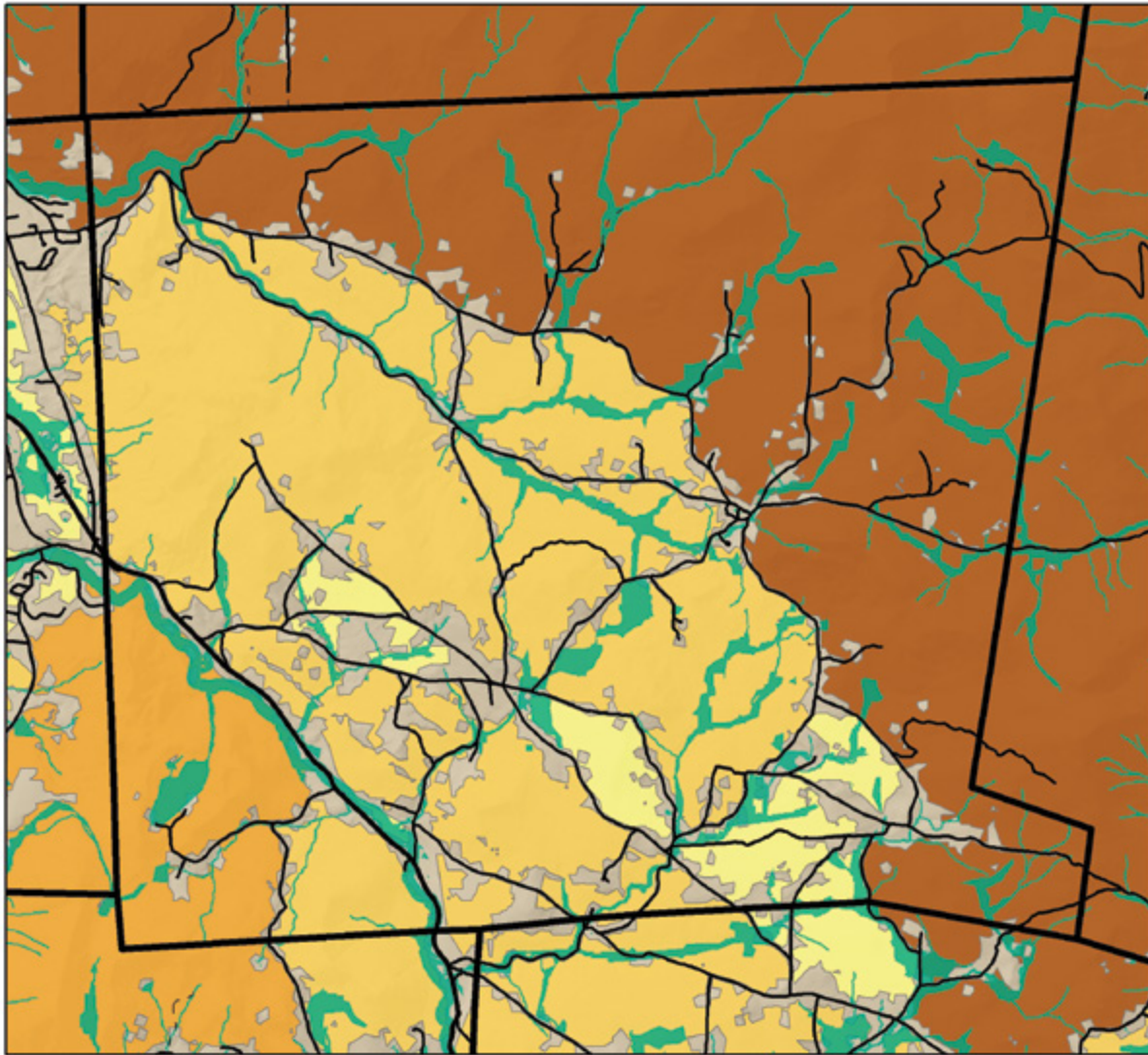


Map 3: Forest Pattern



LEGEND	
Town Boundary	Riparian Wildlife Connectivity
Roads	Habitat Blocks by Acreage
Interstate	Acres
Primary	20 - 500
Secondary	501 - 5,000
Trail	5,001 - 1,0000
Rivers & Streams	10,001 - 50,000
Lakes & Ponds	

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 3 Forest Pattern



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This map shows the pattern of forests and fields, separated by human activity, across your community.

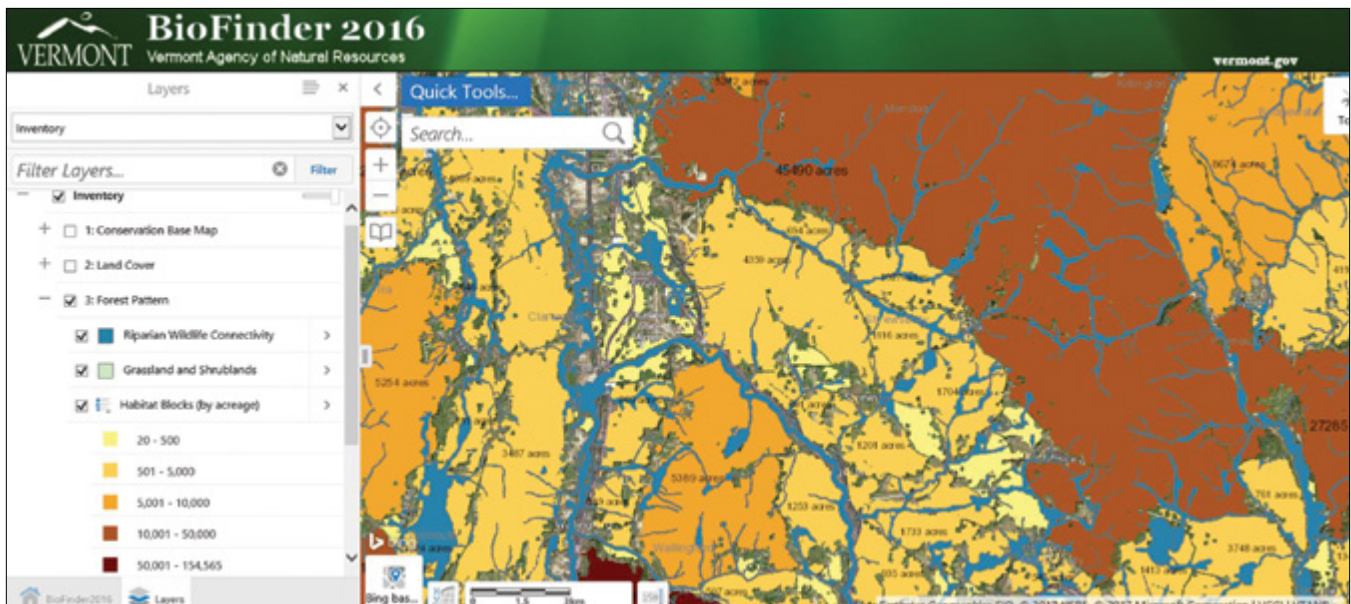
Inventory Layers (Described Below)	Base Layers
1. Riparian Wildlife Connectivity	Roads
2. Grasslands and Shrublands	Streams & Rivers
3. Habitat Blocks (by Size)	Lakes & Ponds
	Town Boundaries

When considering [wildlife](#) on the local landscape, broad-scale vegetation patterns can be very revealing. The degree to which a landscape’s vegetation is connected or separated has direct implications for where wildlife will be on a landscape and which wildlife are present. This concept of [connectivity](#) is particularly important in the face of climate change; maintaining connected pathways of natural vegetation across the landscape is a critical strategy for adapting to a changing climate, allowing animals and plants to disperse to locations that provide favorable conditions ([Heller and Zavaleta 2009](#)).

This map shows where the vegetated banks of streams, rivers, and lakes form continuous pathways in which wildlife can move. It shows where blocks of undeveloped land are located, organized by size. Finally, it shows grasslands and [shrublands](#). These

may be contained within larger habitat blocks, or they may appear isolated. Either way, there is an important [assemblage of species](#) that relies on these open fields or young stands for their survival.

In 2016, the Vermont legislature passed a bill ([Act 171](#))¹ that requires regional and municipal planners to identify important forest blocks and habitat connectors, and then to limit [fragmentation](#) in these areas when conducting land use planning (Vermont General Assembly 2016). Map 3 allows a planner to take a preliminary look at where these forest blocks and connectors are likely to be located. In determining the ecological importance of habitat, size is primary factor, so habitat blocks are displayed here by size. Since wildlife frequently travel along the edges of waterways, [Riparian Wildlife Connectivity](#) can be used to visualize possible routes of wildlife movement.



To load Map 3 on BioFinder: Open the **Inventory** theme, then check the box next to **3: Forest Pattern**. To see all layers, check the box beside the layer title and then click + to expand the group. To see landmark locations, such as roads or town boundaries, check them on in **1: Conservation Basemap**.

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: Riparian Wildlife Connectivity

What is Riparian Wildlife Connectivity?

When moving from one place to another, wildlife often use the vegetated lands adjacent to streams, rivers, lakes and ponds. Sometimes these areas are called corridors even though they are not always linear, as the term implies. The [riparian area](#) includes all land that is directly affected by [surface water](#) (Verry et al., 2000) and often extends some distance from the channel itself. This map highlights the vegetated areas next to rivers, streams, lakes, and ponds.

Riparian Wildlife Connectivity: Significance

In general, riparian ecosystems are high in biological diversity. While they are particularly important for species associated with rivers and lakes such as mink, otter, beaver, and wood turtle, they are used by a wide assortment of wildlife, with even more substantial benefits when continuous vegetated habitat remains alongside waterways for extensive distances. Then, they function as corridors for wide ranging mammals—those animals that must maintain large home ranges to obtain sufficient food, find shelter, or have access to mates—as they traverse the landscape.

Riparian corridors are also important to our human communities, providing highly valued ecological functions relating to [water quality](#), flood attenuation, and shoreline stability.

Riparian Wildlife Connectivity: Map Interpretation

These data show streamside connectivity—on land—and not connected pathways within the water (referred to as aquatic organism passage). In other words, dams, waterfalls, or hanging culverts may prevent fish and other aquatic organisms from freely moving up and down streams even when those streams

Restoring Riparian Areas

In some cases, the riparian area may need to be restored before it can become functional for wildlife. The White River Partnership's Trees for Streams program is one example of a restoration project that works with landowners, students, and volunteers to establish functional riparian corridors: vtconservation.com/success-stories/white-river-partnership-trees-for-streams-program.

Riparian Habitat: A Starting Point

Not sure where to begin conserving your community's natural heritage? Consider starting with riparian habitat. Among conservation actions taken at the community level, maintaining riparian habitat has one of the greatest impacts for wildlife. It's also an area of great benefit for a community, since conserving the riparian area not only protects wildlife habitat but also maintains water quality, reduces erosion, provides flood resilience, and can support recreational opportunities.

are buffered by functional riparian areas. These aquatic barriers are not represented here.

When using these data, keep in mind that all segments of vegetated riparian habitat are treated equally; habitat is either present or lacking. Ecologically, however, some locations are certainly more functional for maintaining traveling wildlife populations than others, such as longer riparian sections or those that connect to high-quality habitat or large interior [habitat blocks](#).

Riparian Wildlife Connectivity: Planning Considerations

Conserving a connected network of lands, waters, and riparian areas can be one of the most effective strategies for maintaining an area's wildlife habitat, particularly in response to changing environmental conditions. From an ecological standpoint, maintaining riparian wildlife connectivity may be the single most important goal a community can accomplish through planning. [Restoration](#) and [conservation](#) of riparian connectivity is especially important in areas of Vermont that are highly developed.

Because conservation of riparian wildlife connectivity should be considered alongside other goals for the riparian area, we list specific conservation strategies in [Map 5, Surface Waters and Riparian Areas](#).

Inventory Layer #2: Grasslands and Shrublands

What are Grasslands and Shrublands?

Grasslands are open lands dominated by grasses, sedges, and other low vegetation, with few or no shrubs or trees. They include some wetlands, such as meadows wet enough to deter most larger vegetation, and managed lands such as hay fields.

As the name implies, shrublands are dominated by low, dense shrubs such as dogwood and willow. They are often associated with the margins of grasslands, including land managed for agriculture or other uses. Other shrublands are created by natural [disturbances](#) that remove larger vegetation, or beavers.

Vermont's grasslands are scattered throughout the state, with the highest concentration in the Champlain Valley. While some are natural, most that we see today are associated with current or past agricultural practices, with a few resulting from other human activities such as the meadows associated with airports, landfills, utility rights-of-way, fairgrounds, and industrial complexes. Most of Vermont's grasslands are in private ownership, although the state and federal governments own small areas of this habitat.

Shrubland habitats are more widely distributed throughout Vermont. They are associated with both upland and [wetland](#) conditions, and they occur on both public and private land. Some result from natural processes, and others represent the transition of agricultural lands and cleared areas into eventual forest.

Grasslands and Shrublands: Significance

Grasslands and shrublands provide essential habitat for many bird, mammal, reptile, and invertebrate species. Numerous birds require these habitats for their survival, with species such as upland sandpiper (endangered), grasshopper sparrow (threatened), sedge wren (endangered), vesper sparrow, savannah sparrow, bobolink, and eastern meadowlark found exclusively in grasslands. Birds specialized to life in shrubland habitat include American woodcock, brown thrasher, golden-winged warbler, eastern towhee, and field sparrow. While some of these species are considered common in Vermont, their populations are undergoing some of the steepest declines of any birds, both in the state and across the U.S.

Since the agricultural boom of the 1800s, Vermont's decline in grassland bird species is primarily a result of habitat loss as farm fields have grown into forests. Grasslands have also given way to residential, commercial, and industrial [development](#). Other threats include changes in agricultural practices, extensive use of agricultural pesticides, and loss of wintering habitats outside of Vermont.

While the ranges of these grassland birds were historically concentrated outside of Vermont, conversion of natural grasslands elsewhere in the Northeast and especially the Midwest has led to the decline of grassland birds across their historic natural

habitats. This has given Vermont, and the Northeast in general, a more important role in the [conservation](#) of grassland birds.

Grasslands and Shrublands: Map Interpretation

At a state level, this layer represents the best available grassland and shrubland data. That said, geographic representation of grasslands outside the Champlain Valley is lacking, and this dataset therefore omits many existing grasslands. Information on the location of shrublands are limited statewide; these are captured by extending grassland habitat data and including relevant categories from Vermont wetlands data.

Data for this layer were collected remotely, through the interpretation of [satellite imagery](#). While this technique can be used to quite accurately record the locations of grasslands, shrublands are difficult to identify in this way. They are included in this dataset primarily because it is presumed that some grasslands identified in the original dataset will have grown into shrublands as time passes before the data is used.

In Vermont's landscape, these types of landscape are both transitional in nature. While some are entirely natural, such as wetland areas in which the soggy soil discourages the growth of larger plants and trees, the majority of grasslands and shrublands are locations of recent disturbance where trees have been cleared. Without continual management, these lands will become forestland. Without regular cutting, grasslands convert to shrublands, which eventually become forest. When using this dataset, it is therefore wise to keep in

mind that grassland and shrubland habitats are difficult to model, and their ephemeral nature renders field data quickly out-of-date.

Because of this ephemeral nature, grasslands and shrublands are combined into a single [map layer](#), to achieve a longer lifespan. Even as the species benefiting from the mapped land change from grassland species to shrubland species, the modeled area remains relevant as a broad [conservation](#) target. Given this, we estimate this data to be relevant for 10 years from each publication update, although land use changes during this 10-year period may alter wildlife habitat value significantly

Please keep in mind that these data could include row crops, which do not support grassland birds or quality habitat for most target species. These are included in this layer because many crops, such as corn and hay, are rotated year-to-year on many farms. One year the habitat may be good, and another, not.

Grasslands and Shrublands: Planning Considerations

Grasslands and shrublands, whether of natural origin or resulting from active land management, are critical to the survival of a suite of Vermont species, namely birds. Most of these species will continue to decline in Vermont if grassland habitat is not maintained.

Most strategies for maintaining grasslands and shrublands rely on individual landowners and managers. When planning, determine what the pattern of grasslands and shrublands looks like in your area. Then include important areas in your conservation planning, and consider working with landowners to ensure continued representation of these habitat types.

Keep in mind that shrubland is crucial to maintain at a regional level. It is wise to view this data at the scale of your town, then to zoom out and see how available this habitat type is in the regional context before taking action. While this habitat type is crucial for an assemblage of bird species in particular, it should be viewed as one relatively minor component of a diverse, connected landscape of other habitat types.

Grassland Bird Conservation

Because Vermont's grasslands are so closely associated with agriculture, conservation programs often work alongside farmers to make grassland bird conservation economically feasible. The Bobolink Project is one example of such a program: www.bobolinkproject.com



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In choosing conservation strategies, your town may want to consider the following strategies:

Conservation Goal	Conservation Strategies for Grasslands and Shrublands	
	Nonregulatory Strategies	Regulatory Strategies
Seek additional information	Conduct field inventories as needed to improve maps. ²	
	Learn more about grassland bird management. ³	
Provide baseline protection	Adopt language in the town plan , including statements about the importance of grassland and shrubland habitat and policies on how they should be managed, protected, and restored.	
Ensure that management is compatible with wildlife	Practice management compatible with nesting birds on town-owned grasslands (the fields around schools or recreation fields, etc.). ⁴	In site plan review, require that developments follow sound grassland bird management guidelines.
	Connect landowners to incentives programs for wildlife-friendly management practices, such as USDA , ⁵ USFWS Partners for Fish and Wildlife , ⁶ or the Bobolink Project . ⁷	
	Provide citizen educational opportunities.	
	Establish a monitoring program for grassland birds.	
Maintain or protect habitat	Ensure that grasslands and shrublands are represented in local conservation efforts.	

Additional information on these strategies found in [Community Strategies for Vermont's Forests and Wildlife](#).

Inventory Layer #3: Habitat Blocks (by acreage)

What are Habitat Blocks?

Habitat blocks are generally forested areas of at least 20 acres with no roads or low densities of Class 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 successional stages of forest, [wetland](#), old meadow, among others. They are then categorized by size to make it easier to view them on the map and to provide a generalized comparison among the blocks in an area.

Habitat Blocks (by Acreage): Significance

Because forest fragmentation is one of the most significant threats to Vermont's natural heritage, maintaining large habitat blocks, and connections between these blocks, may be one of the best ways to ensure conservation. All else being equal, larger habitat blocks generally contain greater biological diversity (a much higher number of species) than smaller blocks. This is because these areas often contain a great diversity of habitat types, which support the requirements of many plants and animals. Some

Vocabulary Note

Habitat block, contiguous forest, core forest, forest block... You may find resources that use each of these terms. All refer to nuances of the same basic concept. While it is important to clearly understand and define any language used in a regulatory setting, these terms are nearly interchangeable in a general sense; they refer to habitat uninterrupted by roads or other human development.

To read more about the role of these areas, see page 39 in [Conserving Vermont's Natural Heritage](#).

species live only in large patches of forest habitat, and others—such as bear, bobcat, and fisher—require such large home ranges to find the food, water, shelter, and access to mates that they require that they are unable to survive in a heavily fragmented landscape. Many human communities rely on large habitat blocks, too, to provide opportunities for recreation and forest management, which in turn support the local economy. Furthermore, large habitat blocks play a large role in maintaining the quality of our air and water.

Over time, the average size of habitat blocks has been shrinking in Vermont. As [development](#) pressure

causes new roads to bisect [natural areas](#), structures creep in from the edges. Species requiring large home ranges must increasingly use several smaller blocks rather than a single large block to get what they need to survive, although this is only possible in locations where enough cover exists between habitat blocks for animals to feel secure traveling from one to another. This often means crossing roads, which can be dangerous for both animals and humans. The [Wildlife Road Crossings](#) layer (Map 6) looks at such locations where wildlife are most likely to cross roads in order to link together habitat blocks. For many wildlife, the most suitable habitat is found within the largest blocks where crossing roads and other fragmenting features isn't necessary.

While size is the important characteristic in this map, there isn't a minimum size that is considered critical as important wildlife habitat. Blocks are best considered within the context of the landscape. 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. The general rule of thumb is "the bigger, the better," and you can determine what big means in your region by viewing the habitat block layer at a regional scale using BioFinder. Habitat configuration is also important. An area that is highly irregular in shape, containing a high proportion of edge compared with interior forest, may be less functional for some species than habitat of the same acreage with a regular shape.

Vermont's development history adds an interesting twist when we think about habitat block size. Because our areas of human settlement and development have historically and currently been along streams and in valleys, the largest remaining areas of [contiguous habitat](#) tend to be in high-elevation areas and those in which soils are unsuitable for agriculture or building. However, it is often those same valley bottoms where we would naturally see the greatest biological diversity. As you identify the largest areas of contiguous habitat in your town, keep in mind that they may be biased towards the uplands or other undevelopable landscape, but it is also important to include [lowlands](#) when planning for [conservation](#).

Habitat Blocks (by Acreage): Map Interpretation

Habitat blocks are derived from the land cover data depicted on Map 2. They include all areas of [natural cover](#) surrounded by roads, development, and agriculture, ranging in size from 20 acres to 154,000 acres. Here, they are displayed by size. In Map 6, we show the same data again, prioritized for biological importance. To learn more, you can find the original report from Vermont Fish & Wildlife Department and Vermont Land Trust online at vtfishandwildlife.com/sites/fishandwildlife/files/documents/Conserve/Vermont_Habitat_Blocks_and_Habitat_Connectivity.pdf.

Habitat Blocks (by Acreage): Planning Considerations

As you examine the habitat available to wildlife in your community, you may find the following useful in evaluating and prioritizing different areas:

- ▶ **Size:** In general, larger habitat blocks are likely to have higher ecological value. They often also provide greater benefits to the civic community through opportunities to access forest resources, hunting, or recreational use.
- ▶ **Condition:** Areas that contain diverse natural habitat types normally have a greater variety of plant and animal species.
- ▶ **Landscape Context:** Locations in which several habitat blocks are close to one another and separated only by minimal fragmenting features like roads, development, or agricultural land may function better as wildlife habitat for many species.
- ▶ **Connectivity:** Connecting features can link blocks together to effectively function as

Act 171 and Forest Fragmentation

In 2016, the Vermont legislature passed a bill requiring regional and municipal planners to identify important forest blocks and habitat connectors and to plan development so as to limit forest fragmentation in these areas. Many communities may find Habitat Blocks to be a good starting point for this requirement. While size is not the only consideration, it will be helpful to know where the biggest blocks and fragmenting features are located as you begin the process. Learn more about this legislation at www.legislature.vermont.gov.



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larger blocks. While larger blocks generally remain better for wildlife than a series of linked smaller blocks, these features can allow a broader diversity of wildlife to inhabit human-populated areas.

In Map 6, you can see how these blocks have

been prioritized by state biologists, keeping in mind that your local priorities may be somewhat different than those chosen at the state level. In Part II of this guide, these prioritized habitat blocks will appear again, categorized into highest priority and priority [interior forest blocks](#) and [connectivity blocks](#).

Once you have identified priority habitat blocks, the following may be appropriate methods for conserving them:

Conservation Goal	Conservation Strategies for Priority Habitat Blocks (by Acreage)	
	Nonregulatory Strategies	Regulatory Strategies
Provide baseline protection	Adopt language in the town plan, including statements about the importance of large forest blocks and policies on how they should be managed, protected, and restored.	Check clarity of definitions in zoning bylaws and update if needed.
	Provide citizen educational opportunities.	Review standards in zoning (subdivision, CU, or use standards), and update if needed.
	Work with neighboring communities and/or the regional planning commission to plan for forest conservation at a regional scale.	Review purpose statements in zoning and update if needed.
Provide stewardship of forestland	Encourage residents to work with a forester to create forest management plans. ⁸	Establish an impact fee program . ⁹
	Encourage enrollment in Current Use (or local tax stabilization program). ¹⁰	
	Connect landowners with supporting organizations, such as Vermont Coverts, ¹¹ Vermont Woodlands Association, ¹² the Natural Resources Conservation Service, ¹³ or your local Natural Resources Conservation District. ¹⁴	
Avoid fragmentation	Encourage residents to enroll in Current Use (or local tax stabilization program). ¹⁵	Allow a greater development density in defined growth areas (like village or commercial districts) than in rural land (through a Forest, Conservation, or Rural Residential Zoning District).
	Encourage citizens to engage in estate planning.	Establish or expand a Wildlife Habitat or Wildlife Corridor Overlay District .
	Encourage residents to conserve their forestlands in important areas. ¹⁶	Establish building envelopes, clearing standards, or limits on driveway length in bylaws to limit the impact of development.
	Create or expand a Town Forest. ¹⁷	Establish or improve Subdivision Regulations .
		Establish road and trail standards. ¹⁸
Review rural residential-type districts to determine whether lot sizes and site design requirements allow for continued function of rural land (i.e., 2- to 5-acre lot sizes can cause fragmentation even if open space remains.)		
Provide support for working forests	Encourage residents to enroll in certification programs that promote long-term support for land management. ¹⁹	Institute local forest products purchasing policy (for municipal purchases).
	Encourage support for businesses that use local forest products.	Ensure that regulations include standards that allow for continued access to working forests and associated infrastructure (e.g., log landing areas). ²⁰

Additional information on most strategies can be found in [Community Strategies for Vermont's Forests and Wildlife](#).