

# Mapping Vermont's Natural Heritage

*A Mapping and Conservation Guide for  
Municipal and Regional Planners in Vermont*



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*This guide was created to support municipal planners in achieving their goals for protecting wildlife habitats within town boundaries. We share resources developed and lessons learned by many agencies and organizations throughout Vermont.*

## Background and Purpose



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Vermont is known for its beautiful forests and agricultural lands, mountain streams and scenic landscapes. This is the Green Mountain State, where residents claim a love of rural places and where visitors come to ski, hunt, hike, and enjoy the scenery. Our landscape drives our economy and is largely what makes our state so special.

Surveys support these claims. Across the nation, only Alaska outranked Vermont for participation in wildlife-related recreation (i.e., fishing, hunting, or wildlife watching) in a 2011 survey ([US Dept. of Interior](#)). In the same survey, Vermont ranked first for wildlife watching activities, with 53 percent of residents participating, more than half our population, and it was estimated that more than \$704 million was spent in Vermont on fish- and wildlife-based recreation. In 2015, a public attitude survey found that 83 percent of respondents agree that [land use](#) and [development](#) should be restricted to protect fish and wildlife and that 81 percent would like to see [wildlife](#) habitat protected even if it reduces the land use options of some landowners and developers ([Duda et al](#)). In Vermont, we like our wildlife and we want to see their continued presence on the landscape.

With more than 80 percent of the state's land in private ownership and the majority of land use and

development decisions made at the local or regional level, the protection of Vermont's species, habitats, and ecological processes is firmly in the hands of landowners, municipal governments, and regional planning groups. At the same time, municipal planners must balance these wildlife needs with countless other goals, and prioritization of such diverse needs can be tricky.

This guide was created to support municipal planners in achieving their goals for protecting wildlife habitats within town boundaries. In it, we share resources developed and lessons learned by many agencies and organizations throughout Vermont, combining background information about our natural landscape, [natural resources](#) maps tailored to individual towns, and a step-by-step strategy for prioritizing ecological needs alongside diverse other goals. For those wishing to dig deeper, we have provided links to additional resources you may find helpful. Our goal is to provide planners with the knowledge and tools necessary to make wildlife-related planning decisions in their own towns or regions. If a community can identify and conserve the most important wildlife resources on its own landscape, it will also achieve goals set forth in Vermont's state-level Wildlife Action Plan and thereby aid with the [conservation](#) of wildlife on a state and even regional scale.

*The Merriam-Webster Online Dictionary* defines conservation as “the careful preservation and protection of something, especially planned management of a natural resource to prevent exploitation, destruction, or neglect.” In this guide, we keep our use of the word broad, including any strategy that can aid in the protection or thoughtful use of the natural landscape to maintain or enhance its healthy condition.

## Using This Guide

The **CD and online files** that accompany this guide include a set of seven maps centered on each town in Vermont. These maps are formatted to be printed at 44 x 36 inches, but they can also be adapted for printing on a home printer or viewed on your screen. The maps can also be recreated on an online program called *BioFinder*, described later in the introduction to this guide.

**Part I** provides information about each layer found on the maps. For each dataset, we describe the layer, its importance, how it was mapped, and considerations for conserving the resource.

**Part II** offers a step by step approach for determining which locations in a community are most important to conserve and then finding conservation strategies appropriate for the community.

An **Appendix** and **Glossary** can be found at the end of the guide.

### Suggested Process:

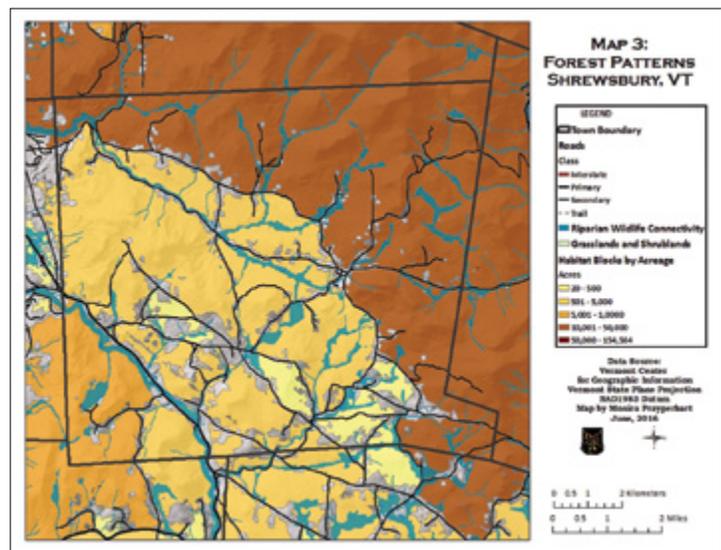
1. Start with Part I. Look at the seven maps of your community and understand the ecological [components](#) presented in each.
2. Read Part II and prioritize important locations in your community. As described in Part II, first identify broad patterns; then add finer details.
3. Go back to Part I and dig deeper into the [natural heritage](#) features found in your priority areas. Find strategies that will conserve first the broad patterns, and then any elements not captured by these patterns.

## Natural Heritage

Natural Heritage includes all the natural resources Vermont residents and visitors value. Vermont's diverse resources, which include forests, clean waters, vibrant fisheries, healthy wildlife populations, rare species, significant natural communities, and a working landscape provide people with the opportunity to—among other things—hike, hunt, fish, trap, birdwatch, and work the land. Natural heritage also includes the concept of biodiversity, which is the variety of life in all its forms and all the interactions between living things and their environments.

## Why Maps?

In 2008, the Vermont Supreme Court struck down a South Burlington [zoning](#) ordinance aimed at protecting a variety of natural resource values (In re Appeal of JAM Golf, LLC, 2008 VT 110). The court determined that the ordinance was too vague to effectively determine what “protection” of the [natural resources](#) listed should entail, thereby making it unenforceable. Because the South Burlington ordinance was written in language similar to that used by towns throughout the state, this ruling is a call to action for all towns wishing to protect their local natural resources. If towns want their plans and bylaws to be legally defensible, they must include clear, specific, and consistent [standards](#) that define exactly what types of development are allowed and prohibited in any given area (Garvey 2009).



A map is the first step in creating such clear, specific, and consistent standards. Before you can effectively plan, you first need to determine exactly what resources you have. The better your information, the more easily you can prioritize, and the more clarity you can provide. A map is essentially an inventory of one or several [components](#) of the landscape, and this guide highlights a series of seven maps created to feature the ecological, biological, and physical resources of each town in Vermont. When combined, these maps become even more powerful, showing how each individual dataset relates to every other.

Of course, every map also has limitations. Maps are static images, and yet they represent a changing landscape. They are also intended for use at a particular scale and can become inaccurate when used at other scales. Imagine, for example, a map of all the lakes present in the state of Vermont. At the

state level, each lake appears accurately placed. However, if you were to zoom in on that map, magnifying everything within the boundaries of your hometown, you may find that the boundaries of the lake are off by 25 feet. When examining that map at the state scale, those 25 feet are unsubstantial. To a landowner whose home is depicted as partially underwater when zoomed to the parcel level, those 25 feet matter!

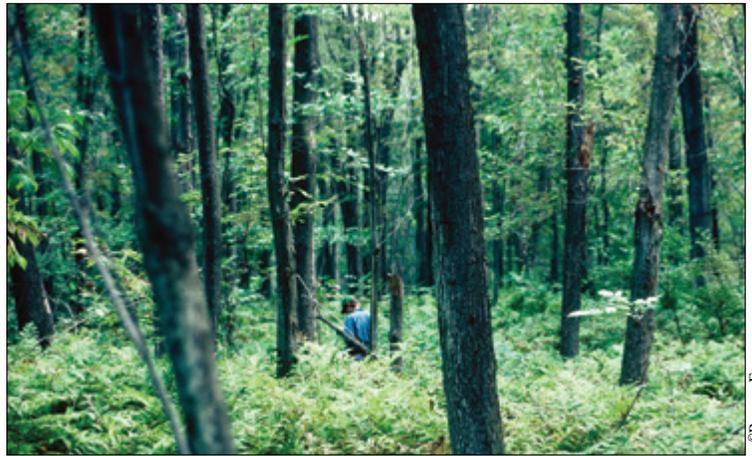
In this guide, we therefore explain the appropriate scales, data sources, and intended purpose of each map. We encourage you to read these descriptions thoroughly before including the maps or the data they contain in implementation efforts. When used appropriately, this information can open new ways of seeing your community and the many natural resources located there.

### **But Wait! What About Private Property?**

As mapping data increases in availability, some fear that the resulting maps could be used to infringe on landowners' property rights—or even that maps themselves can be an invasion of privacy. Certainly not unique to mapping, the question of how to balance protections of privacy with the collection and distribution of useful information pervades today's world. Many technological advances have forced us to consider where to draw the line between what is public and what is private. In terms of maps, there is no doubt that mapping content is substantially more detailed and descriptive today than it was in the past. This increase in detail allows us to learn more about the function of our landscape, and it increases the risk of invading personal privacy. The two go hand in hand.

For cartographers, this discussion is not new. The very nature of creating a map is to take what is present on the ground and draw it in a form that is easier to visualize, easier to understand, and easier to share. Maps are made in an effort to increase understanding of what is present, and to share this understanding with others. Maps by their very nature are central to this debate about balancing enhanced public knowledge and protection of privacy.

We have created this mapping guide because at this point in time, the information displayed on these maps is known. It already appears on public maps. While the data were collected for a variety of reasons, the people most affected by the information—and who can certainly also use it—are landowners and communities. At a local level, it is your land that appears on these maps. If anyone has a right to access



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these data, you do, too—along with information about the intended use of the data.

To some, the distribution of maps depicting natural heritage features is particularly concerning due to a perceived conflict between human interests and the needs of wildlife. To this end, it is true that just as what is “good” for one landowner may not be desirable for the next, some ecological priorities may conflict with a landowner's wishes for his/her land. In writing this guide, our goal is not to dictate any particular course of action; it is simply to describe the way the ecological landscape functions, map the components geographically, and guide you through possible techniques for making informed decisions about ecological priorities.

At that point, it is up to landowners and communities to decide what to do with the information. While this guide outlines a process for taking map information and creating a conservation strategy, the nature of that strategy needs to be decided at the local level. Some communities may use these maps purely for educational purposes. Others may use them when creating [municipal plans](#) and bylaws. Whatever the strategy, these decisions need to reflect local realities—ecological and societal. When implementing any strategy, some communities may find that the ecological components and priorities described in this guide are in conflict with community or landowner goals, and these communities may need to think very carefully about how to handle this conflict. Other communities may find that few conflicts exist. But without information about how the landscape functions ecologically, it is impossible to tell even whether there are conflicts. We provide this guide to allow you to make informed decisions about how to proceed, and encourage you to keep in mind the privacy of those whose land appears on these maps.

# Getting the Most out of the Maps

Maps and inventory may be the basis of natural resources planning, but there are clearly several steps between identifying features on a map and having a plan. In this guide, you will find many references to [Conserving Vermont's Natural Heritage](#), published in 2004 and updated in 2013 by the Vermont Fish & Wildlife Department and Agency of Natural Resources, and [Community Strategies for Vermont's Forests and Wildlife](#), a 2013 document by Vermont Natural Resources Council. Together, these books provide a background of the natural heritage features found on the maps in this guide as well as explanations of a wide range of tools a community might use to protect these resources. We encourage you to read these books alongside this guide.



Additionally, Vermont's Agency of Natural Resources has developed several online mapping tools, such as BioFinder and the [Natural Resources Atlas](#), to allow anyone with an internet connection to explore state mapping data. Using these resources, you can recreate any of the maps you see here, mix and match data, and zoom in and out to different scales on any map.

In addition to the above resources, we also recommend that your planning group captures the goals and values of your community and includes local citizens in the planning process even as you begin. Because it will ultimately be up to your community to adopt the plans and strategies you propose, it is important to be transparent about your intentions. The *Community Heart and Soul Field Guide* outlines one method for involving your community in the planning process, published in 2014 by the Orton Family Foundation and available online at [www.orton.org/what-we-do/what-community-heart-soul](http://www.orton.org/what-we-do/what-community-heart-soul). When combined with the scientifically based background information outlined in this guide and by natural resources professionals, this strategy can be a powerful way to connect with citizens in your community. Of course, all strategies are not for all towns, and this is just one of many possibilities!

## *BioFinder: Vermont's Online Conservation Planning Mapping Tool*

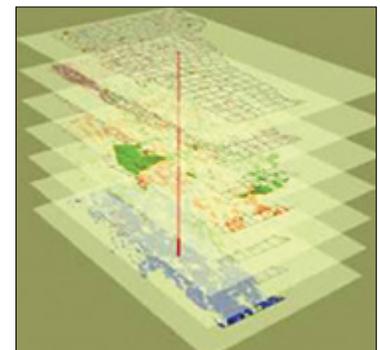
Found online at [biofinder.vermont.gov](http://biofinder.vermont.gov)

### What is Biofinder?

BioFinder is an online mapping tool that allows Vermont citizens, such as planners, developers, educators, scientists, and so forth, to explore the lands and waters in Vermont that are most important for supporting ecosystems, natural communities, habitats, and species. BioFinder shows a variety of ecological components known to contribute significantly to biological diversity, then categorizes these components into conservation priorities. The goal is to allow citizens not only to locate ecologically important components on a local landscape but also to identify the *most important* locations for conservation or the most ecologically logical places for development.



Similar to many modern mapping programs, BioFinder uses a [geographic information system](#), or GIS, that captures, stores, analyzes, and manages a diverse array of geographical information and allows it to be viewed simultaneously. In some ways, this process works just like taking physical maps, copying them onto transparent mylar, then laying one on top of another so that



*A GIS map layers datasets one on top of another, so that they align geographically.*

a location on one lines up with the same location on another. A user can look at multiple layers—meaning multiple sets of map data—at once and add or remove information as needed.

In other ways, GIS is much more sophisticated than a set of transparent maps because the software not only layers the maps on top of one another but also provides tools to analyze them. For example, a user can see which [conserved land](#) has public access, view all lands within 100 feet of a wildlife road crossing, or identify places that are mapped both as a large [habitat block](#) and a [deer wintering yard](#). BioFinder also allows

users to make notes, print maps, and create reports of all the “priority” and “highest priority” ecological components found in a chosen geography.

### BioFinder Themes

BioFinder categorizes all information into two themes. Each theme includes a separate list of map information that can be displayed or turned off as desired. The default theme, **Prioritization**, appears when you first open BioFinder, but an **Inventory** theme is also available. Change the theme by clicking in the box at the top of the information panel, under the word **Layers**.

### Inventory

*Answers the question “What’s here?”*

The Inventory theme on BioFinder mirrors this guide’s presentation of *Part I. Inventory Maps*. This theme displays each individual dataset, organized in the same manner as the first 6 maps here. Just as in this guide, if you begin with Map 1 and view each map in the order presented, you will find yourself beginning with broad, landscape patterns and then zooming in to see increasing detail. Many of the [map layers](#) depict the same information shown in the Prioritization theme, but here information is shown in its raw form, before priorities have been assigned. This allows a user to explore the breadth of ecological components at play on a local or regional landscape.

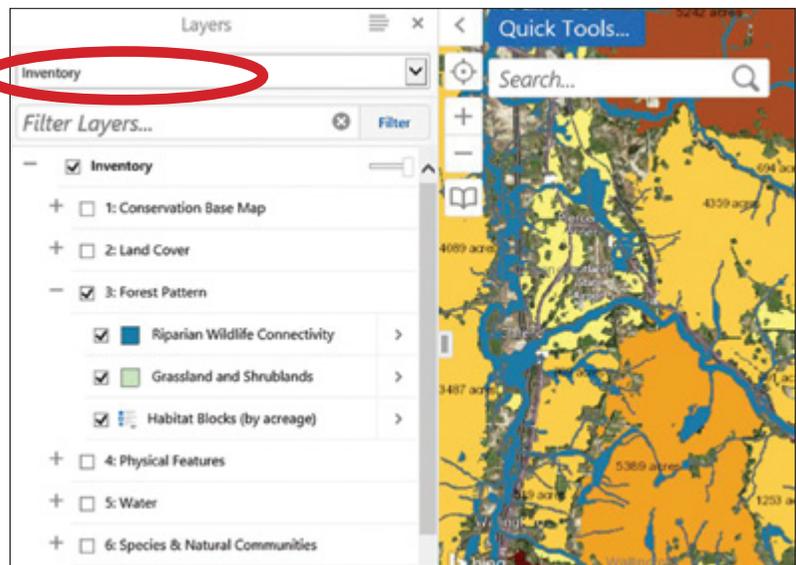
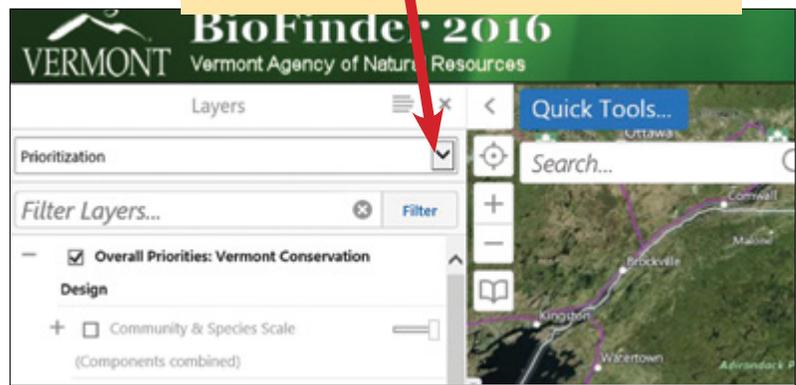
### Prioritization

*Answers the question “Where are the locations of highest ecological importance?”*

The **Prioritization** theme matches the discussion in this guide’s *Part II. Prioritization and Implementation*, displaying maps of important components by ecological priority. This theme uses variations of the same data found in the Inventory section, but these data are categorized here to aid with [conservation planning](#) efforts. This theme identifies statewide ecological priorities based on their contribution to regional **ecological function**—the ability of plants and animals to interact as needed in order to thrive, reproduce, migrate, and move, even as the climate changes.

The theme considers two scales: [Landscape scale](#) and Community and [Species scale](#). Landscape scale components include the forest networks, waterways,

To change themes, click this box.  
You can select **Prioritization** or **Inventory**.



### Inventory Theme

*Use the **Inventory** theme to find specific information about which ecological components are present in an area of interest.*

## Public Access to Digital Mapping Resources

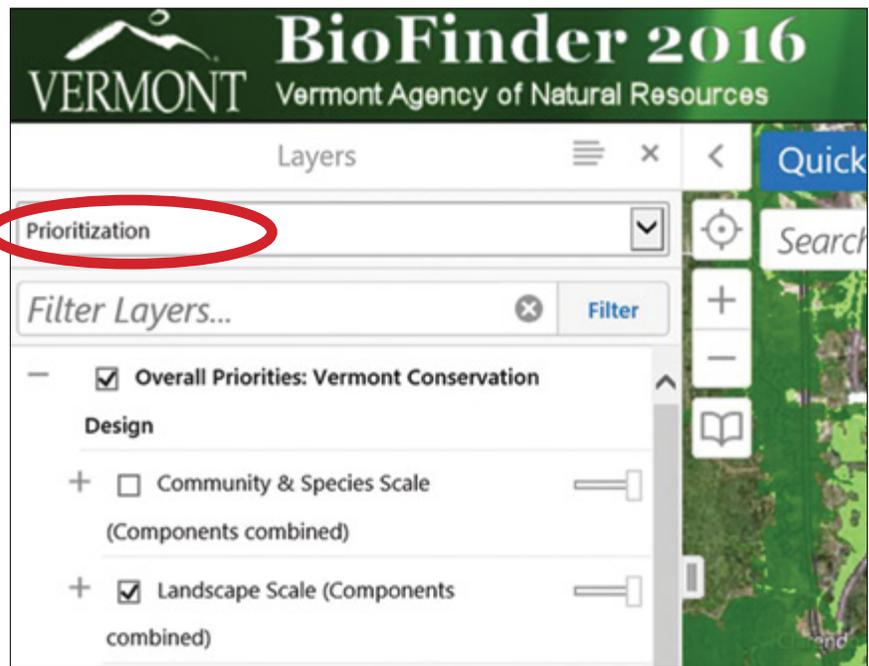
In recent years, [digital mapping](#) resources have become increasingly sophisticated, enabling generation of abundant landscape-based information that was previously unknown. Even with these mapping developments, however, many resources remain relatively inaccessible to the public, requiring expensive software or technical training. The Vermont Agency of Natural Resources developed BioFinder and its sister application, the Natural Resources Atlas, to allow easy public access to map information.

and physical landforms that create a backdrop for interactions among the majority of Vermont’s species. The community and species scale includes those components important to individual species or groups of species of conservation concern within Vermont, such as habitat for [rare species](#), [vernal pools](#), or locations where wildlife are most likely to cross roads.

At each scale, state biologists have divided components between “highest priority” and “priority” groups. Areas tagged as highest priority are those critical for maintaining an ecologically functional landscape. While areas labeled priority are also important, they play a lesser role in maintaining regional ecological function—though they may remain important locally. The highest likelihood of maintaining an ecologically functional landscape will be achieved by conservation of both highest priority and priority components.

### *The Natural Resources Atlas: A Sister to BioFinder*

When conducting conservation planning, BioFinder is the tool of choice, but planners should also be aware of another mapping tool created by the Vermont Agency of Natural Resources: the [Natural Resources Atlas](#). This application uses the same online

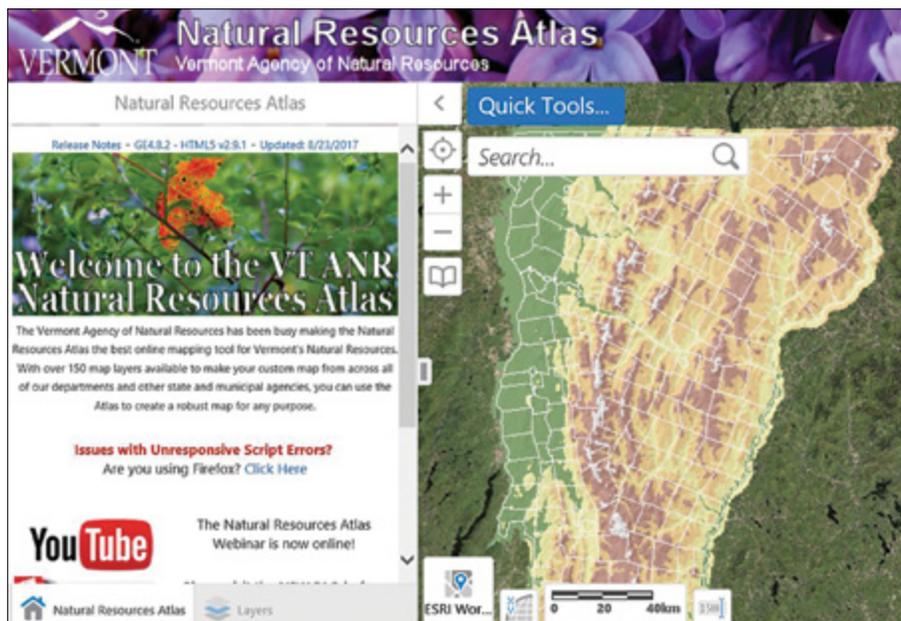


**Prioritization Theme** Use the Prioritization theme to find locations containing generalized ecological priorities.

platform, has the same functionality, and even contains much of the same data. The main difference is that BioFinder was created specifically to aid citizens in accessing [natural heritage](#) and conservation-related data, while the Natural Resources Atlas is intended for much broader use.

The Natural Resources Atlas acts as a clearinghouse for all data generated or used by each of the departments in the Vermont Agency of Natural Resources. It includes, for example, waste management, geologic, and groundwater protection data in addition to landscape and habitat features. While useful, many municipal planners and citizens find this overwhelming. When conducting conservation planning, you may find it simpler to start with BioFinder’s pre-loaded subset of applicable data. If additional information is needed, any Atlas layer can be uploaded onto BioFinder. Because the tools contain the same functionality, users of one can generally transition to the other with ease.

Visit the Natural Resources Atlas at: [anrmaps.vermont.gov/websites/anra5/](http://anrmaps.vermont.gov/websites/anra5/).



## Getting Started

**BioFinder** is found online at [biofinder.vt.gov](http://biofinder.vt.gov)

If you're new to online mapping tools, we suggest starting with a series of videos about BioFinder. This link takes you to a playlist of multiple videos, starting with an orientation, then continuing to tutorials about using specific mapping tools:

[tinyurl.com/BiofinderHowToVideos](http://tinyurl.com/BiofinderHowToVideos).

In fact, there are quite a few instructional videos produced by the Vermont Agency of Natural Resources' GIS mapping team. All are available on a YouTube channel, which is where new videos will be posted as they become available:

[www.youtube.com/user/vtanrgis](http://www.youtube.com/user/vtanrgis).

The Help tools within the application may also prove helpful.

Using **BioFinder**, you can follow the steps below to view any of the maps described in this guide. Please note that colors may differ between those provided in this guide and online.

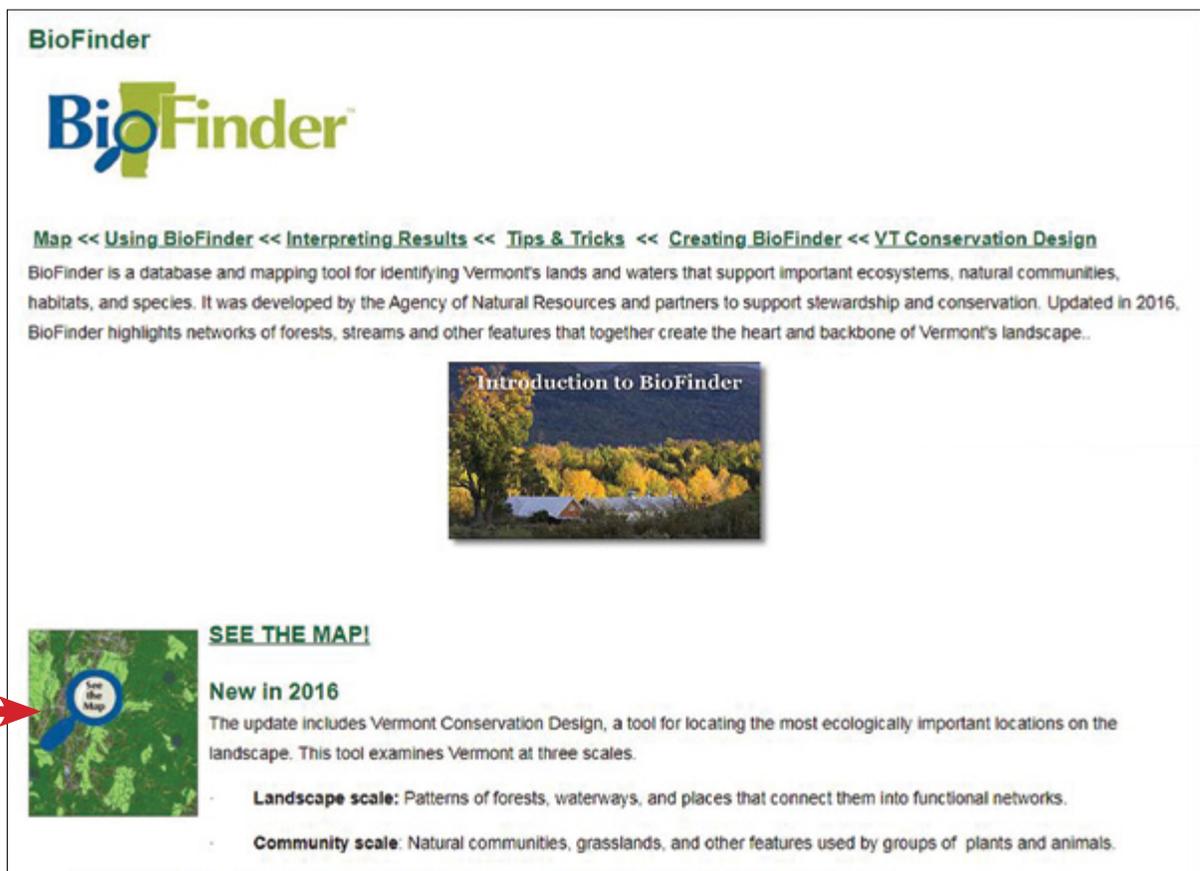
1. Open the BioFinder Homepage at [biofinder.vt.gov](http://biofinder.vt.gov). This page contains links for additional information, instructions, and tutorials.
2. Click the map icon with the words **See the Map**.

## Reproducing the Maps in this Guide

While Vermont Fish & Wildlife Department has prepared static versions of Maps 1 through 7 in this guide specific to every town in Vermont (included on the CD that accompanies the guide), you may find it most useful to explore the maps online, which will allow you to zoom in or out to see locations of particular interest, mix and match datasets from different maps, or see how your town compares to surrounding locations.

## BioFinder Workshops

Want to explore BioFinder in an interactive training? Vermont Fish & Wildlife Department may be available to conduct such workshops. Please contact the department's [Community Wildlife Program](#) for more information on bringing a workshop to your region.



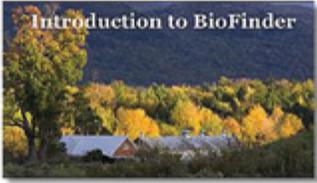
**BioFinder**

**BioFinder**

[Map](#) << [Using BioFinder](#) << [Interpreting Results](#) << [Tips & Tricks](#) << [Creating BioFinder](#) << [VT Conservation Design](#)

BioFinder is a database and mapping tool for identifying Vermont's lands and waters that support important ecosystems, natural communities, habitats, and species. It was developed by the Agency of Natural Resources and partners to support stewardship and conservation. Updated in 2016, BioFinder highlights networks of forests, streams and other features that together create the heart and backbone of Vermont's landscape.

**Introduction to BioFinder**



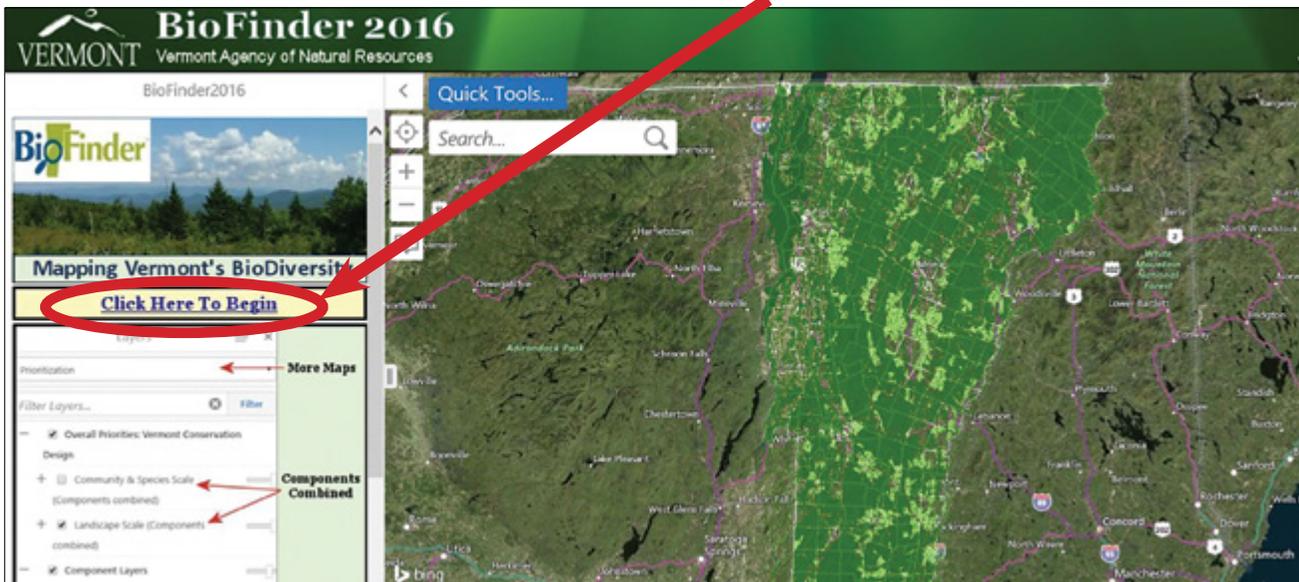
**SEE THE MAP!**

**New in 2016**

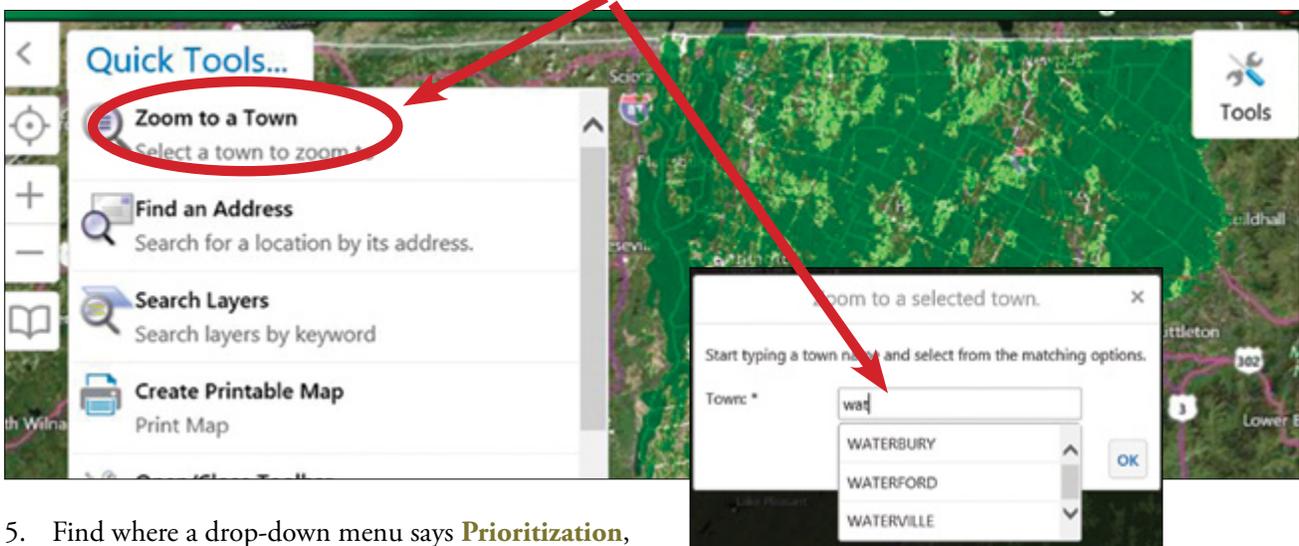
The update includes Vermont Conservation Design, a tool for locating the most ecologically important locations on the landscape. This tool examines Vermont at three scales.

- **Landscape scale:** Patterns of forests, waterways, and places that connect them into functional networks.
- **Community scale:** Natural communities, grasslands, and other features used by groups of plants and animals.

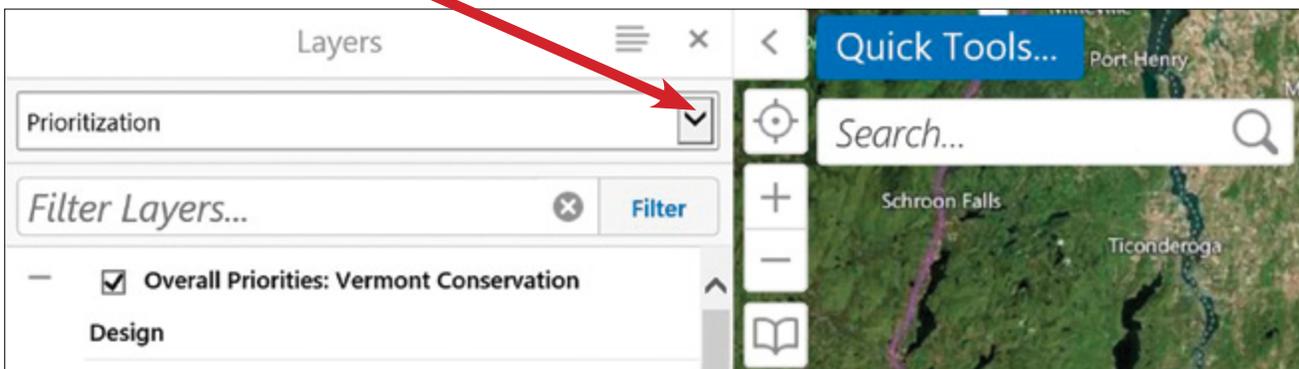
3. On the left-hand panel, click where it says **Click Here to Begin**.



4. Find your town by clicking **Quick Tools** in the top, center of the page. Using the **Zoom to Town** feature, type the first few letters of your town's name, and select your town from the list that appears.

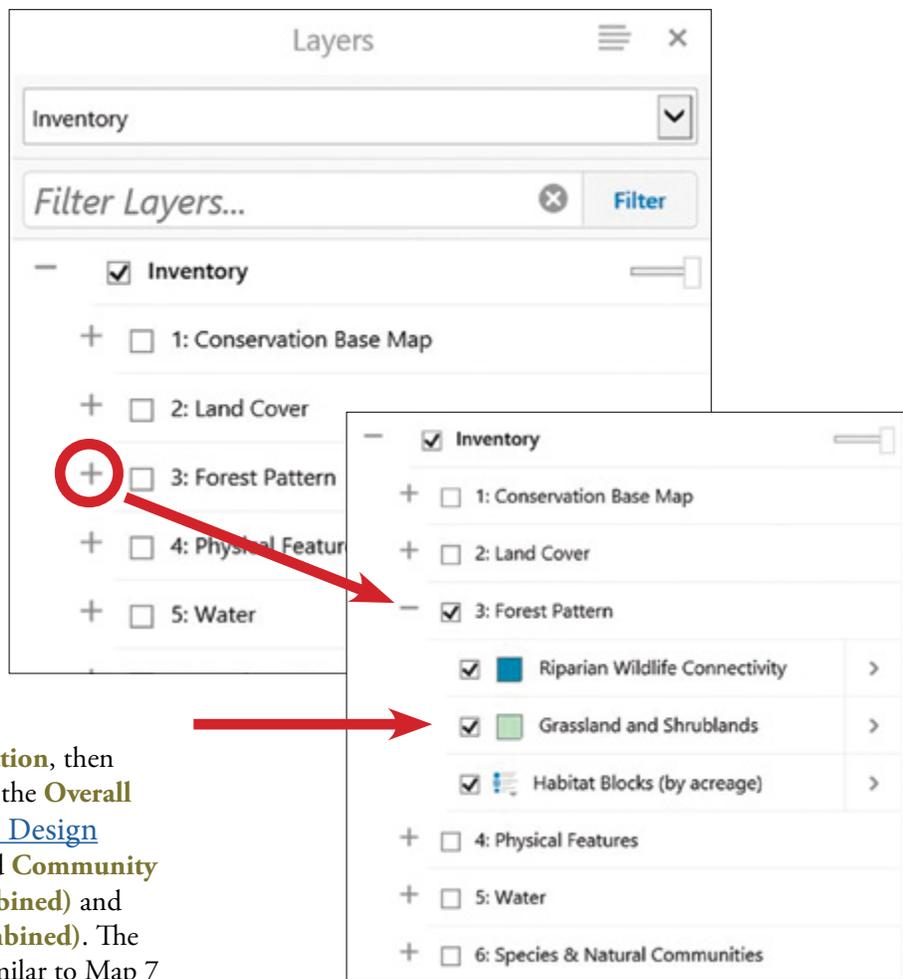


5. Find where a drop-down menu says **Prioritization**, under the word **Layers** at the top, left-hand side of the page. Select **Inventory**.

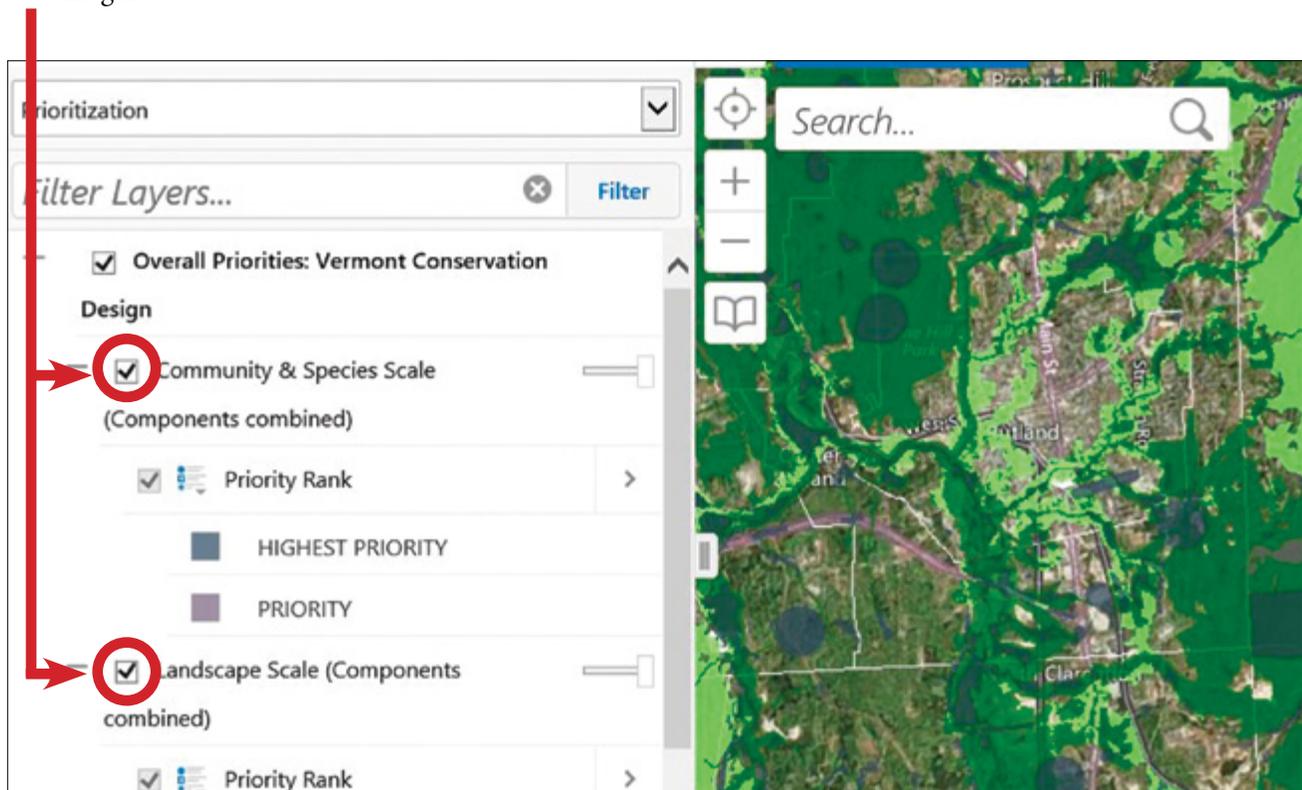


6. Maps 1 through 6 will appear underneath the word **Inventory**. These are the same as Maps 1 through 6 described in this guide.

7. Clicking the + sign will display a list of information that can be turned on or off for each map (the **+** in the image). You can control what information is displayed by clicking on the box next to each dataset (see the **→**).

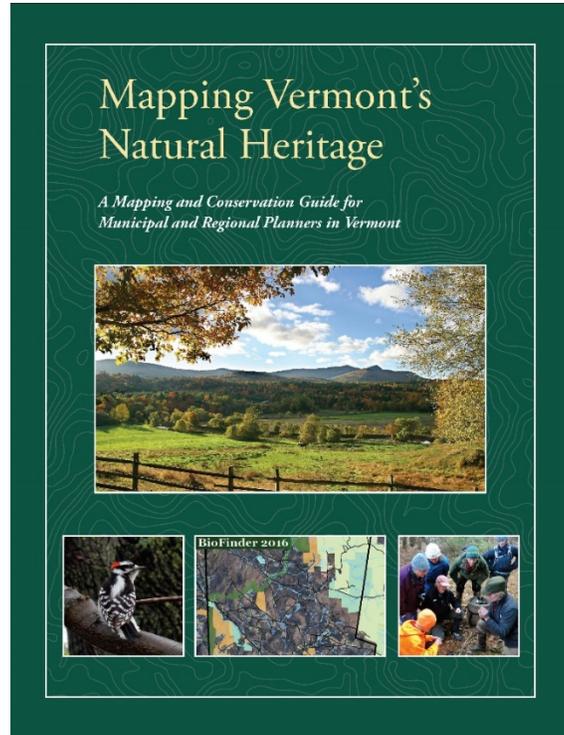


8. You can reproduce Map 7 using the default Prioritization theme. Change the theme back to **Prioritization**, then make sure both of the boxes beneath the **Overall Priorities: Vermont Conservation Design** category are checked. These are called **Community & Species Scale (Components combined)** and **Landscape Scale (Components combined)**. The image that appears should be very similar to Map 7 of this guide.



# 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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