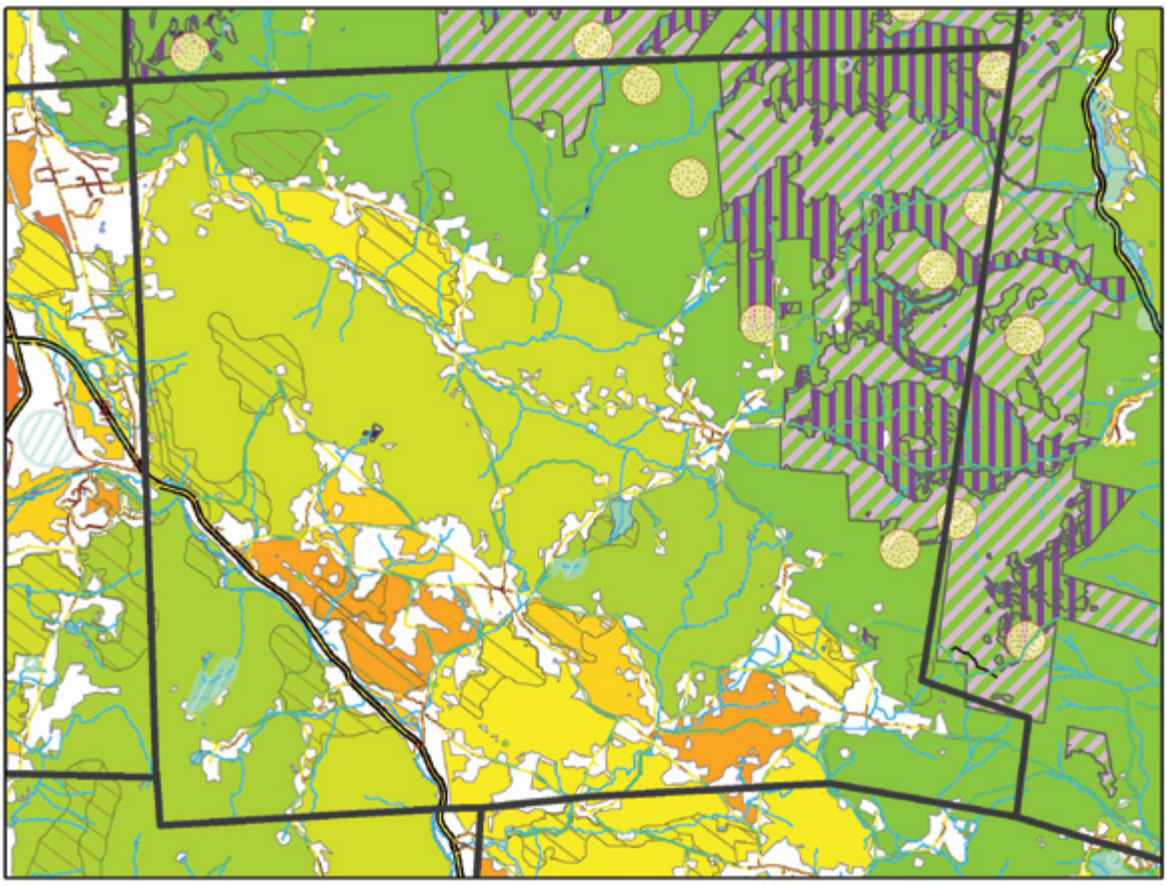
Map 6:
Community and Species Scale Resources



LEGEND

- Town Boundary
- Roads
  - Primary
  - Secondary
- Rivers & Streams
- Lakes & Ponds
- Deer Wintering Areas
- Rare Species
- Uncommon Species

Significant Natural Communities

- Rare
- Uncommon
- Common

Wildlife Road Crossings

Score

- 1
- 2
- 3
- 4
- 5

- Mast Stands

Habitat Blocks by State Priority

Priority Rank

- 8
- 7
- 6
- 5
- 4
- 3
- 2

Data Source:
Vermont Center for Geographic Information
Vermont State Plane Projection
NAD1983 Datum
Map by Monica Przyperhart
October, 2017

0 0.5 1 2 Kilometers

0 0.5 1 2 Miles

Map 6 Community and Species Scale Wildlife Resources

©John Hall

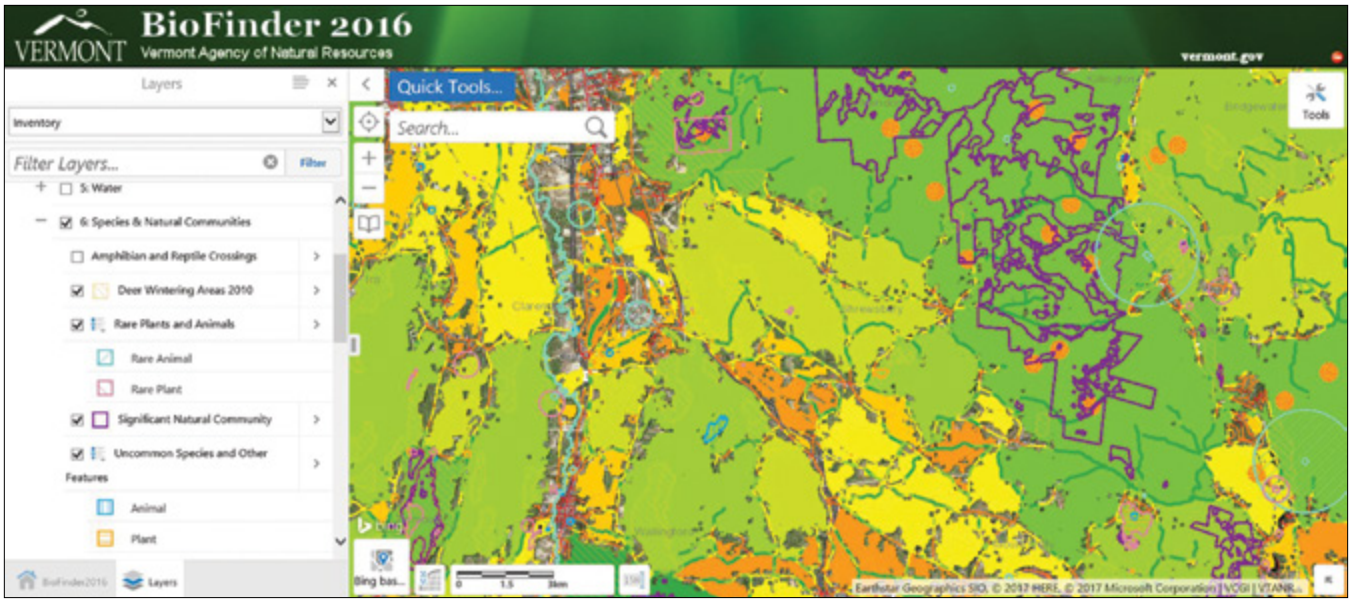
The data on this map is accurate to a finer scale than other maps.

Inventory Layers (Described Below)	**Base Layers**	**Additional Online Data**
1. Deer Wintering Areas		
2. Rare and Uncommon Plants and Animals	Roads	
3. Significant Natural Communities	Streams & Rivers	
4. Wildlife Road Crossings	Lakes & Ponds	Indiana Bat Habitat
5. Mast Stands	Town Boundaries	
6. Habitat Blocks (by State Priority)		
Locally Specific Inventory Layers		

In the context of this map, the Community Scale includes the components and process that occur between groups of plants and animals as they interact with one another and with their physical environment. For example, mast stands are described at this scale because they are associated with a particular set of physical features, plants, and wildlife that function together as a community.

The Species Scale refers to those habitats necessary for the survival of specific fish, wildlife, and plants. For example, wildlife crossings are locations where bear, bobcat, fisher, and other wide-ranging species are most likely to cross roads as they travel to meet daily or seasonal dietary needs, disperse to find mates, or fulfill other requirements. While they tend to be small in size, species-scale components are essential for maintaining biodiversity by supporting species with a known conservation need in the state or region.

As you look at this map, you can imagine zooming in from previous maps to examine the details of your local landscape, even analyzing layers at the level of an individual parcel. Of course, while data are accurate at a local scale, they aren't comprehensive. For example, a mark depicting a rare species is spatially accurate, but the absence of a rare species marker is not a definite sign that there are no rare species present. Because the entire state has never been inventoried for all rare species, there are inevitably omissions from the database. This is true for most of the data displayed on this map. Local inventory information could greatly enhance a community's knowledge of community- and species-scale resources.



To load Map 6 on BioFinder: Open the **Inventory** theme, then check the box next to **6. Species & Natural Communities.** To see all Map 6 layers, click the + next to the layer title. You can add navigational landmarks such as roads and town boundaries by checking them on in **Map 1, the Conservation Base Map**.

For additional guidance on using BioFinder, please see Getting Started in the introduction to this guide, or **Tips and Tools** on the BioFinder website.

Inventory Layer #1: Deer Wintering Areas

What are Deer Wintering Areas?

Deer wintering areas vary in size from a few acres to more than 100 acres and provide essential relief to deer from winter conditions. Covered by dense, mature or maturing softwood trees, they provide protection from deep snow, cold temperatures, and wind. These areas may be characterized by a favorable aspect (south-facing, or perhaps southeast or southwest-facing but rarely north), they generally occur at moderate elevations, and they are found in places with low levels of human activity in winter. Tree cover is most often from hemlock and white pine in the southern part of the state, and white cedar, spruce, and fir in the north. Deer inhabiting these areas expend less energy walking in the reduced snowpack and maintaining their body temperature in the sheltered environment, thus enhancing their survival.

From one year to the next, wintering areas do not change significantly, so these areas can be used by generations of deer over many decades if habitat conditions are maintained. Deer annually migrate—often several miles—from fall habitats to wintering areas, and a single large deer wintering area can occasionally attract deer from a radius of several towns.

Deer Wintering Areas: Significance

The conservation of deer wintering areas is essential to maintaining and managing white-tailed deer in Vermont. Deer wintering areas make up a relatively small percentage of the land base of most towns; only eight percent of the forested landscape of Vermont has been mapped as deer winter habitat. However, residential, commercial, or industrial development within or adjacent to these areas decreases the amount of winter habitat available to deer and can eventually reduce the number of deer within the area. Without adequate winter habitat, deer populations would be subject to extreme fluctuations due to heightened levels of winter mortality during moderate and severe winters.

Deer Winter Habitat

Additional information on deer winter habitat requirements and management recommendations can be found in the publication *Wildlife Habitat Management for Vermont Woodlands, a Landowner's Guide*, which is available from the Vermont Fish & Wildlife Department.

Deer Wintering Areas: Map Interpretation

Deer wintering areas were identified in 2010 using aerial observations, infrared aerial photos, and ground confirmation. Additional areas are added to the database as they are discovered. It is important to keep in mind that not all deer wintering areas have been mapped, and that changes in forest cover and land use affect an area's use as a deer yard. If you suspect an area serves as deer winter habitat that is not mapped, we recommend that you contact us.

©Vermont Fish & Wildlife Department

Deer Wintering Areas: Planning Considerations

In addition to benefits for deer, dense softwood stands provide critical winter shelter and food supplies for a variety of other wildlife species including porcupines, snowshoe hare, fox, fisher, coyotes, bobcats, crows, ravens, red and white-winged crossbills, and many others. Logging can be either detrimental or beneficial to the habitat depending on whether a dense softwood cover and food supply are maintained.

Because so many of the species that use deer wintering areas use them as one type of habitat in a matrix of others, this dataset may be most useful when used to reinforce the importance of larger blocks of forest habitat that contain deer wintering areas. In other words, a broad-scale conservation measure to limit forest fragmentation or support large blocks of undeveloped land that include deer wintering habitat may be the most effective way to conserve this habitat type. For specific planning considerations, please see Layer #3: Habitat Blocks in Map 3.

If you decide to add additional protections specifically for deer wintering areas, you might consider the following:

Conservation Goal	Conservation Strategies for Deer Wintering Areas	
	Nonregulatory Strategies	*Regulatory Strategies*
Seek additional information	Conduct field inventories and improve maps.	
Protect habitat blocks that include deer wintering areas	See Map 3, Layer #3.	
Protect deer wintering areas	Encourage residents to conserve their land through conservation easements.[1]	Establish development design standards that cluster development away from deer wintering areas.[2]
	Encourage residents to enroll their land in Current Use, using Ecologically Significant Treatment Areas (ESTAs) in appropriate locations[3] or working with a forester to plan for the long-term health of the resource.	Establish or improve a Wildlife Habitat Overlay District.[4]
	Adopt language in the town plan, including statements about the importance of deer wintering areas, and policies on how they should be managed, protected, and restored.	Require buffers around deer wintering areas.
	Provide citizen educational opportunities.	

Additional information about using these tools is available in *Community Strategies for Vermont's Forests and Wildlife*. You can also learn more about deer wintering areas and associated conservation goals in *Conserving Vermont's Natural Heritage*.

Inventory Layer #2: Rare and Uncommon Plants and Animals

What are Rare and Uncommon Plants and Animals?

A careful look at the map key will reveal that this data is divided into two layers: "rare plants and animals" and "uncommon species and other features." Because both refer to individual known occurrences of species that are not commonly encountered in Vermont, we discuss them together.

A rare species is one that has only a few populations (generally fewer than 20, depending on the species) and faces threats to its continued existence in Vermont. Uncommon species also face a risk of extinction, but a more moderate one, with between 20 and 80 populations statewide. In general, rare species are subject to state or federal regulations; uncommon species are not, though there are exceptions.

Most of these species in Vermont are rare because they are on the edge of their range or they are separated from the main species population by a large distance. For example, the spiny softshell turtle is found in Vermont in parts of Lake Champlain, and the next nearest population is in the St. Lawrence River. The majority of the population is found west of New York. Several rare species occur in unique habitat types or rare natural communities. Animal species with large home ranges, such as osprey, are considered rare when their overall populations consist of small numbers of breeding pairs.

Included alongside uncommon species data are "other features." These are rare species or natural communities that have been identified but incompletely documented. This means that as with uncommon species, these features are unlikely to trigger state or federal regulatory review as recorded. However, this may change if these features are better studied.

Rare and Uncommon Plants and Animals: Significance

Rare native species in Vermont, such as Indiana bat, loon, spiny softshell turtle, goldenseal, and ginseng are an important part of Vermont's natural heritage. Rare species can play crucial roles in ecosystems, with other species relying on them for their survival. Many of these species are also admired and appreciated by people for their beauty, sounds, or mere presence on the landscape.

Each town harbors its own set of rare and uncommon species that contributes to the overall diversity of the state. Even though Vermont is a small state, it has varied terrain, aquatic systems, elevations, wetlands, geology, and natural communities. It is likely that the rare species mapped in your community are in habitats that are ecologically important at the state or even regional level, even if they don't seem particularly rare in a local context.

Rare and Uncommon Plants and Animals: Map Interpretation

The data shown on this layer were compiled through the Vermont Fish & Wildlife Department's Natural Heritage Inventory (NHI), which is the state's contribution to a greater, regional database of conservation information. Unlike many layers in this guide, all information depicted about rare and uncommon species represent field-confirmed, geographically accurate data points.

Map users should be aware that when a point is used to represent a rare species observation, the size of the population may not correspond to the size of the point. A mapped point may represent only a few square yards, but it could also indicate a large

Rare, Threatened, or Endangered? What's the Difference?

The maps described in this guide are based on how common or rare a species is in Vermont. This follows a system that ranks species on a scale of S1 through S5 in which S1 and S2 are considered rare, S3 is considered uncommon, and S4 and S5 are common. This parallels a global ranking system that records rarity of a species throughout its range on a scale of G1 through G5.

The words threatened and endangered refer to the species' legal status. Threatened and endangered species have been offered protection under the Vermont Endangered Species Law or federal Endangered Species Act. While this status is based on rarity, species are not offered protection without a legal designation.

Legal status is not included in BioFinder. However, it is shown on the ANR Atlas. The two maps use identical data; only the display format differs. To see a complete list of Vermont's rare species that includes state and federal legal status, visit the conserve/conservation-planning/animal-inventory and conserve/conservation-planning/plant-inventory pages on vtfishandwildlife.com.

wetland, a river stretch over a mile long, or an extensive ridgetop that provides habitat for the rare species. Usually, more specific data is recorded in the NHI database, and you can learn more by contacting the Vermont Fish & Wildlife Department. In addition to learning more about the location or population size of a mapped rare species, the database sometimes includes notes recorded by those conducting field inventories, such as threats or management needs such as an invasive species that is affecting the rare species.

©Tom Rogers

While rare and uncommon species locations are provided on this map, you will notice that plant and animal species information is missing. Nationwide, this information is omitted from mapping efforts so as not to jeopardize the survival of sensitive species.

Some rare organisms are sought for collection, others are targeted as unwanted (such as the timber rattlesnake), and others draw attention from those attracted to the uniqueness of the species, which can sometimes disturb the species' natural habitat or behavior (as can happen with the peregrine falcon or bald eagle). In addition to the potential damage to the species, these behaviors can also be disruptive to land owners and managers.

As a result, each location mapped here is labeled generally as a plant or animal. Landowners, land managers, and town officials can contact the Vermont Fish & Wildlife Department for additional information, but the information is not provided to the public.

Rare and Uncommon Plants and Animals: Planning Considerations

In Vermont, state and federal laws protect threatened and endangered species. However, most rare and uncommon species have not been given this legal status, and they receive no protection. Review and consideration of rare and uncommon species in local and regional planning efforts can help to ensure that important habitat remains.

When planning, the first step may be to contact Vermont Fish & Wildlife Department for more information about the rare and uncommon species found in your community. It is wise to consider the habitat needs of these species, as well as the age and quality of the data, before determining a particular conservation strategy. In some cases, collection of additional field data may also enhance your decision-making ability.

Because the planet in general (and possibly Vermont specifically) is experiencing the loss of species at a rate never before experienced, those species most at risk serve as barometers of the state of the environment (George 1998). Protecting and restoring rare and uncommon species represents one of the most difficult present-day conservation challenges in Vermont. If we are to see the continued presence of these species in our state, we need to address their needs at all levels of planning, including local, regional, and statewide.

More Resources

Chapter 6, page 106 of *Conserving Vermont's Natural Heritage* details many strategies for keeping rare, threatened, and endangered species on our landscape.

To conserve rare and uncommon species, you may consider the following strategies:

Conservation Goal	Conservation Strategies for Rare and Uncommon Species	
	Nonregulatory Strategies	*Regulatory Strategies*
Seek additional information	Conduct field inventories and improve maps of rare and uncommon species.	
Provide baseline protection	Adopt language in the town plan, including statements about what resources are important, and policies on how they should be managed, protected, and restored.	Check clarity of definitions in zoning bylaws and update if needed.[5]
	Provide citizen educational opportunities.	
Protect significant species	Encourage landowners to conserve land that supports rare or uncommon species.[6]	Create a Conservation or Wildlife Habitat Overlay District that protects significant wildlife habitat and a surrounding buffer.[7]
	Encourage landowners to enroll in Current Use and enroll eligible areas as Ecologically Significant Treatment Areas (ESTAS).[8]	
Manage invasive species	Provide landowners with opportunities to learn about management options for invasive species.[9]	Adopt a mowing policy in which town roadsides with invasive species are mowed before they go to seed.
Restore degraded habitat	Connect landowners with incentives programs (USDA, USFWS, etc.) that aid in restoring significant natural communities or habitat.[10]	

Additional information about using these tools is available in *Community Strategies for Vermont's Forests and Wildlife*. You can also learn more about rare and uncommon species and associated conservation goals in *Conserving Vermont's Natural Heritage*.

Inventory Layer #3: Significant Natural Communities

What are Natural Communities?

A natural community is a group of plants, animals, physical features, and natural processes that can be found together wherever similar environmental conditions exist. For example, the most common natural community type in Vermont is northern hardwood forest, dominated by a matrix of sugar maple, yellow birch, and American beech. Young forests of this type often contain mixes of quaking or big-tooth aspen and paper birch. In Vermont's higher elevations with cooler temperatures and shallower soils, montane spruce-fir forest is more common, with red spruce, balsam fir, and paper birch as the dominant species. Each community of trees grows on specific soil types and is associated with a predictable assemblage of understory plants. Each vegetative matrix in turn provides habitat for a somewhat different array of wildlife species. Together, the combination of species commonly occurring together is considered a separate natural community.

This layer is divided into three sub-categories: "rare," "uncommon," and "common." Rare natural communities have the fewest occurrences on Vermont's landscape, and they are generally associated with rare physical or environmental conditions. For example, a rare natural community may occur on a type of bedrock that has limited distribution in Vermont or be associated with climatic conditions that occur only in small parts of Vermont's geography, such as when Vermont is at the edge of a climatic range. Natural

Wetland, Woodland, Wildland

Vermont's natural communities are described in detail in a publication entitled *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*, by Elizabeth H. Thompson and Eric R. Sorenson. The guide is available online at vtfishandwildlife.com or in printed form in bookstores.

©Charlie Hohn

communities can also become rare as the result of habitat loss due to human activity. Uncommon natural communities result from similar conditions, but with a slightly heightened rate of occurrence in Vermont. Common natural communities include all natural community types that are not rare or uncommon.

For all categories, only those occurrences of natural communities that are considered state-significant appear in BioFinder or in the maps associated with this guide. Significance is determined based on the quality of an individual occurrence, coupled with the rarity of the community type. A rare natural community is considered significant for all but the poorest quality occurrences. Uncommon natural communities are considered significant when they are ranked as having either "good" or "excellent" quality. Only the highest-quality occurrences of common natural communities are considered significant, included as examples of the natural communities that create the matrix of Vermont's landscape.

Using the analogy of a theater production, natural communities are our best way of representing all actors (species) and plot elements (natural processes) without needing to identify each individually in an extremely complex drama. Rare and uncommon natural communities are the elements of the play that stand out as different from the standard plot line. Common natural communities represent the majority of actors and plot that make up the play. Instead of pointing to each of the many occurrences of these groups of actors, however, this map identifies a few occurrences in which they are strongly demonstrating their roles in the play.

Natural Communities: Significance

Natural communities represent the distribution of plant and animal species that have grown in response to current and past environmental conditions and natural processes. Although the species composition of natural communities may shift over time in response to a changing climate, it is believed that locations of present-day high-quality natural communities will continue to support important natural communities into the future because they represent differences in the physical landscape setting. Rare natural communities typically include rare species and occur in environmental settings that are rare. Common natural communities occur in more common environmental settings. Natural communities can therefore act as a filter for long-range conservation efforts by showing us locations worthy of protection.

In such conservation efforts, it is important to include not only rare and uncommon natural communities, but common ones, too. Increasingly, conservation strategies include "keeping common species common," because it is far easier to maintain a common species or community than to work only with those that have become rare and try to restore them. Common natural communities are important ecologically because they form the natural matrix of the Vermont landscape, provide habitat for innumerable species and support ecological processes such as natural disturbance, water filtration, and carbon sequestration.

Natural Communities: Map Interpretation

The locations of the rare and uncommon natural communities mapped here represent known examples in the state. They are based on detailed site surveys, so they are accurate even at a very local scale. However, a comprehensive natural community inventory has not been done at the state level. While rare and uncommon natural community types are better represented than common types, the database contains many omissions for all natural communities. Nearly all mapped examples of common natural communities are on

state-owned land, with few examples mapped on private land despite the numerous high-quality natural communities occurring there.

Interacting with this map on BioFinder will provide you with an opportunity to learn more about an individual natural community. A click on a mapped feature will open an information box, and the box will tell you the type of community and other information. Included in this box is also a "State Rank" category, which refers to a scale ranging from S1 through S5. On this scale, S1 and S2 are considered rare, S3 is considered uncommon, and S4 and S5 are common.

Natural Communities: Planning Considerations

Because significant natural communities can encompass so many different types of habitat, this dataset may be most useful when used to reinforce the importance of the larger habitat blocks that contain them. In other words, a broad-scale conservation measure to limit forest fragmentation or support large blocks of undeveloped land is likely to also protect the natural communities in that block. For specific planning considerations, please see Layer #3: Habitat Blocks in Map 3.

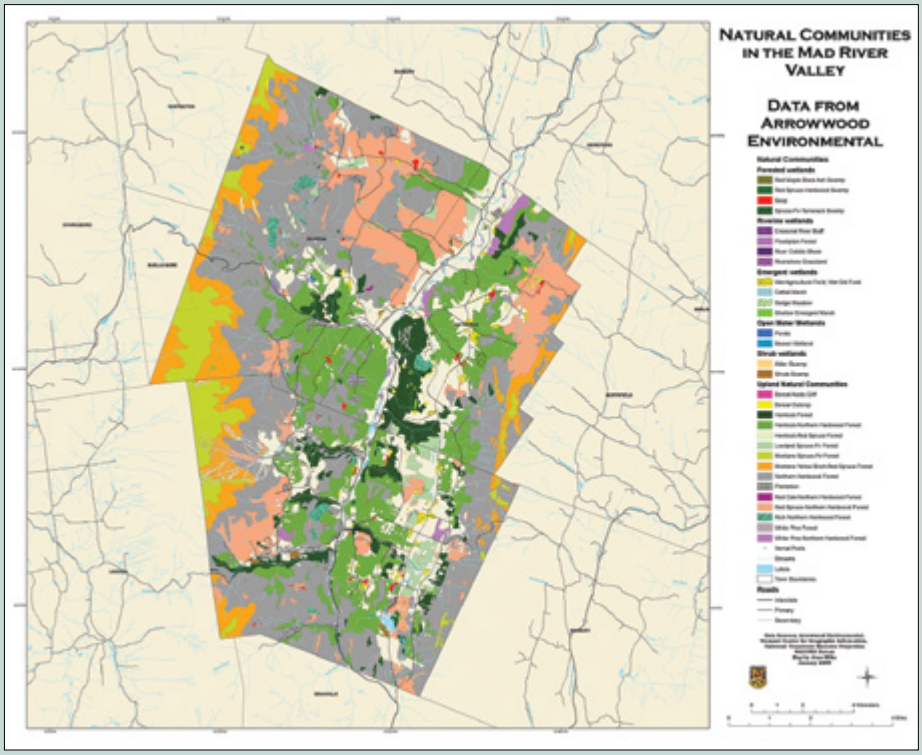
However, some significant natural communities may not be located within large blocks of habitat. In these cases, communities should consider conserving them on their own. Often, these natural communities are located closer to developed areas, and they are frequently located along rivers or other waterways. When this is the case, strategies to conserve riparian areas such as those suggested in Map 5, Layer #2 may be appropriate.

Because natural community information is incomplete across the state, most communities wishing to conserve their natural heritage could benefit from a local inventory of natural communities. This would build on the data available through state resources to provide a better sense of the types and distributions of natural communities in the local area.

If a community's goal is to protect biodiversity, one effective approach is to then to conserve and/or restore high quality examples of all natural community types that occur within the area. To be most effective, these efforts should consider not only the natural communities themselves, but also the ecological processes that support them—hydrologic patterns throughout the landscape, for example, or movement of wide-ranging species as they travel between natural community types. Consideration should also be given to the extent to which invasive species are impacting biodiversity. In some locations, management of these invasive species may be an important step in conserving the resource.

Natural Community Inventories

Several Vermont communities have conducted natural community inventories to capture a snapshot of the diverse habitat elements present in the local landscape. The Mad River towns of Fayston, Warren, and Waitsfield together hired a consultant to conduct such an inventory. Read more: vtconservation.com/success-stories/arrowwood-inventory-of-fayston-warren-and-waitsfield-natural-community-mapping.



You might find the following strategies appropriate for conserving natural communities:

Conservation Goal	Conservation Strategies for Natural Communities	
	Nonregulatory Strategies	*Regulatory Strategies*
Seek additional information	Conduct field inventories and improve maps of natural communities.	
Protect habitat blocks that include significant natural communities	See Map 3, Layer #3.	
Protect significant natural communities	Encourage landowners to conserve land that supports rare or uncommon natural communities.[11]	Create a Conservation or Wildlife Habitat Overlay District that protects significant natural communities and a surrounding buffer.[12]
	Encourage landowners to enroll in Current Use and enroll eligible areas as Ecologically Significant Treatment Areas (ESTAS).[13]	
	Create or expand a Town Forest.[14]	
	Provide citizen educational opportunities.	
Manage invasive species	Provide landowners with opportunities to learn about management options for invasive species.	Adopt a mowing policy in which town roadsides with invasive species are mowed before they go to seed.
Restore degraded habitat	Connect landowners with incentives programs (USDA, USFWS, etc.) that aid in restoring significant natural communities or habitat.	

Additional information about using these tools is available in *Community Strategies for Vermont's Forests and Wildlife*. You can also learn more about natural communities and associated conservation goals in *Conserving Vermont's Natural Heritage*.

Inventory Layer #4: Wildlife Road Crossings

What are Wildlife Road Crossings?

Just as the term implies, wildlife road crossings are areas where wildlife are most likely to cross roads. They are one type of "connecting habitat"—land that links together larger blocks of habitat. When wildlife can successfully cross roads between habitat blocks, these blocks sometimes fill the role of an even larger habitat block, allowing for enhanced movement and migration of animals and plants. Of course, these crossing areas are most effective for wide-ranging mammal species such as black bear, bobcat, and fisher; even a road routinely crossed by these species can present an insurmountable barrier to other species.

While each species prefers a slightly different combination of habitats that increases the likelihood of crossing a road, there are some general trends. Many species are most likely to cross a road when:

- Terrain is relatively flat, with no steep slopes on either side of the road;
- Wetland exists on at least one side of the road;
- Evergreen cover grows on both sides of the road;
- No houses are nearby (within 50m, for example);
- Animals can access larger habitat blocks on each side of the road.

For some species, the presence of guardrails also significantly reduces the likelihood of crossing in a particular location, and when a bridge or large culvert is present, some species may be able to cross under a road rather than across the road surface.

Connecting Habitat Types

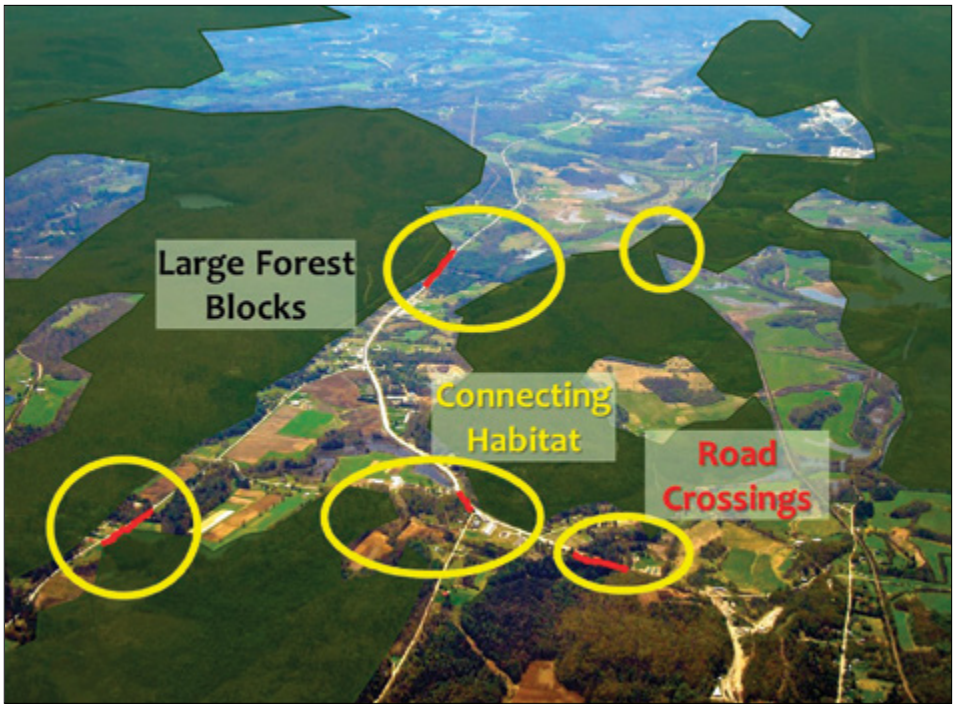
To read more about the variety of connecting habitat types that link our landscape, see page 48 in *Conserving Vermont's Natural Heritage*.

Wildlife Road Crossings: Significance

Roads present a significant barrier for many of Vermont's wildlife species. They fragment habitat, preventing animals from accessing food, appropriate

shelter, and mates. Some species live only in interior forest, far from roads, and biodiversity decreases in roadside areas. Furthermore, reproductive success for plants and trees can be impacted, water flow patterns can be altered, and roads can be conduits for the introduction of invasive species to new areas.

While most roads diminish the habitat available to Vermont species, some roads present more substantial barriers than others. The wildlife crossing areas depicted can be used by many species, but they are particularly important for wide-ranging mammals, such as bobcats and black bears that maintain large home areas to meet their needs. In some cases, roads may be crossed daily as animals fulfill routine dietary needs. Others may be crossed only periodically. For example, the food resources important to black bears change seasonally, and crossings can allow access to different foods as they become available. Crossings can also prevent the isolation of populations, avoiding problems associated with inbreeding. In these cases, an individual animal may cross a road only once during its lifetime as it seeks to establish a new territory. Even in these cases, that single successful road crossing can be critical for maintaining wildlife populations in Vermont for the long term.



For wildlife to get from one large forest block to another, they need to pass through connecting habitat that may be composed of smaller patches of forest, shrubs, fields, or residential land. Within this connecting habitat, locations where wildlife can successfully cross roads are crucial.

Wildlife Road Crossings: Map Interpretation

These data were generated by the Vermont Fish & Wildlife Department to provide a preliminary look at where wildlife are most likely to cross Vermont roads. The department used a computer modeling process to locate areas with a high concentration of the landscape features most closely associated with wildlife crossing areas. These features were weighted according to importance, and then road segments were given a score of 1 to 5, with 1 being the locations with the fewest associated features (the worst crossing areas) and 5 being the locations with the most (the best crossing areas).

While the crossings depicted on this map are sometimes very small and can be viewed at a fine scale, please keep in mind that these are locations of probable wildlife road crossings—that is, places that contain landscape features associated with wildlife

Wildlife Road Crossings in BioFinder

There are two versions of this dataset available on the BioFinder website. The version described in the text can be found in the **Inventory** theme, on Map 6. As mentioned, roads are all ranked on a scale of 1 to 5, with 5 (in green) being the most probable crossing areas.

In the **Prioritization** theme, you can find an alternative version, broken into **Highest Priority Wildlife Crossings** and **Priority Wildlife Crossings.** While these layers use the same data source, they each display only a subset of the full dataset. Highest priority is given to those crossings ranked as 3, 4, or 5 in which a section of the crossing is located in either a riparian area or a Highest Priority Connectivity Block. Priority was given to crossings ranked 3, 4, or 5 found in other locations.

crossing areas. Additional field investigation is needed to confirm the frequency at which wildlife actually use these potential crossings.

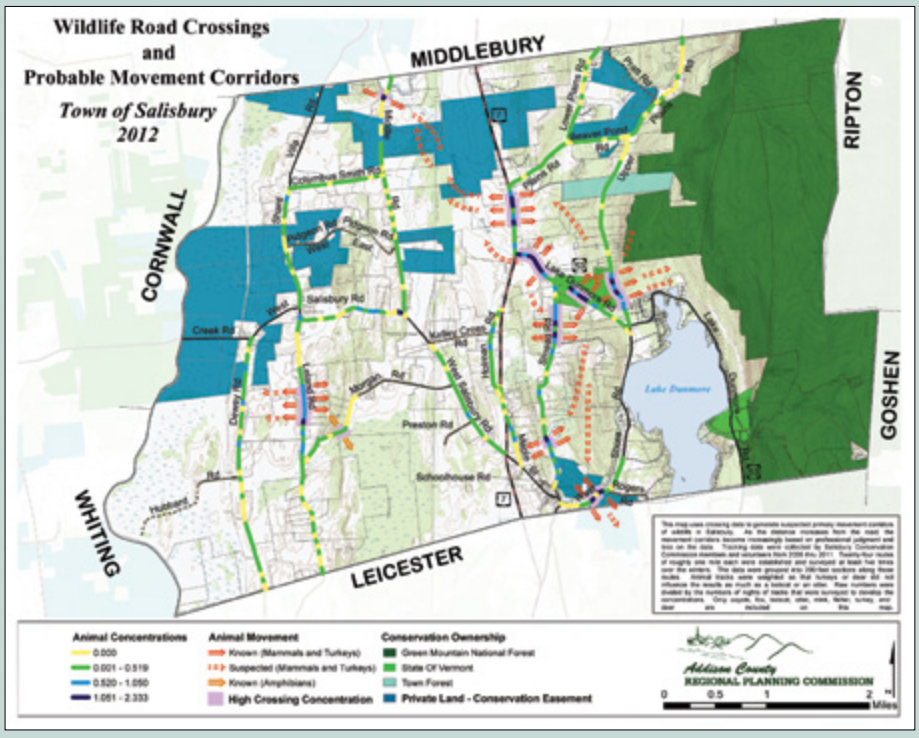
It should also be noted that the dataset's focus is on terrestrial species. There is certainly a lot of wildlife movement that isn't captured by this computer model, such as amphibian crossing areas or fish passage. This layer also doesn't show the connecting habitat between the road and the bigger blocks, only the road itself. Maintaining this buffer of roadside habitat is generally critical for continued use of the crossing by wildlife. Regardless, these data offer a first step in addressing a likely pattern of wildlife movement across a town or region.

Wildlife Road Crossings: Planning Considerations

As mentioned earlier, there are other forms of habitat connectivity. Road crossings address only one feature that fragments landscapes (i.e., roads) but there are other fragmenting features, ranging from human-built infrastructure to natural features such as steep slopes or wide lakes. Your community may want to identify other potential connecting habitats through the interpretation of aerial or orthophotos and/or by enlisting a natural resources professional. Once you have identified wildlife road crossings and other potential connecting features in your community, the next step may be to confirm which areas are most heavily used by wildlife by conducting field assessments of wildlife use in probable areas.

As you examine this layer, keep in mind that this map does not represent the safety of different road crossing areas. An unsuccessful wildlife crossing attempt can be disastrous for both the human and the animal involved in a collision. Some crossing areas are therefore better choices in terms of road crossing success—and human safety—such as roads with lower speed limits or straight roads that provide heightened visibility to drivers. Even more ideal are places where wide culverts or bridges provide enough space for animals to cross under roads rather than across them. As you consider strategies that allow for wildlife connectivity in your community, you may simultaneously be able to address these safety concerns.

Planning efforts that use wildlife road crossings data should also include habitat blocks, since these are the destination points for wildlife as they cross roads. Together, consideration of these two layers will benefit a wide range of native plant and animal species by enabling them to shift geographically or adapt to a changing climate. However, maintaining only crossing areas will not necessarily protect an area's ecological values and biological diversity in an otherwise developing area.



Wildlife Road Crossings in Town Plans

In 2006, the Town of Salisbury set out to determine which of the town's roads were most heavily used by wildlife to cross from one patch of habitat to another. Wildlife road tracking surveys were conducted by Conservation Commission members and local volunteers during the next several years, data were analyzed and mapped, and eventually, the town changed their town plan to reflect their newfound information.

To conserve wildlife road crossings, you might consider the following strategies:

Conservation Goal	Conservation Strategies for Wildlife Road Crossings	
	Nonregulatory Strategies	*Regulatory Strategies*
Seek additional information	Conduct field inventories and improve maps of roads used as wildlife crossings.	
Protect habitat around wildlife crossings	Adopt language in the town plan, including statements about what resources are important, and policies on how they should be managed, protected, and restored.	Check clarity of definitions in zoning bylaws and update if needed.[15]
	Encourage residents to conserve their land through conservation easements, particularly when crossings are part of larger parcels that have additional conservation values.[16]	Require vegetated buffers around wildlife crossings in the general standards section of your bylaws, to apply in all districts.[17]
	Connect landowners to incentives programs, such as through USDA or USFWS Partners for Fish and Wildlife.	
	Encourage residents to enroll in Current Use.	Adopt road management standards to allow vegetation to remain up to the road.
	Encourage residents to manage their land so as to leave vegetation right up to the road.	
	Provide citizen educational opportunities.	
Limit fragmentation	When conducting planning efforts, consider wildlife road crossings and connectivity blocks together.	Establish or improve a Conservation District.
		Establish or improve a Wildlife Corridor or Wildlife Habitat Overlay District that includes both areas of habitat and important wildlife road crossings.[18]
		Review or establish an access management plan and consider limiting curb cuts in important wildlife crossing areas through site plan review or other standards within the zoning.[19]
Reduce danger to humans and wildlife	Work with road officials to provide appropriate signage and install/remove structures (fences, guardrails, and so on) to guide animals to cross in safer areas (under bridges, on straighter road segments, and so on).	Establish traffic rules that ensure the safety of humans and wildlife along roadways in which wildlife are most likely to cross.
	As needed, upgrade culverts and road infrastructure to VTrans standards. VTrans requires that all crossings include full-width banks and natural, at-grade bottom substrates to facilitate aquatic and terrestrial organism passage.[20]	Adopt road management standards to avoid guardrails, the removal of roadside vegetation, or deep roadside ditching in crossings wherever possible.

Additional information about using these tools is available in *Community Strategies for Vermont's Forests and Wildlife*.

Inventory Layer #5: Mast Stands

What are Mast Stands?

Mast is the fruit or seeds of shrubs and trees that are eaten by wildlife. It provides many species with an important calorie source, particularly in the fall months as wildlife are preparing for winter. Hard mast refers to nuts (especially those of beech and oak trees), whereas soft mast refers to berries and fruits of species such as black cherry, raspberry, blackberry, and apple. While most forested areas contain at least a few mast-producing trees and shrubs, forests producing significant concentrations of mast are much less common. In general, hard mast production areas of beech and oak that are used by wildlife represent a small fraction of the landscape. Only hard mast areas are represented on this map.

Mast Stands: Significance

Significant mast production areas are recognized as a very important wildlife food source, both because available food is concentrated into a small land area and because the food contains a high energy content, especially when beech nuts and acorns are present. Mast stands are used by at least 170 species of wildlife in Vermont, including deer, black bear, turkey, blue jays, and cedar waxwings. Red and gray squirrels rely on beechnuts and acorns for their survival and reproductive success, and since these are prey for fisher, coyote, fox, owls, hawks, and other predators, the influence of mast stands can be seen throughout the food chain.

Hard mast production areas of beech and oak are also important for the survival and reproduction of black bear in Vermont. Studies have documented that the availability of hard mast in the fall affects the minimum reproductive age of bears, productivity rates, and cub survival, and that female bears may skip reproduction after poor mast years (Elowe and Dodger 1989).

Mast Stands: Map Interpretation

A mast stand is identified as being important for bear if scars left by climbing black bears can be found on at least 15 to 25 tree trunks or show other evidence of use by bears, such as a "bear nest" in the crown of a tree (where bears have bent numerous branches in order to strip them of their mast). Because evidence of use by bear is easier to see than signs left by other animals, this layer relies entirely on bear data. All data on this map represent stands of hard mast as mapped by Vermont Fish & Wildlife Department. It is important to note that while mast stands are represented as points on the map, the actual habitat covered by each mast stand could be either larger or smaller. Dots cover 65 acres of area, which is the average acreage of all mapped mast stands in the state.

www.pxhere/en/photo/1154662

Beech nuts are used as a vital food source by numerous species.

It should be noted that this dataset is incomplete; there has not been a statewide survey of mast production areas. Throughout the state, just 277 mast production areas appear on the map, although the real number is far larger. Because data for this map were collected by individuals visiting field locations, we can say with assurance that there are, or at least have been historically, mast stands in the locations mapped. However, it cannot be assumed that there are no mast stands in areas lacking mapped points. If using mast stand information for local planning purposes, a local field inventory may reveal additional examples and provide additional accuracy.

Of the data present on this map, mast stands are more likely to have been reported in areas containing beech, because bear scarring is so prominent on this species and remains in the bark of the tree for so long. While other types of hard mast are certainly also important, this dataset favors beech. It should also be noted that the current condition and wildlife use of mapped mast production areas is not known, as they

are not periodically monitored. Furthermore, Beech Bark Disease, an invasive fungus that has been reducing the health of beech in recent years, has been altering the productivity of some mast stands.

Mast Production Areas: Planning Considerations

Because the wildlife that use mast stands also rely on the surrounding forest areas, mast stand information is best used to elevate the importance of the habitat blocks that encompasses them. Any strategy used to limit fragmentation or otherwise protect or maintain these large forest blocks can then be used, such as those listed in Map 3, Layer #3.

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To conserve mast stands, you might consider the following strategies:

Conservation Goal	Conservation Strategies for Mast Stands	
	Nonregulatory Strategies	*Regulatory Strategies*
Seek additional information	Conduct field inventories and improve maps.	
Protect habitat blocks that include mast stands	See Map 3, Layer #3.	
Protect mast stands	Encourage residents to conserve their land through conservation easements.	Establish or improve a Wildlife Habitat Overlay District.*
	Connect landowners with educational resources, such as landowner habitat management guidelines or mast production area guidelines.	
	Connect landowners with incentives programs (particularly USDA) to aid with possible financial and technical assistance.	Establish development design standards that cluster development away from resources.*
	Encourage residents to enroll their land in Current Use, using Ecologically Significant Treatment Areas (ESTAs) in appropriate locations.	Require buffers around mast stands.*

**Improving inventory information is necessary before implementing any of the regulatory strategies above. State-level information does not provide enough spatial accuracy for these actions.*

Additional information about using these tools is available in *Community Strategies for Vermont's Forests and Wildlife*. You can also learn more about mast stands and associated conservation goals in *Conserving Vermont's Natural Heritage*.

Inventory Layer #6: Habitat Blocks (by State Priority)

What are Habitat Blocks?

We first introduced habitat blocks in Map 3, and the same data are used again here. Habitat blocks are areas of at least 20 acres with no roads or low densities of Class III or IV roads. They contain little or no human development such as buildings, parking areas, lawns, gravel pits, active agricultural land, and so forth, but can be composed of any natural land cover type: various ages or stages of forest, wetland, and so on, or former, inactive agricultural land.

Habitat Blocks

In Map 3, we displayed Habitat Block information by block size. This map uses the same data, categorized here through a statewide ranking system.

Habitat Blocks (by State Priority): Significance

Prioritizing habitat blocks is one way to capture the functional role that each block plays within its region. This layer allows us to evaluate habitat blocks not only as groups of trees but for their contributions as core habitat for diverse species, connected landscapes for wildlife requiring movement or migration routes, or enhancement of other natural processes.

Habitat Blocks (by State Priority): Map Interpretation

In Map 3, habitat blocks were displayed by size. However, there isn't a minimum size block that is considered critical as important wildlife habitat. While size is certainly an important factor and can sometimes be the best factor for determining priority, other features can be important, too.

For example, a habitat block that is well-connected to other habitat blocks through wildlife road crossing areas, stream corridors, or other means is more likely to be used by wildlife than one isolated from other blocks. A habitat block containing a variety of habitat components—wetlands, ridgelines, a high density of lakes or streams, or a mix of forest types, for example—is also likely to contain higher biodiversity than a block that contains primarily uniform habitat. The same is true for a block with a lower density of Class IV roads compared with a block containing many of these low-traffic roads.

The prioritization depicted on Map 6 also considers the regional context. A 100-acre habitat block located in Vermont's heavily fragmented Champlain Valley may play a much more ecologically important role than a 100-acre block in the Northeast Kingdom, where larger blocks are prevalent. While Champlain Valley forest blocks are smaller, they also include greater species diversity due to a low elevation and variety of habitat types. The configuration of the habitat is also important. An area that is highly irregular in shape (containing a high amount of edge) may be less functional for some species than habitat of the same acreage with a regular shape.

Habitat Blocks Information Background

To learn more about how habitat blocks information was generated, you can find the original report from Vermont Fish & Wildlife Department and Vermont Land Trust online at vtfishandwildlife.com. The full report is entitled *Vermont Habitat Blocks and Habitat Connectivity: An analysis using Geographic Information Systems.*

Conserving Habitat Blocks

While there are many possible strategies for conserving habitat blocks, the Town of Enosburg addresses habitat block fragmentation through their zoning. Find their story at: vtconservation.com/success-stories/zoning-changes-in-the-town-of-enosburg-2013.

Habitat Blocks (by State Priority): Planning Considerations

When considering conservation measures for habitat blocks, refer to list found in the Habitat Blocks description in Map 3. In general, appropriate conservation measures avoid fragmenting these blocks and maintain connections between them. The added benefit of the information on this map is that it provides a sense of priority. A block labeled as a higher priority on this map indicates that biologists have recognized the block as playing a significant role in maintaining the regional ecosystem. In your conservation planning, consider focusing efforts on higher-priority blocks.

Additional (Locally Specific) Inventory Layers

In specific locations across the state, we have included additional datasets representing important wildlife habitat. While these datasets are each relevant only to particular regions of Vermont, the habitat is considered important regionally. Clayplain fragments and Indiana bat hibernacula are both important in the Champlain Valley, but absent from other regions of the state. While comprehensive amphibian and reptile road crossing information could be relevant in most Vermont towns, inventories have been conducted only in a few select areas, so this information, too, has been placed here.

Clayplain Fragments

Clayplain forest is a unique natural community that occurs on the clay soils of the Champlain Valley. It is dominated by oaks and hickories, and prior to European-American settlement, it was the dominant forest type in the Champlain Valley. Aided by a climate somewhat milder than in much of the state, these fertile but poorly drained soils once grew more species of native plant than any other New England forest type. In addition to the oaks and hickories that dominate the natural community are maple, ash, elm, beech, basswood, white pine, and hemlock. Shrubs and other plants proliferate, including several that are found only in this type of forest. Similar diversity is found not only in plants, but in all forms of wildlife: amphibians, birds, mammals, reptiles, and insects. Because the deep, rich, soils and flat topography provided ideal agricultural lands, most clayplain forests were cleared and are now quite rare. Remaining remnants are scattered, and most are no bigger than 20 or 30 acres.

Even these small fragments represent important landscape diversity, but they alone are unable to support the variety of wildlife once found in the Champlain Valley. Larger species and those that maintain large home ranges are now rarely seen in this habitat type, and they are unlikely to return unless clayplain fragments are connected together and/or incorporated into larger blocks of forest habitat.

Amphibian and Reptile Crossing Areas

In Map 5, we described vernal pools and their importance for amphibians. Streams, rivers, lakes, ponds, and wetlands provide habitat for a host of other amphibian and reptile species.

But for many reptiles and amphibians, conserving these aquatic habitats alone isn't enough, because the animals' habitat needs change at different times of the year. Vernal pools, for example, are used only in the breeding season and for the safe development of eggs and larvae. The adult frogs and salamanders turn to other forest habitats for year-round needs. They need two different habitat types and a safe travel route between them.

Consider the spotted salamander. Throughout most of its adult life, a spotted salamander lives a solitary life in woodlands, generally in hardwoods or mixed forests where it burrows into loose soil and under moist leaf litter. But each year, spotted salamanders emerge from their woodland homes and head en masse to their closest breeding spot—generally a vernal pool, but sometimes a pond or wetland. For this species, 95 percent of the movement occurred within 600 feet of the vernal pool (Faccio 2003)

Even where a vernal pool is surrounded by forest or other natural habitat, this journey can be hazardous for an amphibian due to predation, weather-related events, or other dangers. For vernal pools and other breeding grounds located near roads, the journey can be particularly risky, in many cases putting populations at risk of extirpation (Gibbs and Shriver 2005).

This dataset displays known and suspected locations where reptiles and amphibians cross roads in order to move between year-round and breeding habitats. There are certainly omissions from this dataset; there has been no statewide survey to map all the locations important for breeding reptiles and amphibians. Locations are mapped as potential road crossing areas when first reported, confirmed when field data have demonstrated that numerous individuals of at least one species cross roads each year to reach breeding habitat.

Community Education & Science

In several Vermont communities, amphibian crossing areas provide opportunities for community education and science to come together. Salisbury has documented one example here: vtconservation.com/success-stories/amphibian-road-crossing-at-morgan-road-salisbury-vermont.

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Indiana Bat Hibernacula and Summer Habitat (Online Only)

Listed as a federally endangered species, Indiana bats have been on the decline across the United States. Because these bats live in different habitat types in summer and winter, conservation of the species requires protection of both summer and winter habitat. Summer colonies can be found in trees, rock ledges, and occasionally buildings, but the preferred habitat is trees with loose bark, such as shagbark hickory or older trees with sloughing bark. These trees must also have accessible habitat nearby for finding food, generally including a relatively open stand below a main canopy. Forest edges, connected forest patches, lakes, streams, and wetlands are all important habitat as well.

Bat Habitat

For more information on important bat habitat, see page 92 of *Conserving Vermont's Natural Heritage*.

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In winter, the bats migrate to a place providing a constant temperature and protection from weather and predators, often in a cave or mine. Bats may migrate from great distances to hibernate at these sites, as they are rare on the landscape.

Like Vermont's other five hibernating bats, Indiana bats are susceptible to white-nose syndrome, a disease that was discovered in the northeastern U.S. in 2006 and has caused drastic population declines to a species with already-low populations.

These map layers, appearing online on BioFinder only, highlight the towns in which Indiana Bats are known to occur. The map treats summer and winter habitats separately; the towns in which bats hibernate in winter are often different than those with summer habitat for maternal colonies. Because the Indiana bat is an endangered species, the map shows only very general areas (i.e., towns) where the species occurs, rather than individual caves or trees used by the animal, to protect these areas from over-visitation or abuse. However, many of these specific spots are known, and interested town officials can contact Vermont Fish & Wildlife Department for additional information.

To conserve locally specific important wildlife habitat you might consider the following strategies:

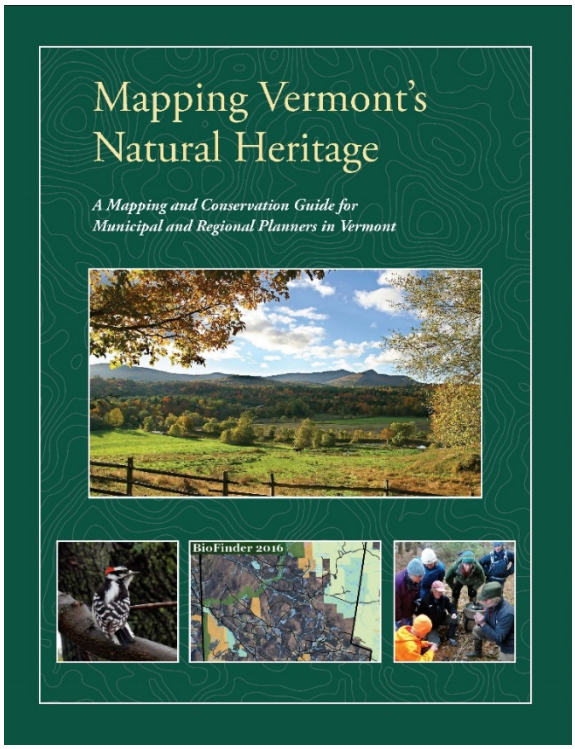
Conservation Goal	Conservation Strategies for Locally Specific Important Wildlife Habitat	
	Nonregulatory Strategies	*Regulatory Strategies*
Seek additional information	Conduct field inventories and improve maps of locally important resources.	
Protect habitat blocks that include important resources	See Map 3, Layer #3.	
Protect wildlife resources	Adopt language in the town plan, including statements about what resources are important, and policies on how they should be managed, protected, and restored.	*Establish or improve a Wildlife Habitat Overlay District.[21]
	Encourage residents to conserve land with important resources through conservation easements.[22]	
	Encourage residents to enroll their land in Current Use, using Ecologically Significant Treatment Areas (ESTAs) in appropriate locations[23] or working with a forester to plan for the long-term health of the resource.	*Establish development design standards that cluster development away from resources.[24]
	Provide citizen educational opportunities.	*Require buffers around these resources.

**Improving inventory information is necessary before implementing any of the regulatory strategies above. State-level information does not provide enough spatial accuracy for these actions.*

Additional information about using these tools is available in *Community Strategies for Vermont's Forests and Wildlife*.

Mapping Vermont's Natural Heritage

This is one chapter of a larger publication called *Mapping Vermont's Natural Heritage: A Mapping and Conservation Guide for Municipal and Regional Planners in Vermont*. Please visit https://anr.vermont.gov/node/986 for additional information or to see the entire guide.



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