighted in gray) and work to be completed under this project, 2008 Charlotte Habitat Revision Process (highlighted in orange), can be applied to the seven conservation ecology principles (Xs indicate which projects can be applied to which principles). This will provide the Town with scientific evidence for justifying any polygon's given "Significant Habitat" designation and also highlights how the many sources of information available for this project are to be integrated in the revision process.

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Appendix A: Principle Detection Methods

The following appendix contains the specific methods for detecting each of the landscape ecology principles in "significant habitat" polygons, provides brief explanations of relevant prior work, details how previous work was incorporated into the process, and outlines techniques used in this project, the 2007 Significant Wildlife Habitat Revision process.

I- Maintain large, intact patches of native vegetation. (Core Habitat)

Presence of "Core Habitat" detected by:

1) VT Biodiversity Project "Core Habitat" Map

As part of the larger Vermont Biodiversity Project, this group mapped out "core habitat" in Vermont. They Define "core habitat" as

> *".. at least 100 meters distant from a zone of human disturbance. Human disturbance zones were defined as developed, industrial, or residential areas, agricultural openings, and roads (Core Habitat Metadata)".*

2006 Inclusions

- Core habitat defined during the VT Biodiversity Core Habitat mapping project

OR…

2) 2006 Charlotte Significant Habitat Revision process

As part of this project, the presence of Core habitat was examined at the town-wide scale.

Desktop and field assessment conducted using "Contiguous Habitat" (Austin et al., 2004) and VT Biodiversity Project "Core Habitat" criteria and guidelines

2006 Inclusions (or potential removals):

- Core habitat not identified during the VT Biodiversity mapping project.
    - Methods: Because VT Biodiversity Core Habitat delineation was done at a coarse-scale, or low-resolution (28x28 meter grid cells), smaller occurrences of "core habitat" may have been glossed over. Therefore, a fine-scale, or high resolution, (vector-based) assessment may highlight areas not previously identified.
- Areas that supported interior habitat in 2000/2003, but no longer do so.
    - Methods: Site visits of identified interior or core habitat areas. Because 2003 NAIP aerials photos are the most recent aerial imagery for the entire Town of Charlotte (Kolan and Mohr

assessment) and the VT Biodiversity "Core Habitat" data is dated 2000, site visits may identify loss of interior habitat.

II- Protect habitats that are key to the distribution and abundance of priority species (priority species habitat is based on the 2006 Vermont Wildlife Action Plan). (Priority Species Habitat)

Presence of priority species habitat detected by:

1) 2006 Charlotte Significant Habitat Revision process

As part of this project, habitat and habitat needs commonly associated with regional and local priority species, or Species of Greatest Conservation Need, were identified at the town-wide scale.

Desktop and field assessments for Species of Greatest Conservation Need (SGCN) habitats are based on the Vermont Wildlife Action Plan (Kart et al., 2005). This methodology utilizes multiple scales including the species (C), habitat and community (B), and landscape (A) scales. Conservation priorities (landscape, habitat, and species), habitat descriptions/classifications, and SGCN-habitat associations are also based on the Vermont Wildlife Action Plan. Occurrences of SGCN are based on field observations (Kolan and Mohr, 2006; LCA Tracking Project, Vermont Breeding Bird Atlas) and the VT Nongame and Natural Heritage Database. Natural community descriptions are based on Thompson and Sorenson (2000) and elemental occurrence (EO) rankings are based on Sorenson (unpublished report) and Thompson (1995).

2006 Inclusions

- **(A)-SGCN Landscape needs**

  Include landscape-scale habitat needs of SGCN that may occur in the Charlotte area.
  - Northern Hardwood Landscape needs-
    - Contiguous forest (1,000+ acre blocks)
      - Methods. 1 Locate and include as part of core habitat assessment (Principle-I).
    - Mast Stands
      - Methods: 1. Include any important mast stands identified by the Vermont Biodiversity Project that still support this function 2. Locate during field assessments and include any stands that have the potential to be important hard mast stands (Butternut, Oak, Hickory and/or Beech comprise 30% or more of the Basal area (adapted Flatebo et

al., 1999)) 3. Locate during field assessment and include any concentrated soft mast areas

- Oak-Pine-Northern Hardwood needs
  - Contiguous forest (1,000+ acre)
    - Methods. 1 Locate and include as part of core habitat (Principle-I) and/or connectivity (Principle IV) assessments.
  - Mast Stands
    - Methods: 1. Locate during field assessments any current or historically important mast stands (based on scarring that is less than 10 years old of 15-25 trees (Austin et al., 2004)) 2. Locate during field assessments any stands that have the potential to be important mast stands (Butternut, Hickory, Oak and/or Beech comprise 30% or more of the Basal area (Flatebo et al., 1999)
- Aquatic(Lakes and Ponds) and Shoreline needs
  - Aquatic-terrestrial interface
    - Methods: 1. Identify and include areas with limited or no barrier between the lake/pond/wetland-shoreline and terrestrial habitat interface.
- Fluvial (Streams) needs
  - Longitudinal habitat (cover) connectivity
    - Methods: 1. Identify and include areas with continuous riparian cover
  - Lateral habitat (cover) connectivity
    - Methods: 1. Identify and include areas with limited or no barriers between the riparian system and upland forest.

- **(B)-SGCN Habitat and Community needs**

Include community-scale habitat needs of SGCN that may occur in the Charlotte area. Note: WAP has identified different levels of conservation or protection for different habitats/communities. This information is included in parentheses.

- Persistent Grassland Habitat (ensure protection)
  - Methods: 1. Using the Grasslands Study data and predictive model (UVM, Alan Strong) identify and locate areas of potential grassland habitat. 2. Landowner contact to verify persistence. 3. Include areas that provide the necessary habitat features and will likely persist as a result of natural environmental conditions and ecological processes or management..
- Persistent Early Successional Habitat(ensure protection)
  - Methods: 1. Identify areas of potential early successional persistence (powerline corridors, WHIP enrollees, above-ground gas lines) 2. Field assessment to verify current early

successional habitat. 3. Landowner contact to verify persistence. 4. Include areas that provide the necessary habitat features and will likely persist as a result of natural environmental conditions and ecological processes or management..

- Lake Champlain Tributaries (ensure protection)
  - Methods 1. Include a minimum 300 ft buffer (from top of the bank) on main channel of LaPlatte and Lewis Creeks(VT ANR, 2003) and other exemplary Aquatic features identified by the Vermont Biodiversity Project . 2. Include a minimum 100 ft (Flatebo et al., 1999) on Lake Champlain Tributaries
- Upland Shores (protection of high quality examples)
  - Methods 1: 1. Identify and locate potential high-quality examples. 2. If site visits reveal SGCN usage, include. 3. Assess remaining potential areas using Heritage program elemental occurrence ranking systems (Sorenson, unpublished report; Thompson, 1995). 4. Include all areas of an A or B ranking.
- Outcrops (protection of high quality examples)
  - Methods 1: 1. Identify and locate potential high-quality examples. 2. If site visits reveal SGCN usage, include. 3. Assess remaining potential areas using Heritage program elemental occurrence ranking systems (Sorenson, unpublished report; Thompson, 1995). 4. Include all areas of an A or B ranking.
- Cliffs and Talus Slope (protection of high quality examples)
  - Methods 1: 1. Identify and locate potential high-quality examples. 2. If site visits reveal SGCN usage, include. 3. Assess remaining potential areas using Heritage program elemental occurrence ranking systems (Sorenson, unpublished report; Thompson, 1995). 4. Include all areas of an A or B ranking.
- Shrub Swamps (protection of high quality examples)
  - Methods: 1. Identify and locate potential high-quality examples. 2. If site visits reveal SGCN usage, include. 3. Assess remaining potential areas using Heritage program elemental occurrence ranking systems (Sorenson, unpublished report; Thompson, 1995). 4. Include all areas of an A or B ranking.
- Buildings/Structures, including barns and other outbuildings, abandoned buildings, bridges, dam sites, and towers or tall buildings that mimic cliff sites (protection of high quality examples)
  - Methods: 1. Evaluate areas for SGCN occurrences. 2. Include all areas that currently support SGCN.

- Subterranean (protection of high quality examples)
    - Methods: 1. Include all known occurrences in Charlotte (including entrances, streams flowing into or out of, and associated sinkholes)
- Mines and Quarries (protection of high quality examples).
    - Methods: 1. Evaluate areas for SGCN occurrences. 2. Include all areas that currently support SGCN.
- Vernal Pools and Seeps (protection were appropriate)
    - Methods: 1. Locate and identify potential high quality vernal pools or pool complexes from flight and desktop reconnaissance. 2. Include pools that currently support SGCN or are buffered and well connected with suitable terrestrial habitat. 3. Locate and identify potential high-quality seep complexes or seepage forests. 4. Include any seep areas that support SGCN or are buffered and well connected with suitable terrestrial habitat.
- Hardwood Swamps (protect large and connected occurrences)
    - Methods 1: 1. Identify and locate potential high-quality examples. 2. If site visits reveal SGCN usage, include. 3. Assess remaining potential areas using Heritage program elemental occurrence ranking systems (Sorenson, unpublished report; Thompson, 1995). 4. Include all areas of an A, B, or C (prime restoration candidate) ranking.
- Floodplain Forests(protection of high quality examples)
    - Methods 1: 1. Identify and locate potential high-quality examples. 2. If site visits reveal SGCN usage include. 3. Assess remaining potential areas using Heritage program elemental occurrence ranking systems (Sorenson, unpublished report; Thompson, 1995). 4. Include all areas of an A, B, or C (prime restoration candidate) ranking.

III- Protect exemplary natural communities and aquatic features (Rare Landscape Features)

Presence of exemplary significant natural communities and aquatic feature detected by:

1) VT Nongame and Natural Heritage Biodiversity Tracking and Conservation System

The following guidelines are for determining whether a particular site will be included in an inventory report and entered into the NNHP database only; there is no legal or regulatory significance involved.

Although these are intended as guidelines only, they are meant to represent the default position and any deviation from them would need to be justified.

Meeting any of the following criteria would constitute state significance of sites for the purposes of NNHP inventories and for mapping and entering into the NNHP database.

<u>COMMUNITIES</u>

--- the presence of any S1 or S2 communities with an EO rank of A, B, or C;

--- the presence of an S3 or S4 community with an EO rank of A or B;

--- the presence of a S5 community with an EO rank of A.

Note that C-ranked S3 communities and B-ranked S4 and S5 communities are tracked, and may be considered state-significant

2006 Inclusions

- Areas identified as rare, endangered, or significant natural communities in the Natural Heritage Program Database.

OR…

2) Thompson (2006), Significant Limestone Bluff Cedar-Pine Forests of Vermont (2006), Thompson and Perlow (2005), Hardwood Swamps of Vermont (2004),Thompson (2003),) Biological Natural Areas of Chittenden Country (1991), Champlain Valley Clayplain Forests of Vermont (1998), and Floodplain Forests of Vermont (1998), and Thompson (Undated).

These site evaluations have examined, assessed, and identified a number of Charlotte’s unique and significant natural communities. As a collective, they tend to define rare, endangered, or significant natural communities as:

- Communities with a state ranking of S1(likely none in Charlotte (Thompson, 2003)) or S2 (Cedar-Pine Bluff and Valley Clayplain (Thompson, 2003)
- High quality occurrences (EO ranking of A or B) of uncommon (S3) and widespread (S4) communities.
- Occurrences given priority “1” in Thompson (2003)

2006 Inclusions

- Areas identified as rare, endangered, or significant natural communities in above site evaluations

OR…

3) 2006 Charlotte Significant Habitat Revision

As part of this project, rare, endangered, or significant natural communities were identified at the town-wide scale.

Desktop and Field assessment conducted using Thompson and Sorenson (2000) for community identification and state rarity rankings, and Thompson (1995) and Sorenson (unpublished report) for quality/elemental occurrence rankings.

2006 Inclusions:

- Significant community occurrences identified, but not assessed (priority ranks 2 and 3) in Thompson (2003).
  - Methods: 1. Identify communities present in areas targeted for visit by Thompson (2003). 2. Include any S2 communities. 3. Conduct quality/elemental occurrence rankings for potentially high quality S3 and S4 community occurrences and include any occurrences with rankings of A or B.
- Significant community occurrences not identified or targeted in any prior work.
  - Methods: 1. Include any significant communities occurrences (using State Heritage Program guidelines-see 1 under the first subheading of this principle) not previously detected.

IV- Maintain connections among wildlife habitats for movement and geneflow (Connectivity)

Effective habitat connections allow four types of movement or dispersal (Flatebo et al., 1999)

- Daily movements for foraging
- Seasonal or annual migrations
- Movement by young organisms away from their natal areas
- Complete or partial geographic range shifts

Even within a single species, each of these connections can take place at very different spatial scales. Movement from foraging to denning locations maybe measured in a single kilometer, while winter migration maybe measured in tens of thousands of kilometers, for example. This variability in scale is further compounded by species considerations, as corridor design and corridor efficacy need to be considered in a species-specific context (Noss, 1987).

Cohesiveness in Charlotte must, therefore, provide for movements across the entire Town, between significant habitat patches within the Town, and between different habitats that are important for different specie's life stages and/or functions. As a result, we have identified two major scales at which connections can be evaluated and provided for in the town of Charlotte:

- Regional connectivity
- Between patch connectivity

Presence of regional connectivity detected by:

These connections and corridors are important for seasonal migration, daily movement of far-ranging species, maintaining genetic diversity, and potential response to climate change.

1) Contiguous Wildlife Habitat – Lewis Creek and LaPlatte River Watershed Region: Landscape Level Identification of Contiguous Wildlife Habitat and Connecting Corridors for the Lewis Creek and LaPlatte River Watersheds and Adjoining Lands (Royar et al., 2003)

This project identified what appears to represent the best quality areas within and adjacent to the Lewis Creek Watershed for animals to move across roads and through developed lands linking identified habitat patches and habitat patch mosaics sufficient in space and area to support most wide-ranging and area sensitive native species. Because this was largely a predictive, desktop assessment, this dataset will be further assessed using field techniques.

2006 Inclusions

- Areas identified by this project as Contiguous Wildlife Habitat and Connecting Corridors and verified by the Charlotte Significant Habitat Revision process.

OR…

2) Vermont Wildlife Linkage Habitat Analysis: A GIS-Based Landscape-level Identification of Potentially Significant Wildlife Linkage Habitats Associated the State of Vermont Roadways (Austin et al., 2006)

As part of this project, potentially significant Wildlife Linkage Habitats and corresponding significant road crossings associated with state roads were identified and predicted throughout Vermont. Because this was largely a predictive, desktop assessment, this dataset will be further assessed using field techniques.

2006 Inclusions

- Areas identified by this project as having a High Probability of Contiguous Linkage Habitat and verified by the Charlotte Significant Habitat Revision process.

OR…

3) Lewis Creek Watershed Wildlife Tracking Project (LCA and Addison County Regional Planning)

This tracking group has identified preferred movement corridors for Bobcat, Black Bear, and to a lesser degree Otter.

2006 Inclusions

- Areas identified by this project as and verified by the Charlotte Significant Habitat Revision process.

Presence of between patch connectivity detected by:

These connections and corridors are important for movement between habitat patches for colonization or recolonization, juvenile dispersal, maintaining genetic diversity, and movement of mid- to short-ranging species.

1) Lewis Creek Watershed Wildlife Tracking Project (LCA and Addison County Regional Planning)

This tracking group has identified preferred movement corridors for Bobcat, Black Bear, and to a lesser degree Otter.
2006 Inclusions

- Areas identified by this project and verified in the Charlotte Significant Habitat Revision process.

OR…

2) 2006 Charlotte Significant Habitat Revision

As part of this project, corridors previously delineated by the 1999 Significant Habitat Project will be evaluated for use and potential use. Because functional corridors are not necessarily discrete structures (Turner at el., 2001) and previously mapped corridors all tend to follow riparian areas or other discrete forested linkages, this project will also examine areas not previously identified as corridors. In addition to corridor cover (including cover type, width, and length), this project recognizes many other abiotic factors influence wildlife movement, including matrix land management (Franklin, 1993), topography (Pe'er et al., 2006), and habitat quality (Noss, 1987).

Desktop and Field assessment conducted using guided and linear, intuitively placed transects.

2006 Inclusions or removals:

- Movement corridors not mapped or detected in previous work.
  - Methods-1. Detection of concentrated and significant movement during tracking and/or transects.
- Corridors identified in the 1999 Significant Wildlife Habitat Map that are not functioning as movement corridors:
  - Metods-1. Identify poor corridors for site visits, monitoring, and evaluation. 2. Remove corridors that are not and will not likely be functional corridors.
- Corridors identified by the LCA tracking group
  - Methods-1. Verify corridor usage as identified by the citizen tracking group. 2. Include areas with significant usage.

V- Maintain significant ecological processes (such as those associated with wetlands and floodplains for recharging groundwater and filtering surface water). (Maintenance of Ecological Process)

Presence of areas that support and/or are shaped by historically important ecological processes detected by:

1) 2006 Charlotte Significant Habitat Revision

Areas that support the maintenance of, or harbor species important to significant ecological processes were identified on the town-wide scale.

We recognize that ecological processes are dynamic in time and space and are often poorly captured by our currently available spatial data. We have, therefore, partitioned ecological processes into two lists: processes that are fairly discrete in location and are readily identified by our current spatial data, and processes that are more difficult to identify (due to any number of reasons including: dynamic and unpredictable nature, presence at a temporal and spatial scale beyond the scope of this project, species-specific context, town-wide presence, or our limited understanding).

Significant ecological processes (or surrogates) that are readily identifiable in Charlotte include:

Natural Disturbances:

- Beaver habitat and influenced systems
  - beaver-vegetation-ecosystem dynamics
  - habitat creation
  - habitat diversification
- Floodplains and riparian zones
  - alluvial deposition
  - river channel migration
  - river bank erosion
  - fluvial deposition
  - channel scour
  - habitat creation
  - habitat diversification
- Lakeshore areas
  - shoreline bluff erosion
  - shoreline scour and erosion
  - shoreline deposition
  - habitat creation
  - habitat diversification
- Cliffs and Talus slopes
  - slope erosion
  - colluvial deposition
  - habitat creation
  - habitat diversification

Wetland-related Ecological Services:

- Groundwater recharge
- Flood control
- Nutrient retention
- Sediment retention

Significant ecological processes or surrogates of that are not readily identifiable in Charlotte include:

Natural Disturbances:

- Fire
  - fire-vegetation-ecosystem dynamics
  - habitat creation
  - habitat diversification
  - nutrient cycling
- Windthrow
  - wind-vegetation-ecosystem dynamics
  - habitat creation
  - habitat diversification
  -

Biological:

- Natural Selection
- Species Evolution
- Birth
  - important breeding areas
  - important rearing areas
- Migration
  - seasonal movement corridors

Ecological Services

- Pollination
- Nutrient cycling
- Carbon Sequestration

Desktop and Field assessment conducted using the Charlotte Wetlands GIS Layer, Charlotte Forest Cover GIS Layer, Vermont Geomorphic Assessment and Floodplain GIS layers, ANR Groundwater and Aquifer Recharge Maps, Vermont Hydrography Dataset, USGS 10 meter Seamless DEM, and the UVM of Conserved Public Land Database.

2006 Inclusions:

- Beaver habitat and influenced systems as identified by the Charlotte Wetlands GIS Layer
- Floodplain and riparian zones as identified by the Vermont Hydrography Dataset and the Vermont Geomorphic Assessment and Floodplain GIS layers
- Lakeshore areas in a natural/semi-natural condition as identified by field reconnaissance, the Charlotte Forest Cover GIS layer, UVM Conserved Public Land Database, or the Charlotte Wetlands GIS Layer
- Cliffs and talus slopes interpreted from the USGS 10 Meter Seamless DEM
- Groundwater recharge areas as identified by ANR Groundwater and Aquifer Recharge Maps
- Wetlands that have not been significantly altered by damming or diking activities as identified by the Charlotte Wetlands GIS Layer
- If opportunities arise to sustain or support those less identifiable process, such as an area critical to pollinator species, this inclusion will be addressed on case-by-case basis

VI-Rare Species Protection Contribute to the regional persistence of rare species by protecting their habitat locally. (Rare Species Protection)

Presence of rare or threatened animal and plant species detected by:

1) VT Nongame and Natural Heritage Program Database Biodiversity Tracking and Conservation System

This database contains information on Vermont's endangered, rare, and threatened species.

2006 Inclusions

Globally Rare Species with a 100m (328 ft) minimum buffer for discrete plant populations

- All G1 species occurrences
- All G2 species occurrences
- Viable (EO ranking of A-C) G3/S1 species occurrences

- High Quality (EO ranking of A or B) G3/S2 species occurrences or the highest quality occurrence (C or D) if no A or B occurrences exist
- Excellent (EO ranking of A) G3/S3 species occurrences or the highest quality occurrence (B, C or D) if no A occurrences exist

State Rare Species with a 100m (328 ft) minimum buffer for discrete plant populations

- High Quality (EO ranking A or B) S1 species occurrences or the highest quality occurrence (C or D) if no A or B occurrences exist
- High Quality (EO ranking A or B) S2 species occurrences or the highest quality occurrence (C or D) if no A or B occurrences exist
- Highest Quality (EO ranking of A) S3 species occurrences or the highest quality occurrence (B, C or D) if no A occurrences exist

VII- Represent the full diversity of Charlotte's ecosystems. (Representation)

Maintenance of biodiversity requires that all aspects of biodiversity, including the full range of conditions driving biotic response, be protected (Noss and Cooperrider, 1994). Because scientific understanding of biodiversity, especially the many conditions driving biotic response, is still fairly limited, representative reserve or conserved land systems can be an effective surrogate. Representative reserve or conserved land systems include elements of all natural features (ecosystems, communities, habitats), especially those unlikely to persist under current extractive use or development patterns (Bourgeron and Jensen, 2001).

For this project, this principle will primarily be used as an overall assessment tool, but also offers a limited opportunity to enhance the representativeness of the State's and Bioregion's conserved and protected land system. As the "Significant Wildlife Habitat Map" begins to take shape, this principle will be used to highlight any shortcomings or missing features within the Town's Habitat Map and conserved area system. Because the biological data (primarily species distribution and drivers of biotic response) are largely unavailable, landform diversity will be the primary vehicle for the representative assessments.

Presence of state-wide representation gap (inclusion will increase representativeness of existing conserved area system in the State) detected by:

1) VT Biodiversity Project "Complementary Landscapes"

As part of the larger Vermont Biodiversity Project, this group assessed four components of Vermont's enduring (physical) landscape: climate, bedrock geology, surface geology, and topography. These four components were combined into a unique physical landscape classification system -- Landscape

Diversity Units (LDUs). The group then assessed the conservation status of these units, evaluating the representativeness of the current conserved and protected lands in the state. Their findings are in displayed in the state's Complementary Landscapes Map (Austin et al., 2004; Thompson, 2002). Complementary landscapes are defined as:

> *"enduring features (of the physical landscape) that are not found on any conserved land in Vermont (Thompson, 2002)."*

Protection of these feature will complement Vermont's existing conservation network, hence the name "complementary landscapes".

2006 Inclusions:

- Complementary Landscapes on the State-wide scale mapped by the Vermont Biodiversity Project.

Presence of bioregion-wide representation gap (inclusion will increase representativeness of existing conserved area system in the Champlain Valley) detected by:

1) 2006 Charlotte Significant Habitat Revision

As part of this project, the representativeness of the Charlotte Significant Habitat Map will be assessed on two scales: the town and bioregion (in addition to the state-scale addressed under the complementary landscapes heading).

Desktop and Field assessment conducted using Land Type Associations described by Ferree and Thompson (in progress). **Land Type Associations** are ecological groupings of land units based on similarities in geomorphic process, geologic rock types, soil complexes, stream types, lakes, wetlands, and natural vegetation (National Hierarchical Framework of Ecological Units,1997).

Analysis conducted during the Charlotte Significant Wildlife Habitat Project revealed a striking disparity in percent area of Land Type Associations within the bioregion's conserved area system. Only 2.6 % of the Valley Floor Glacial Lake/ Marine Plains are conserved in a way that protects natural vegetation cover. Likewise, only 1.9% of the Gently Rolling (till-derived) Hills are similarly conserved. The remaining Land Type Associations found in Charlotte—Bedrock Hills and Valley Bottom Riverine and Lakeside Floodplain—are relatively better represented in the bioregion's conserved area system, 8.8% and 16.6% respectively.

Forest cover analysis by Land Type Association indicates that there are ample opportunities to increase the overall representativeness of the bioregion's conserved area system through conservation action in Charlotte, including advisory protection through the Significant Wildlife Habitat Map. The Glacial Lake/Marine Plain, for example, is 26.2% forested in Charlotte, but only .4% of it is conserved in a way that protects natural vegetation cover. A similar, but more striking, discrepancy can be observed for the Gently Rolling (till-derived) Hill Land Type Association: 40% forested but only .01% conserved.

2006 Inclusions:

- Valley Floor Glacial Lake/Marine Plain forest patches greater than 10 acres and/or Valley Floor Glacial Lake/Marine Plain forest patches that satisfy at least one other principle identified under this project.
- Valley Floor Gently Rolling (till-derived) Hill forest patches greater than 10 acres and/or Valley Floor Gently Rolling (till-derived) Hill forest patches that satisfy at least one other principle identified under this project.