Biodiversity in Vermont

House Committee on Environment and Energy

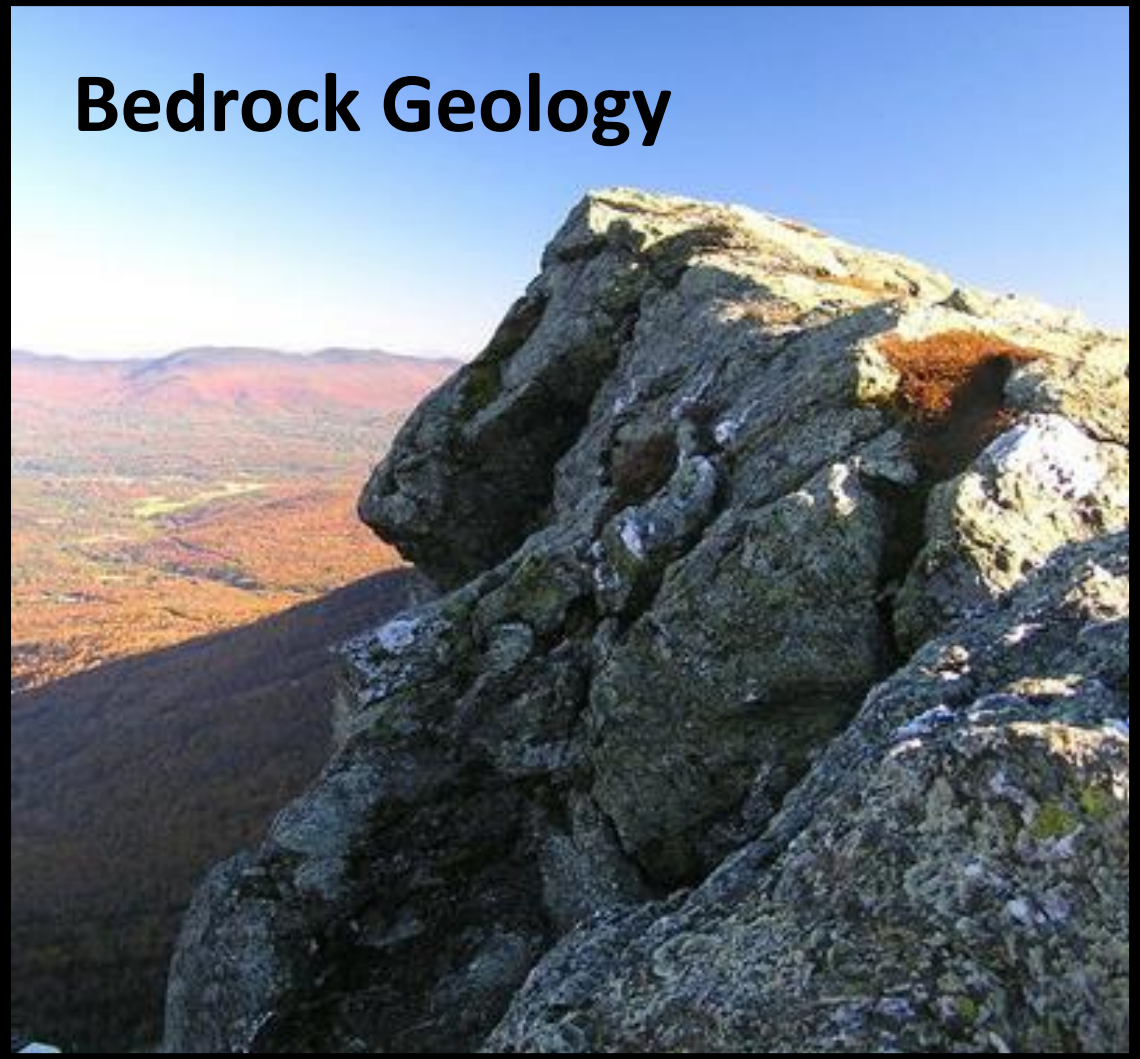
January 18, 2023

Eric Sorenson, ecologist

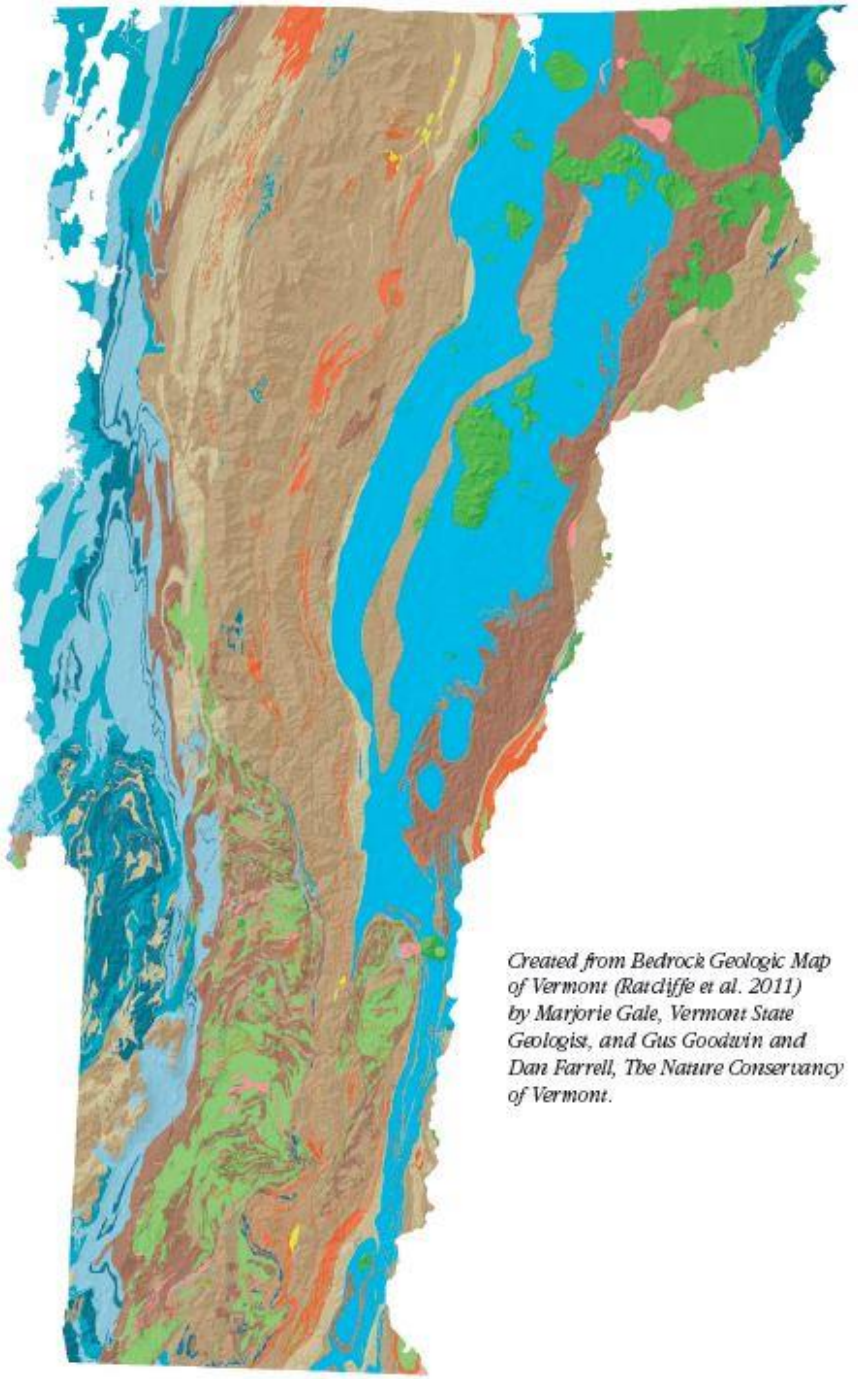
NASA

NASA

Bedrock Geology



Ratcliffe, NM, Stanley, RS, Gale, MH, Thompson, PJ, and Walsh, GJ, 2011, Bedrock Geologic Map of Vermont



Created from Bedrock Geologic Map of Vermont (Ratcliffe et al. 2011) by Marjorie Gale, Vermont State Geologist, and Gus Goodwin and Dan Farrell, The Nature Conservancy of Vermont.

ECOLOGICAL CLASSIFICATION OF BEDROCK

CALCAREOUS SEDIMENTARY AND METASEDIMENTARY ROCKS

Highly calcareous limestones, marbles, and dolomites: These rocks have notable concentrations of carbonate minerals, which weather easily and release calcium and other important plant nutrients. They produce some of Vermont's most diverse natural communities.

Waits River Formation: Phyllite with abundant bands of micaceous marble. This distinctive bedrock formation is largely responsible for the character of Vermont's Piedmont regions.

Moderately calcareous slate, shale and schist: Examples include the shale beaches of Lake Champlain and some of the Taconics.

Locally calcareous quartzose metasandstones, slates, and schists: The Monkton Formation is an example.

METASEDIMENTARY ROCKS, RARELY CALCAREOUS

Slates, graywackes, and conglomerates: Metamorphosed clastic sedimentary rocks—including rocks rich in quartz and feldspar—of the Taconics and western foothills of the Green Mountains.

Schists, phyllites, granofels, and related gneiss: Although generally non-calcareous, these rocks can be locally calcareous, capable of supporting rich-site species or natural communities, especially when topography and hydrology serve to amplify enrichment.

Quartzite, quartzose metasandstones and paragneiss: These rocks are notable for their resistance to weathering and limited availability of calcium and other important plant nutrients. The Cheshire Quartzite is an example.

MAFIC AND ULTRAMAFIC ROCKS

Mafic plutonic and related rocks: Mafic rocks are rich in iron, magnesium, and sometimes calcium and other metals. Although these elements are tied up in slow weathering minerals, topography and hydrology can serve to amplify ecological enrichment.

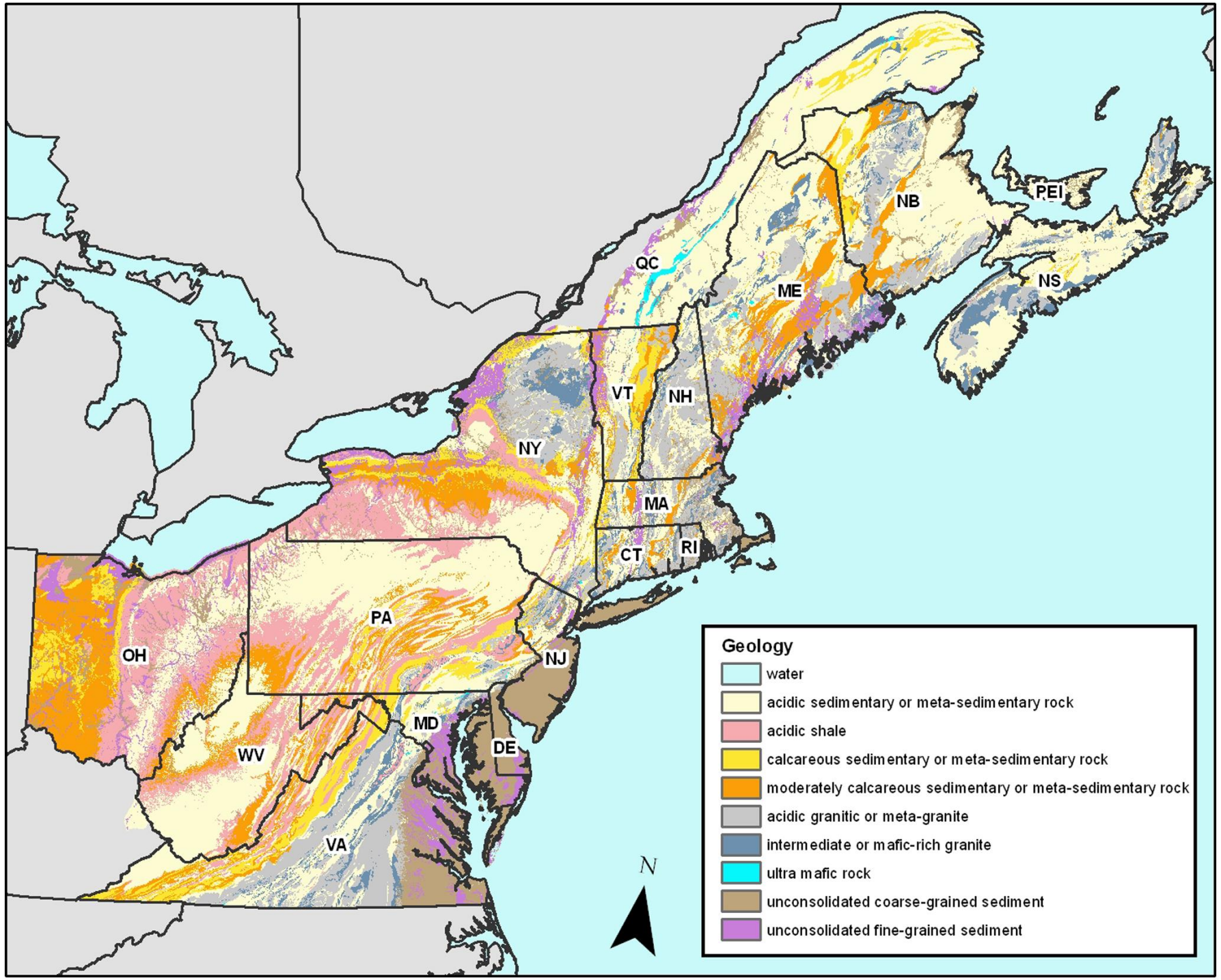
Mafic schist and amphibolite: Metamorphosed mafic volcanic and related rocks. Many of these rocks also contain minor dispersed calcium carbonate.

Ultramafic rocks: These unusual rocks have their origins deep beneath the oceanic crust and can be exceptionally rich in iron, magnesium, nickel and other heavy metals that are toxic to some plants. In Vermont, these rare rocks can support distinctive natural communities and rare plants. These rocks include serpentinite (the source of asbestos) and steatite (the source of soapstone).

FELSIC IGNEOUS AND PLUTONIC ROCKS

Felsic plutonic rocks: Felsic rocks are rich in quartz, feldspar and aluminum, and are non- calcareous. These rocks rose as magma through the earth's crust mainly during the Acadian Orogeny. They are generally resistant to weathering and when embedded in softer rock, they often form dome-shaped highpoints in a landscape. Black Mountain in Dummerston and the granite hills of Groton State Forest are notable examples.

Felsic, granitic gneiss: Metamorphosed granites, similar in composition to felsic plutonic rocks, but without the domelike tendencies and topographical character.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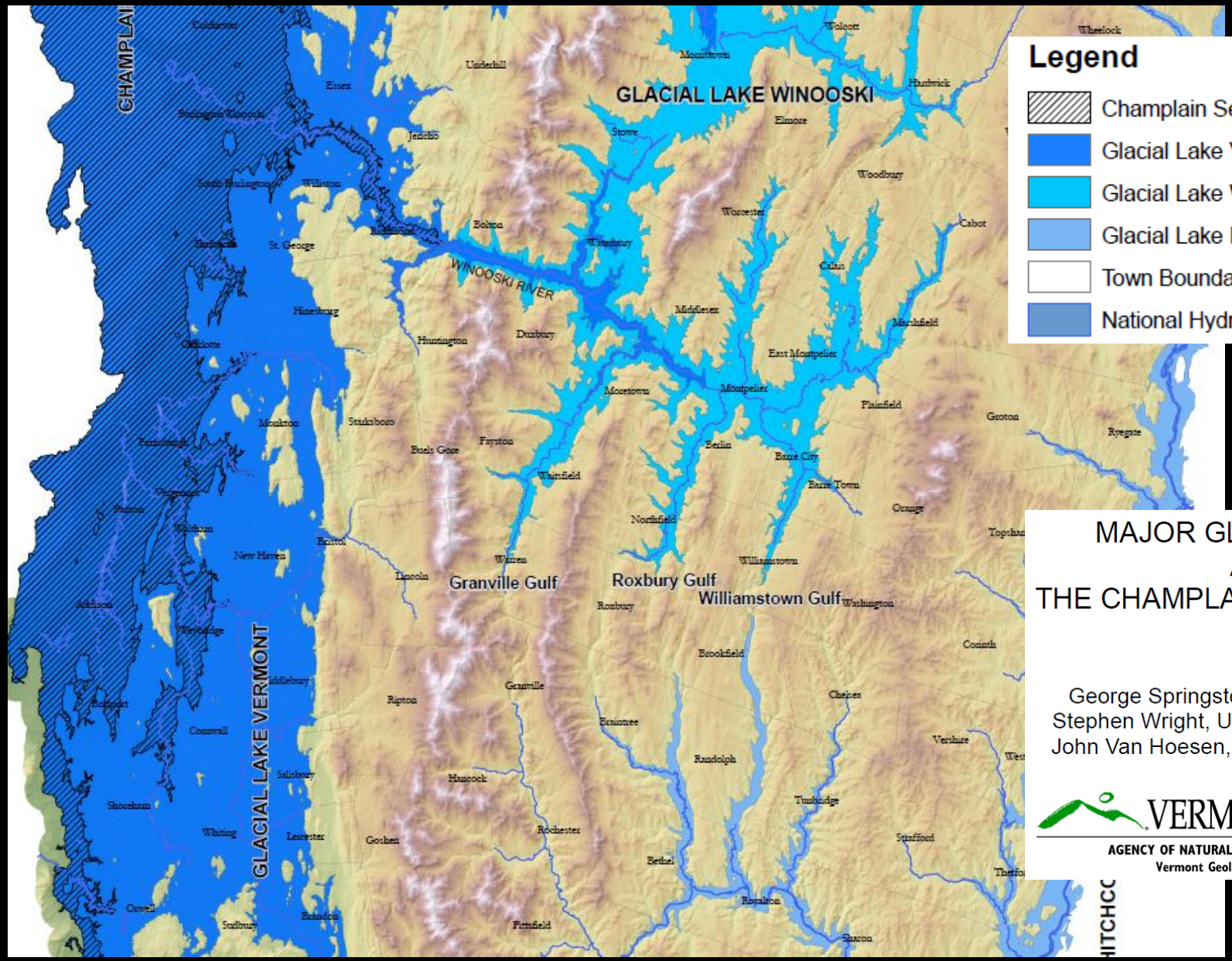
Geology
water
acidic sedimentary or meta-sedimentary rock
acidic shale
calcareous sedimentary or meta-sedimentary rock
moderately calcareous sedimentary or meta-sedimentary rock
acidic granitic or meta-granite
intermediate or mafic-rich granite
ultra mafic rock
unconsolidated coarse-grained sediment
unconsolidated fine-grained sediment



MAJOR GLACIAL LAKES AND THE CHAMPLAIN SEA, VERMONT 2020

by
George Springston, Norwich University,
Stephen Wright, University of Vermont and
John Van Hoesen, Green Mountain College

VERMONT
AGENCY OF NATURAL RESOURCES
Vermont Geological Survey

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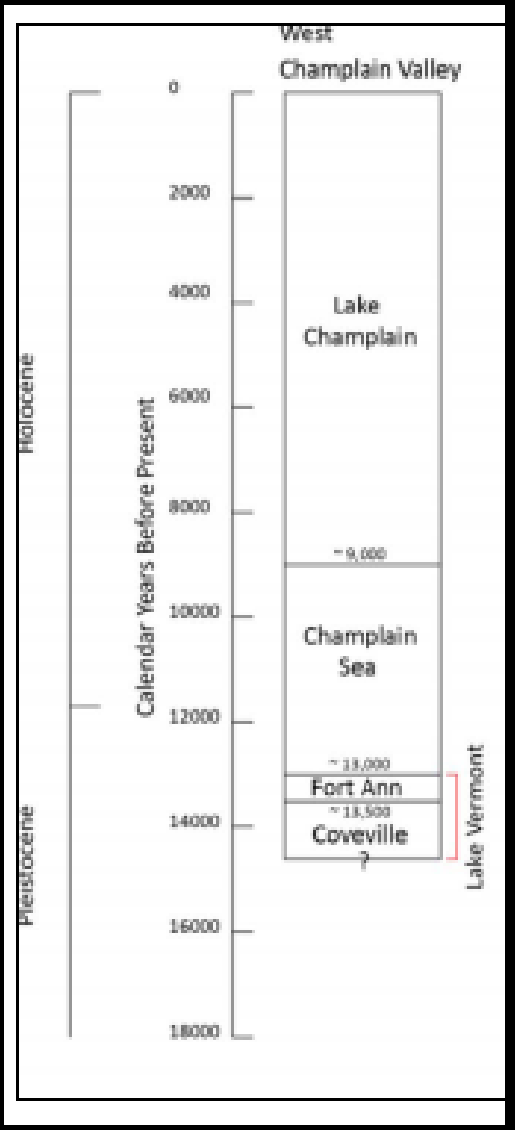
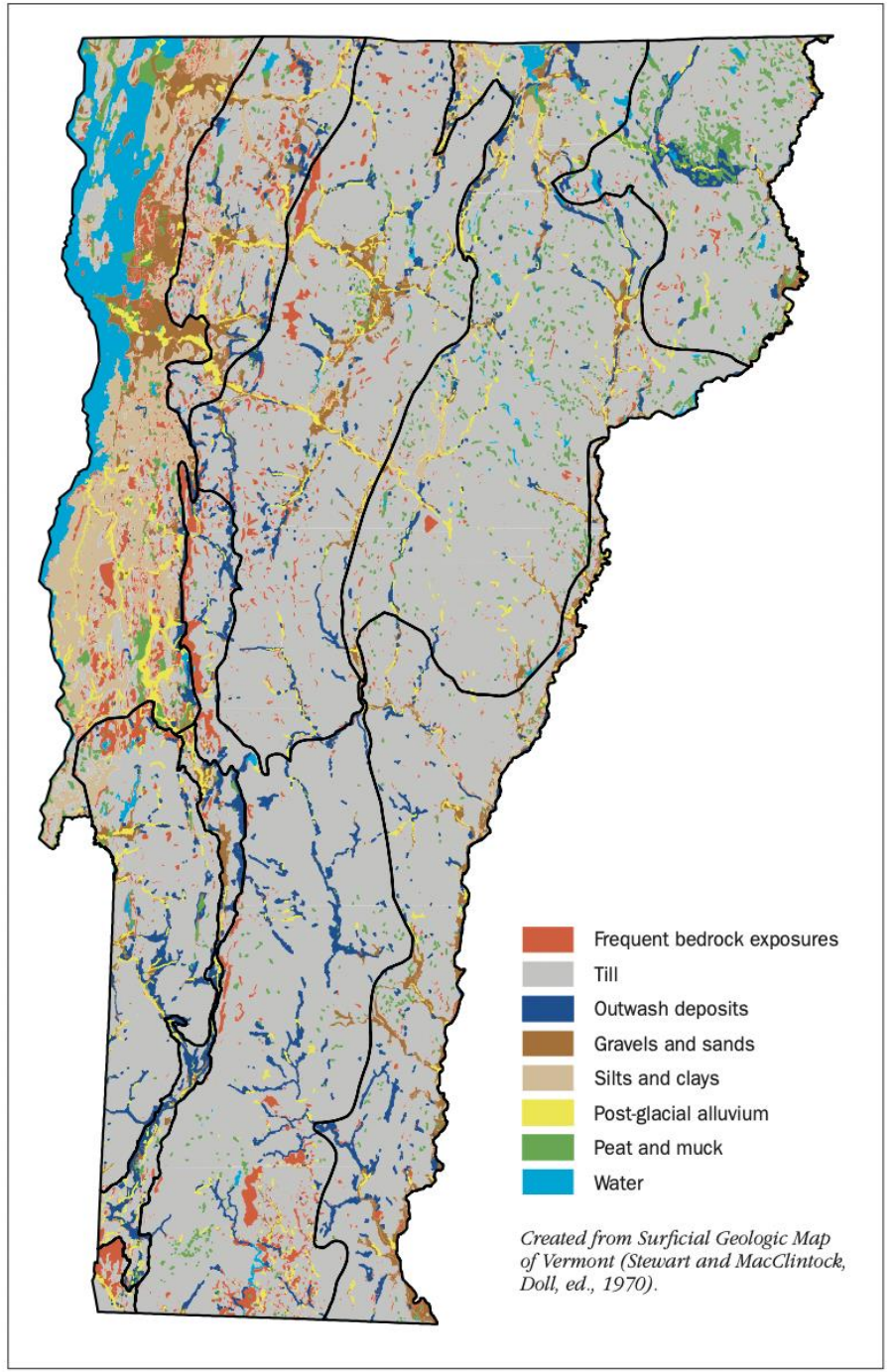


Figure 3: Vermont's Surficial Geology



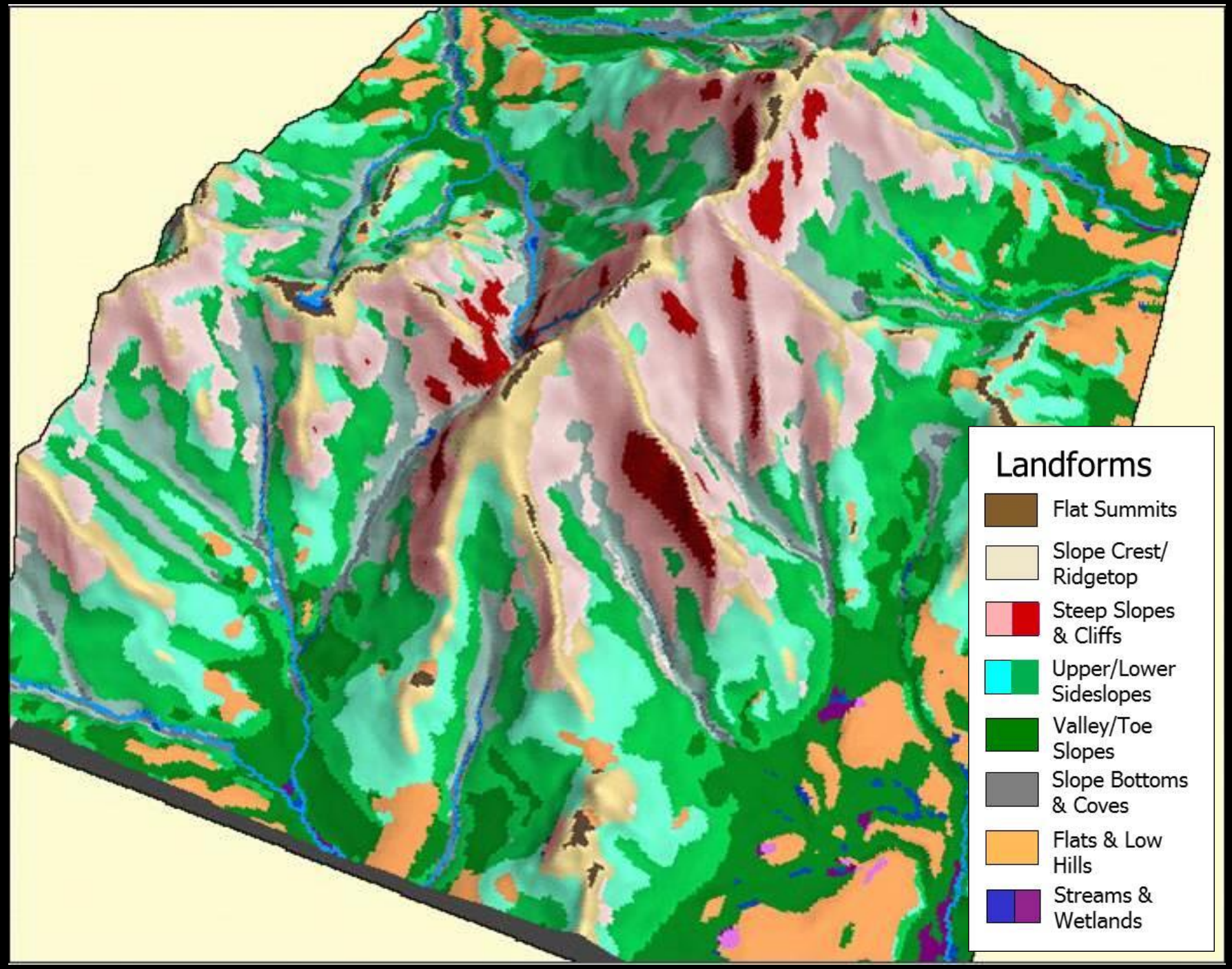
Surficial Geology and Soils

Physical Landscape Diversity

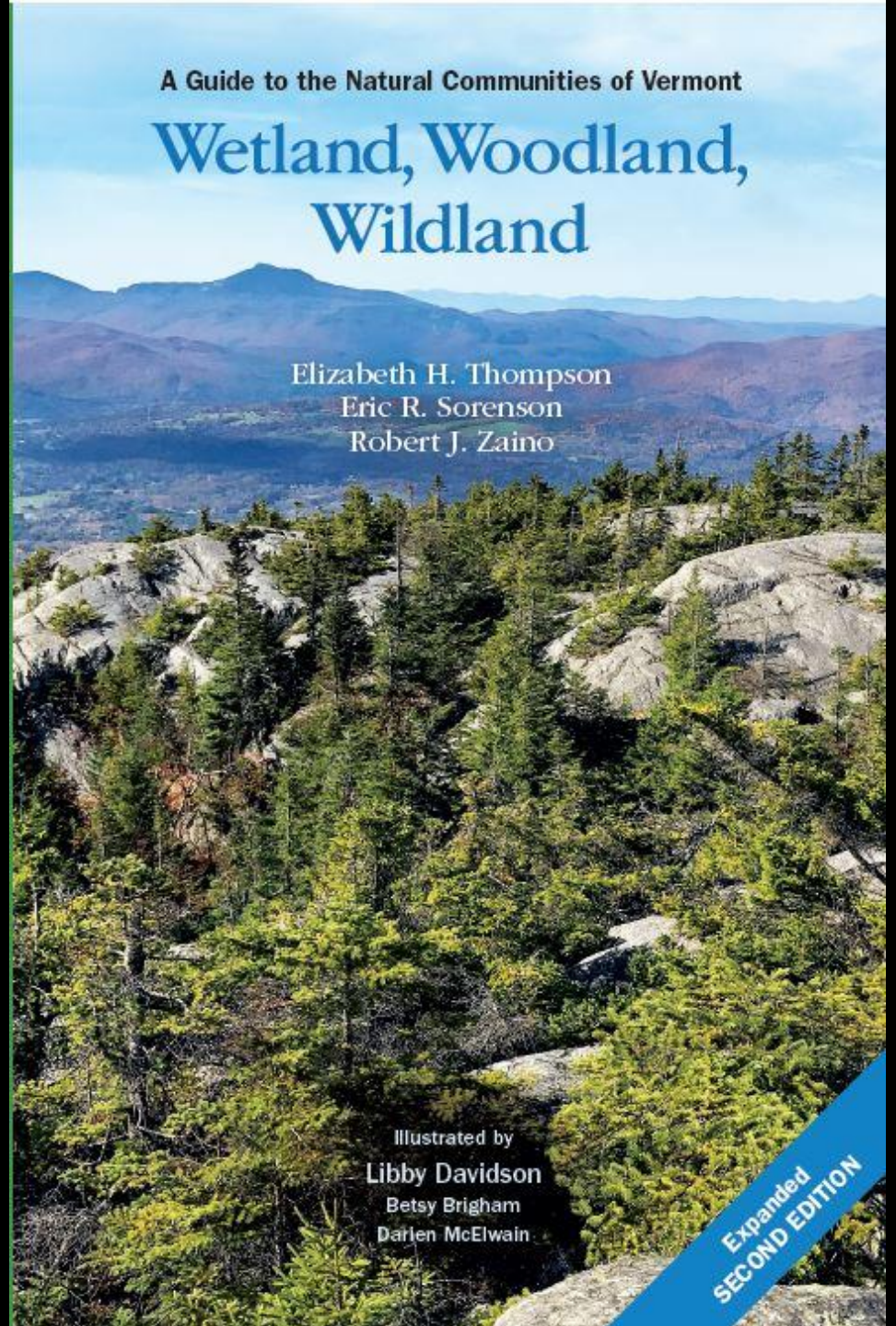
“Nature’s Stage”

- **Landform**
- **Bedrock**
- **Surficial Deposits**
- **Slope**
- **Aspect**
- **Elevation**

Importance of topographically diverse forest blocks.

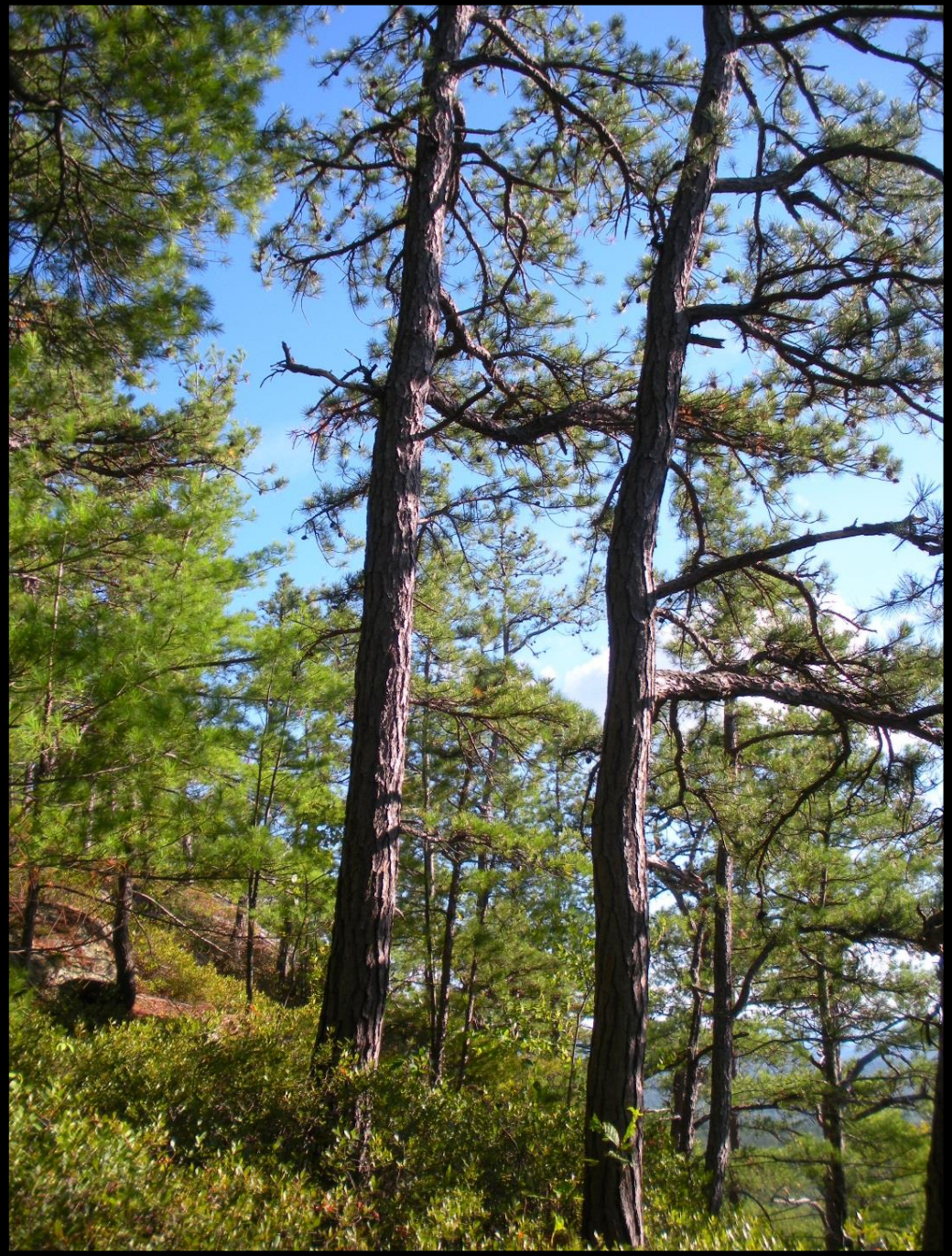


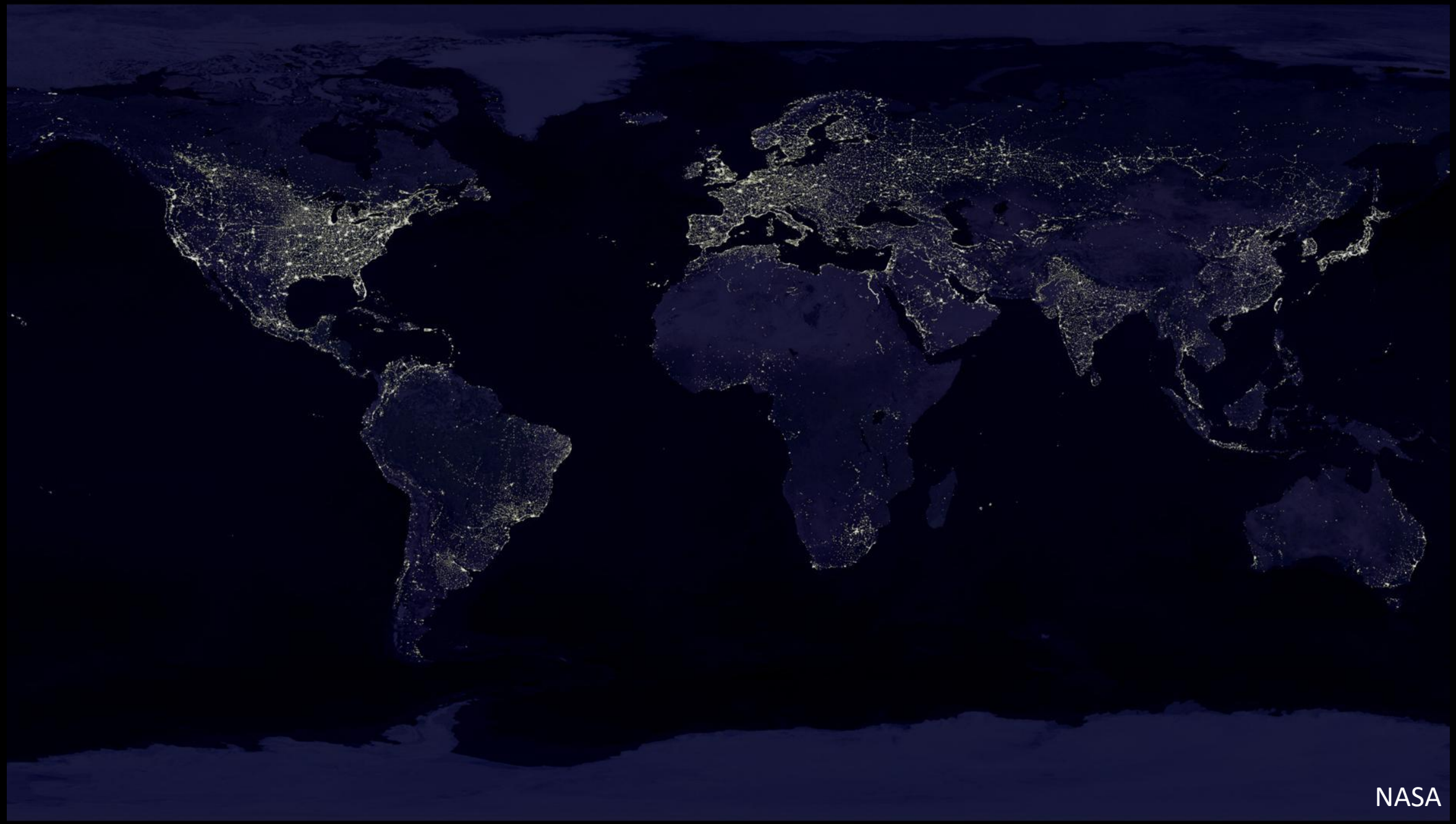

CH
NH
NVP
Burlington
NGM
St. Johnsbury
CV
Montpelier
SVP
White River Junction
VV
Rutland
TM
SGM
Bennington
Brattleboro
TM
BIOPHYSICAL REGIONS
CV: Champlain Valley
CH: Champlain Hills
TM: Taconic Mountains
VV: Vermont Valley
NGM: Northern Green Mountains
SGM: Southern Green Mountains
NVP: Northern Vermont Piedmont
SVP: Southern Vermont Piedmont
NH: Northeastern Highlands



A natural community is an interacting assemblage of organisms, their physical environment, and the natural processes that affect them.

Bryan Pfeiffer

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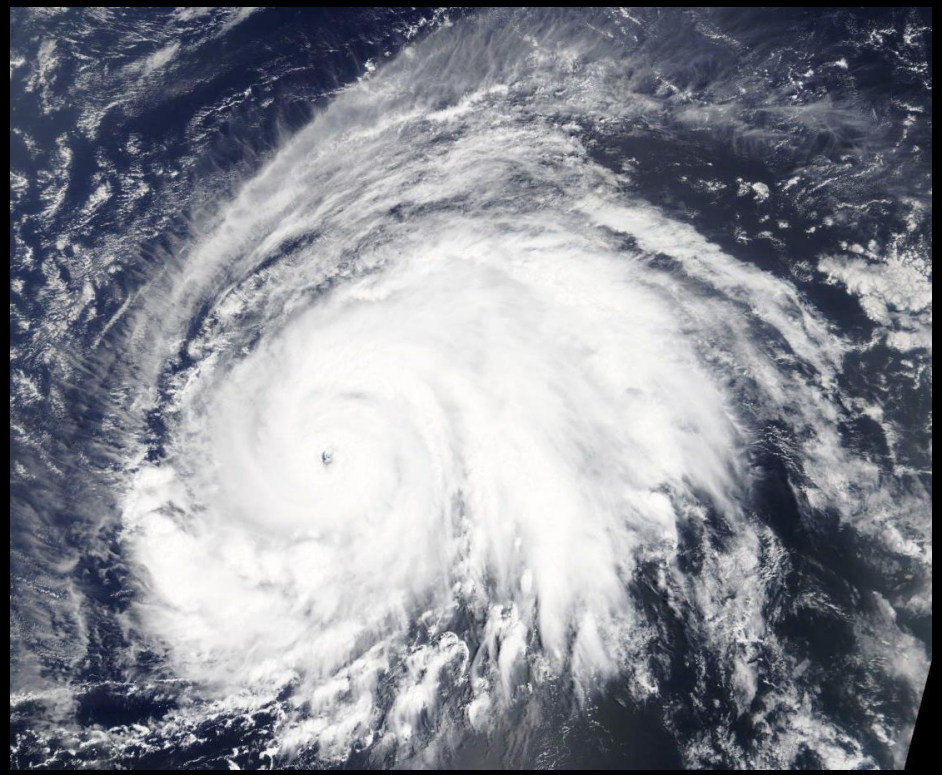


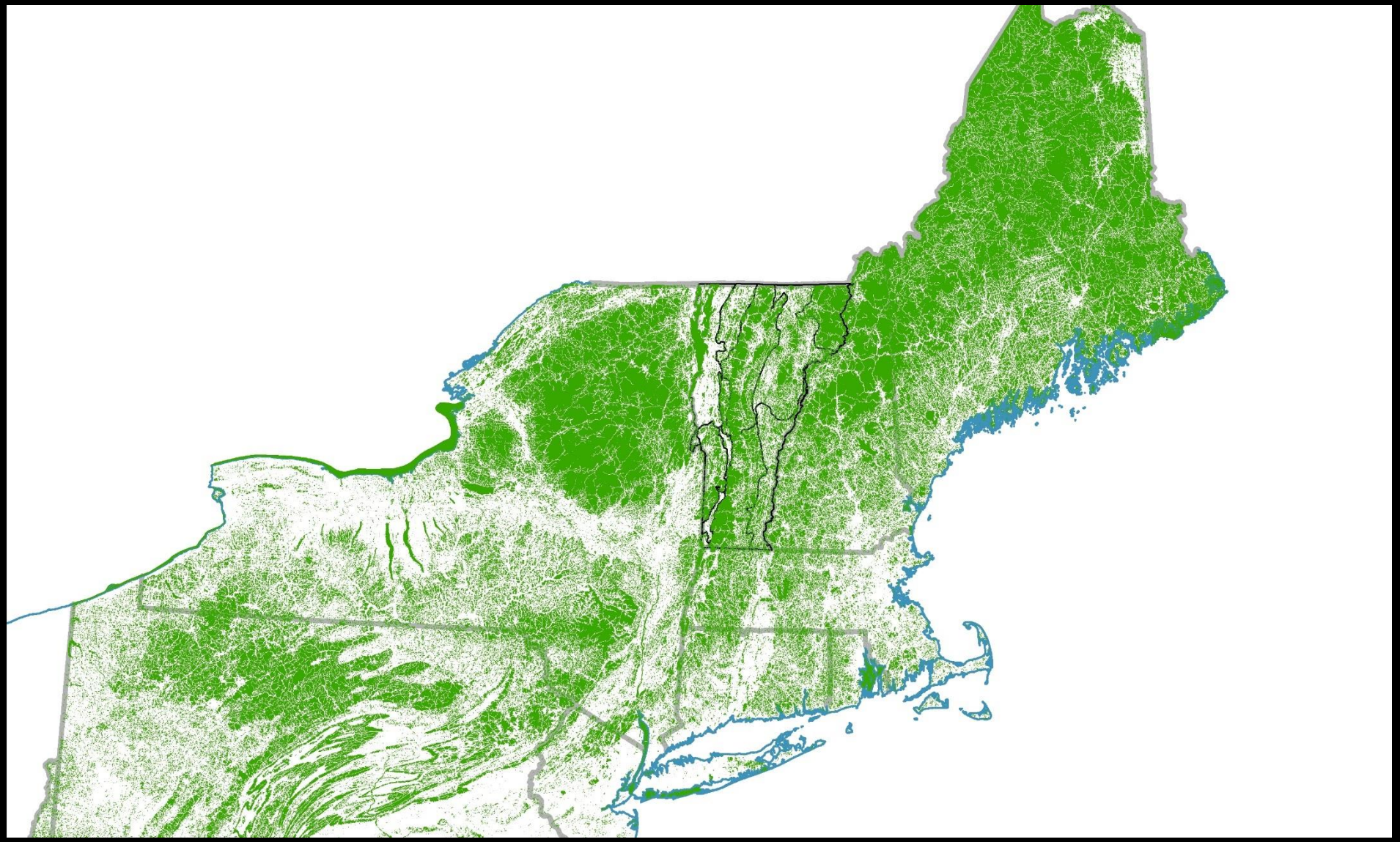
NASA

In Vermont and the Northeast…

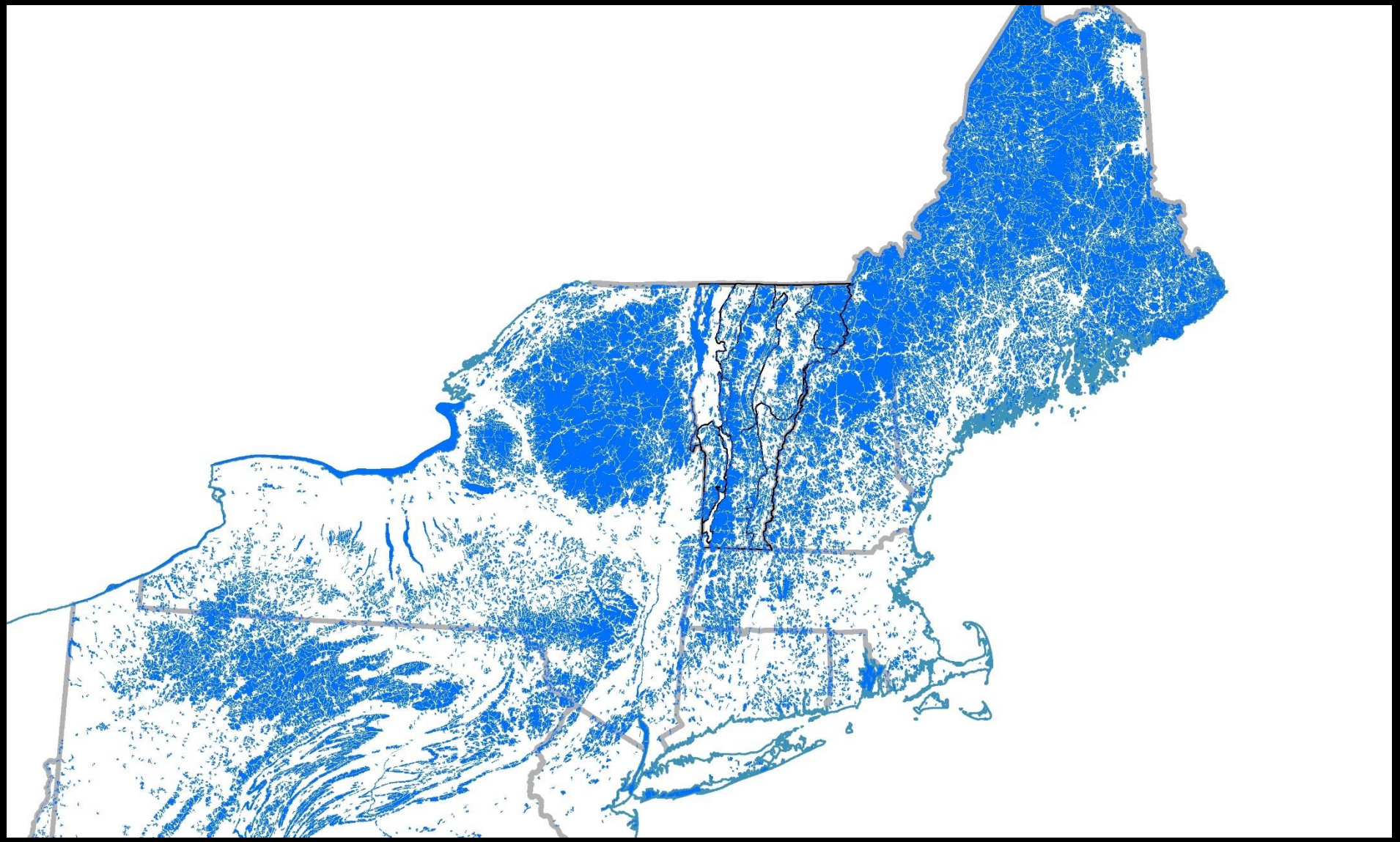
- Forest and habitat fragmentation and loss
- Climate change – temperature, precipitation patterns, storms
- Non-native invasive species

Climate change has made us think about conserving biological diversity and nature in new ways

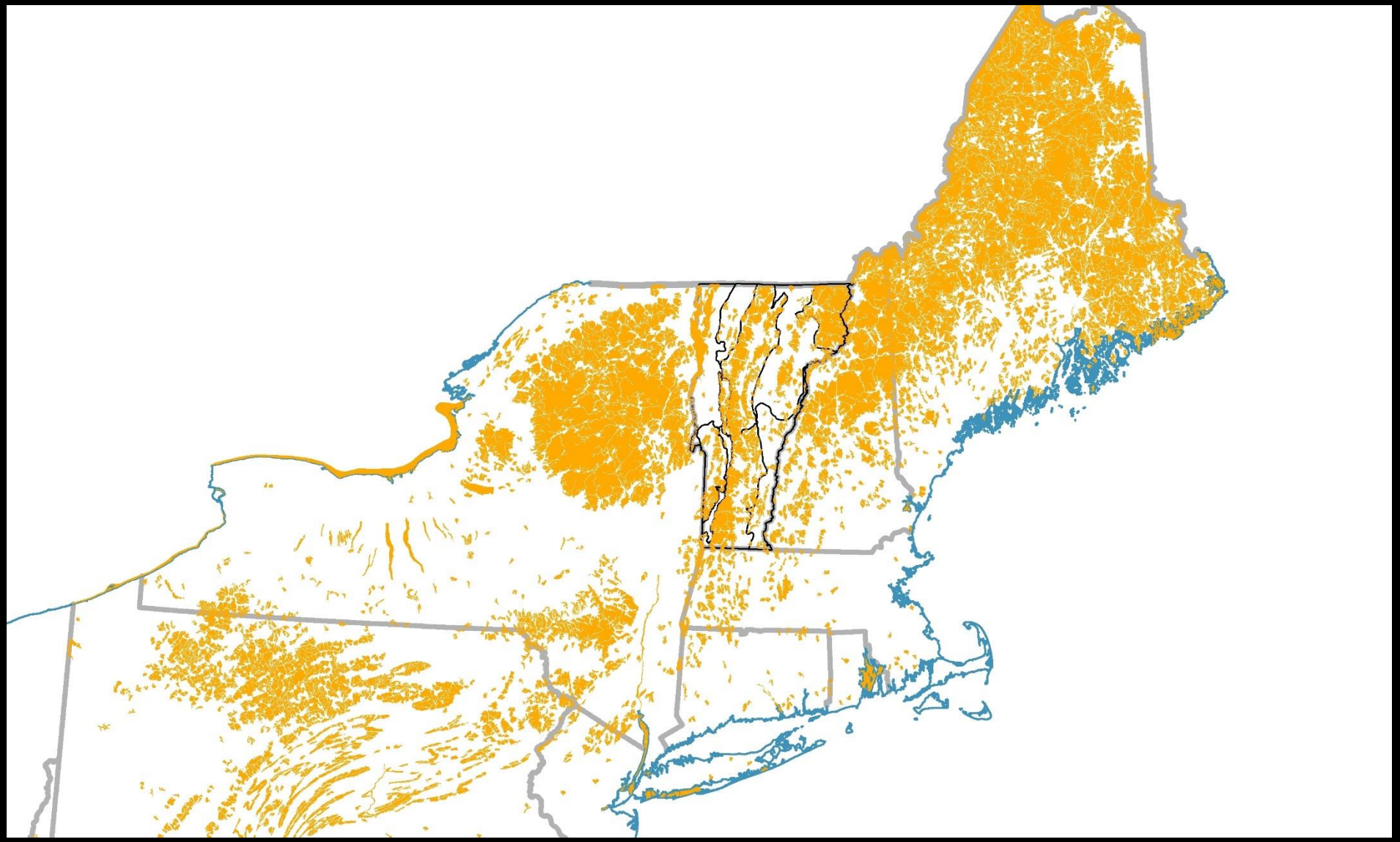
- rapid and uncertain climate change – direct and compounding e
- species will shift independently across the landscape
- need landscape connectivity for species and ecological processes
- need to conserve physical landscape diversity – bedrock, elevation, landforms,…



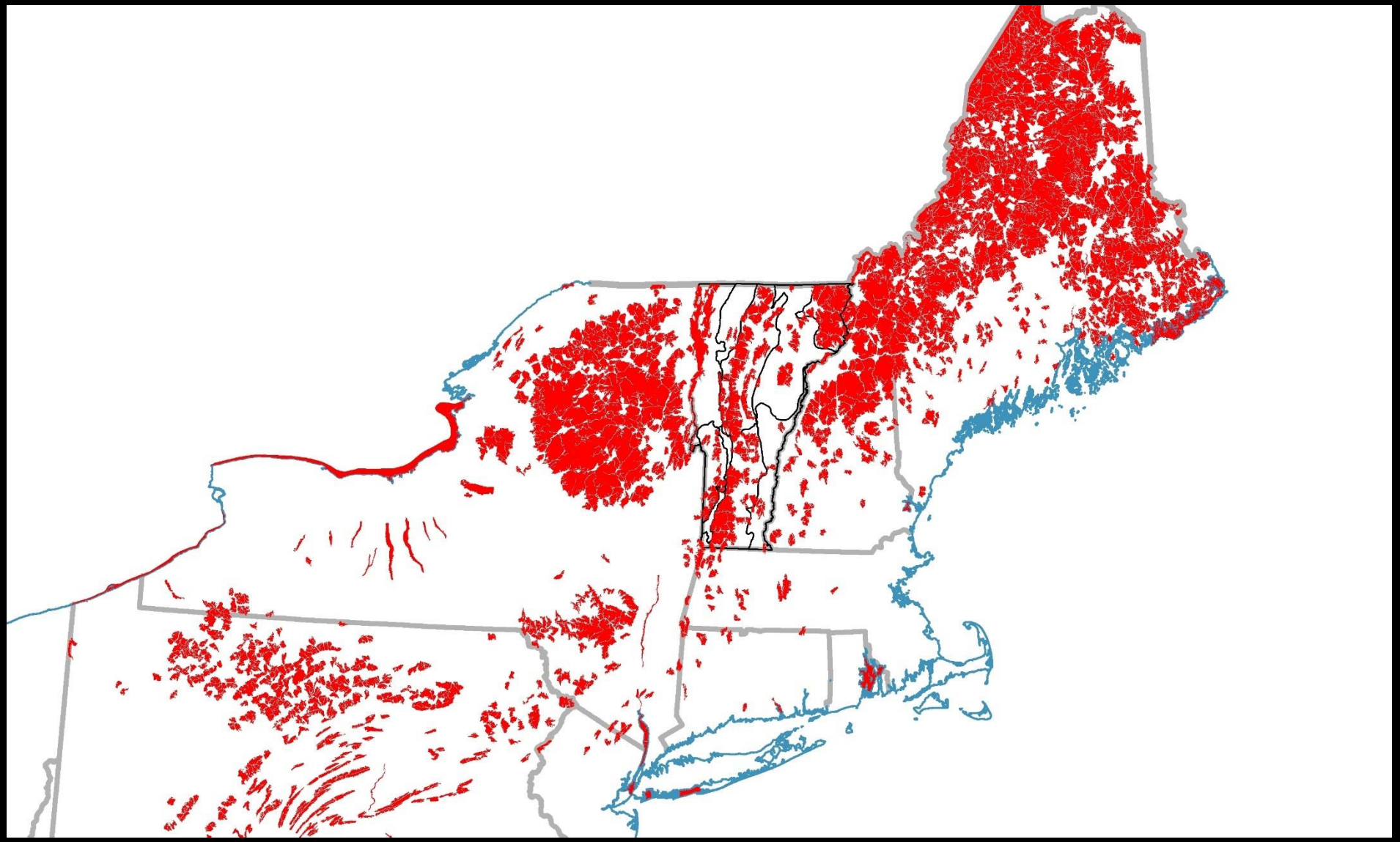
Blocks of Forest and other Natural Cover greater than 20 acres



Blocks of Forest and other Natural Cover greater than 500 acres



Blocks of Forest and other Natural Cover greater than 2,000 acres

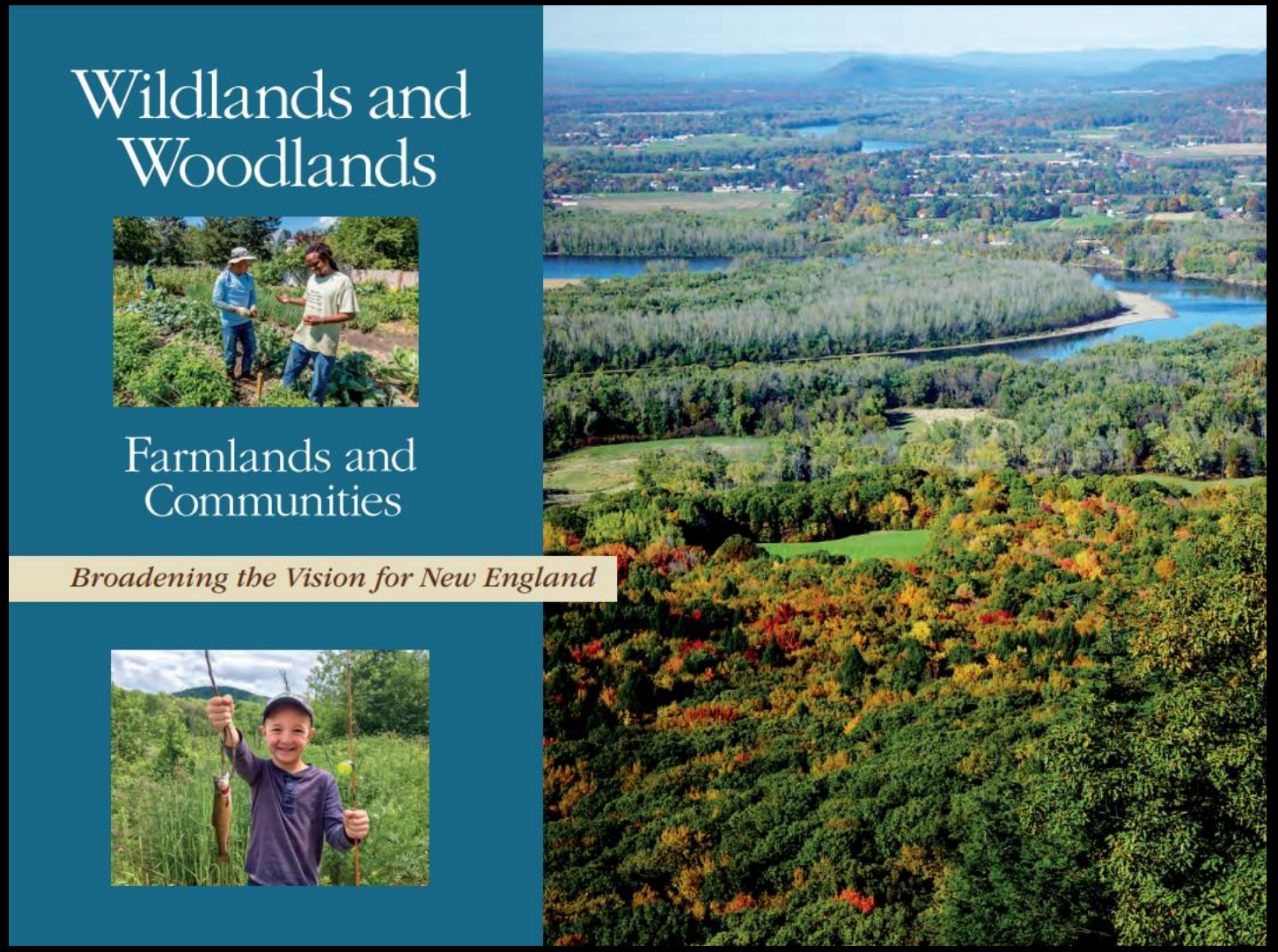


Blocks of Forest and other Natural Cover greater than 5,000 acres

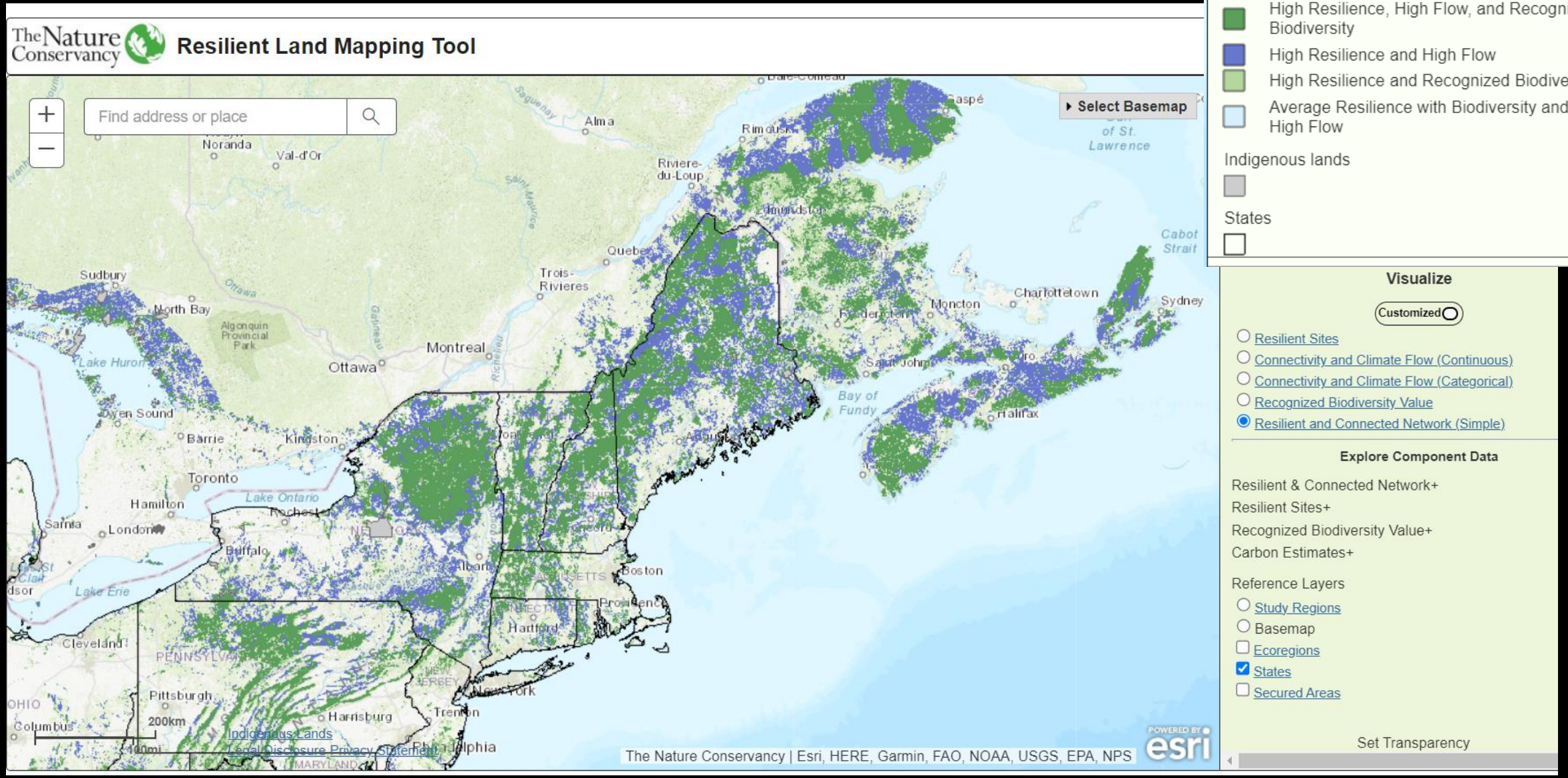
We know what to do on many fronts:

- Stabilizing the human population and reducing our consumption of earth resources and our carbon footprint
- Social justice and equity
- Landscape scale conservation and traditional protection of biodiversity

Wildlands, Woodlands, Farmlands and Communities calls for permanently protecting 80% percent of New England in a mixture of natural wildlands (at minimum 10%), productively-managed woodlands (60%), farmland (7%), and other (up to 3%)



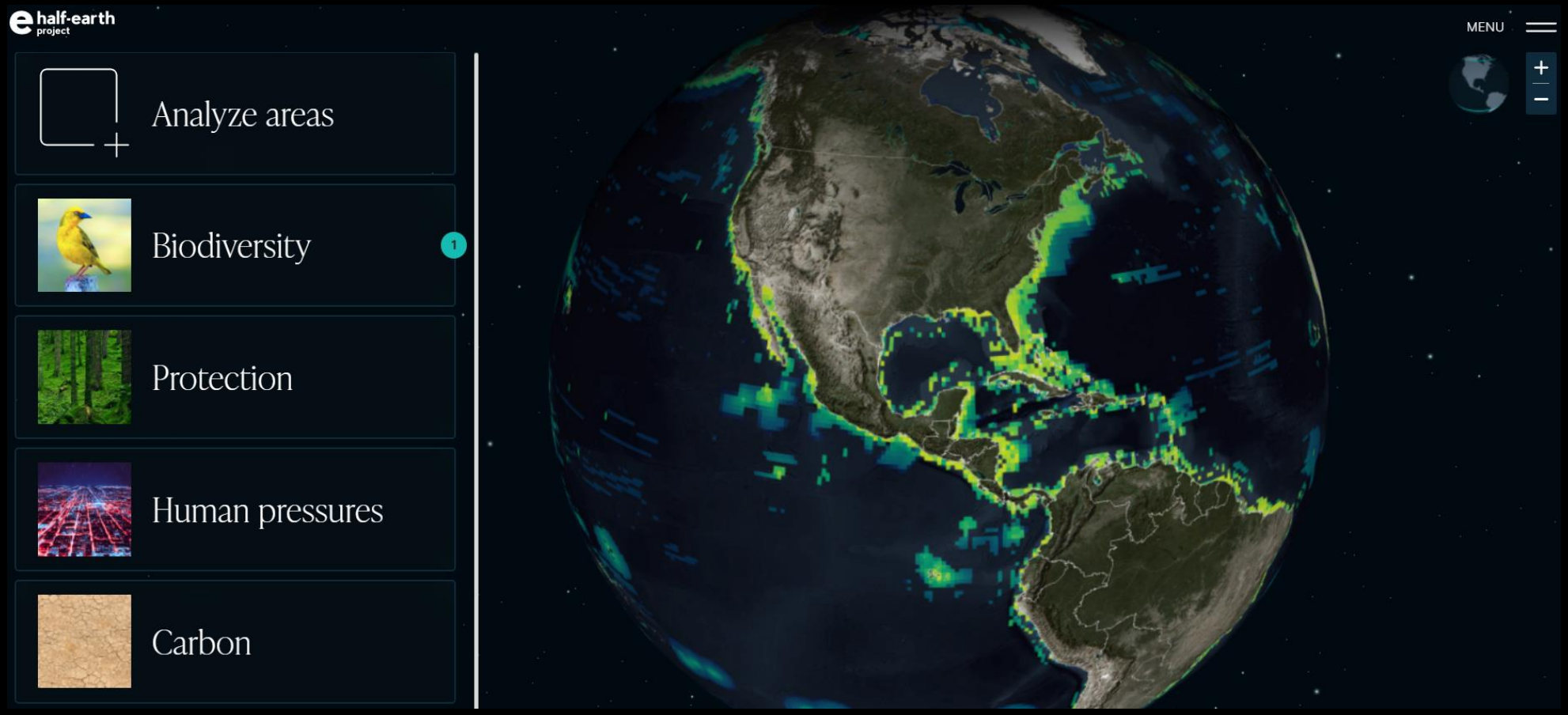
The Nature Conservancy – Resilient and Connected Landscapes



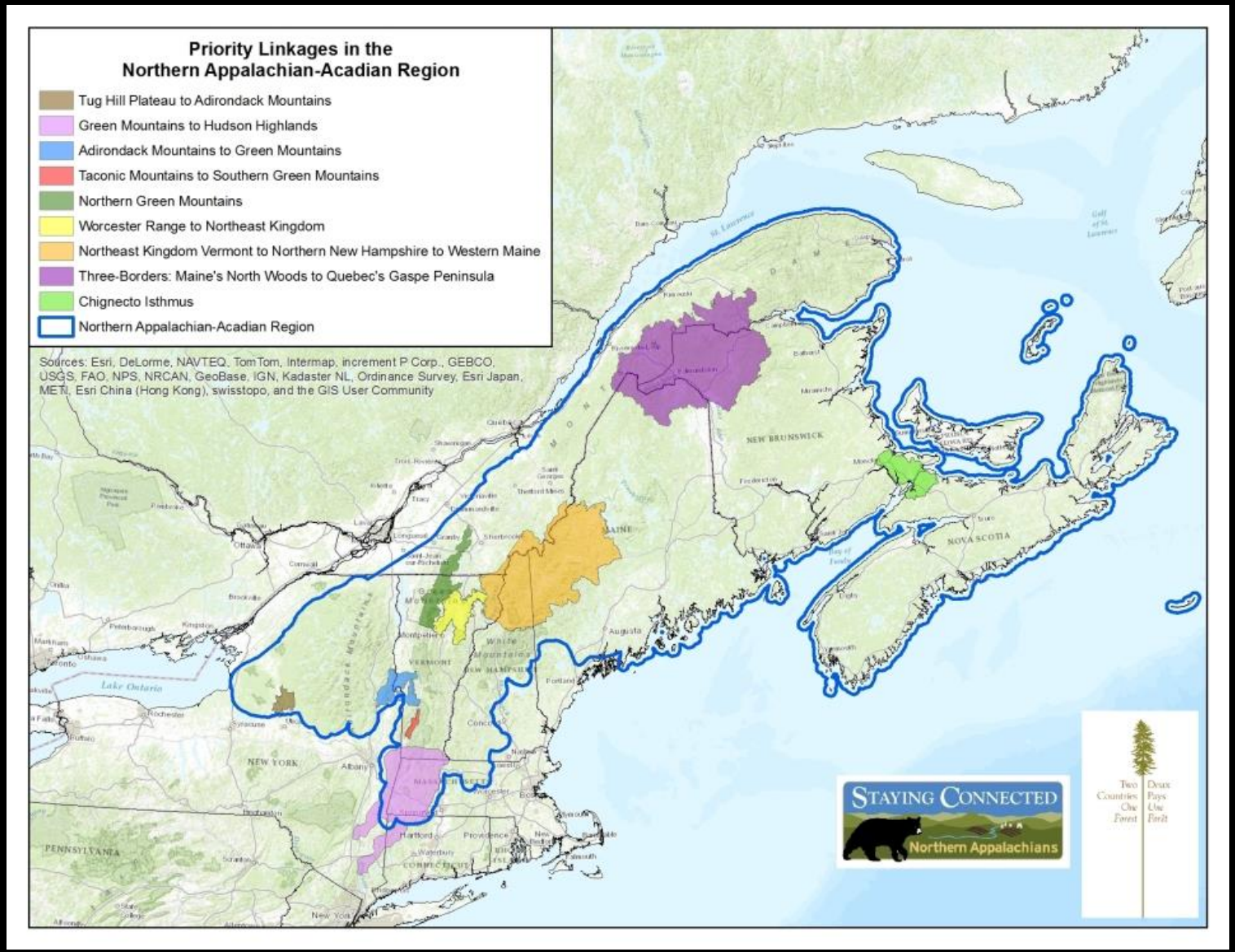
Half-Earth Project

The Half-Earth proposal offers [a solution] commensurate with the magnitude of the problem: …only by setting aside half the planet in reserve, or more, can we save the living part of the environment and achieve the stabilization required for our own survival.

– E.O. Wilson (1929-2021)

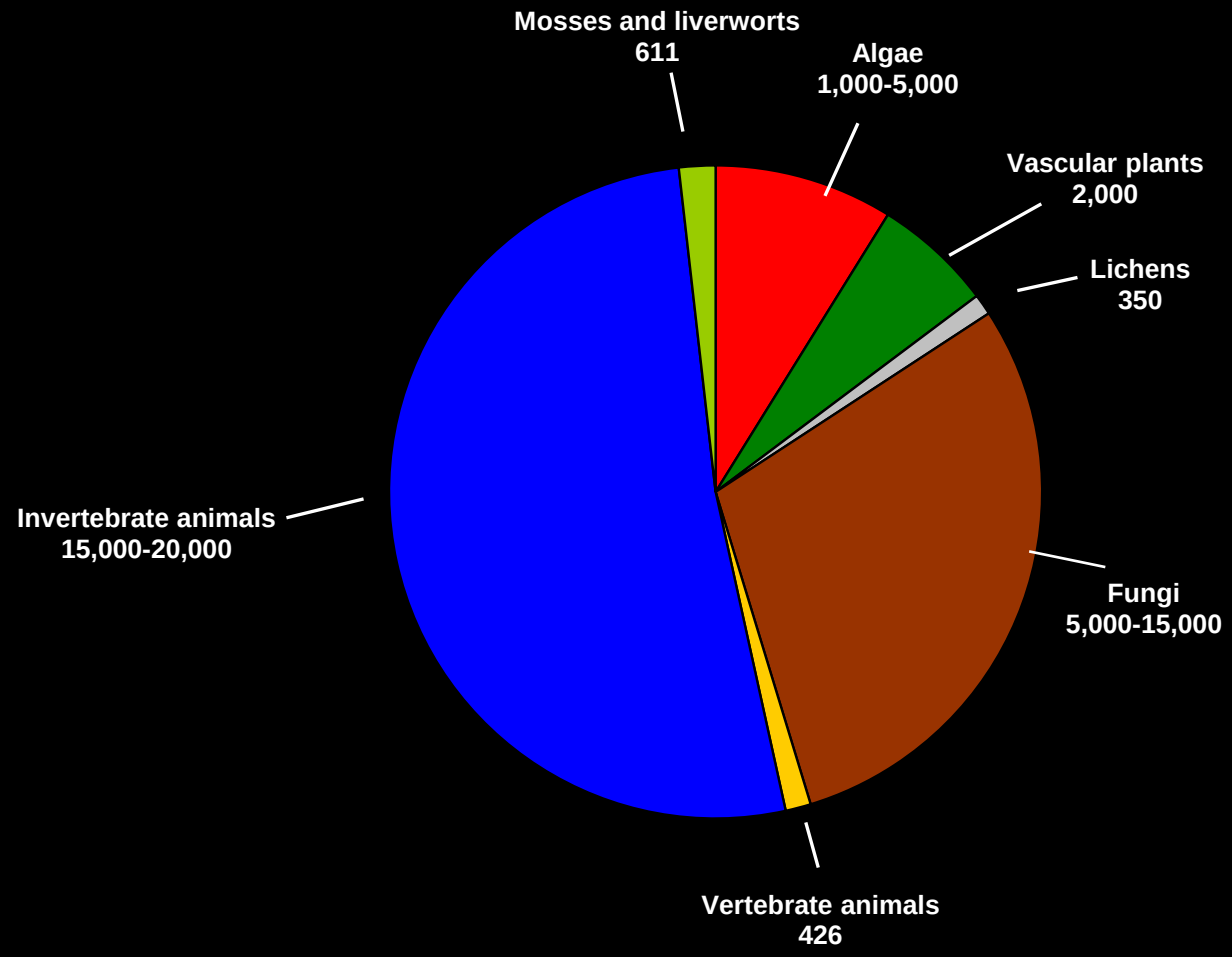


The Staying Connected Initiative seeks to conserve, restore, and enhance landscape connectivity across the Northern Appalachian/Acadian region of the U.S. and Canada for the benefit of nature and people.



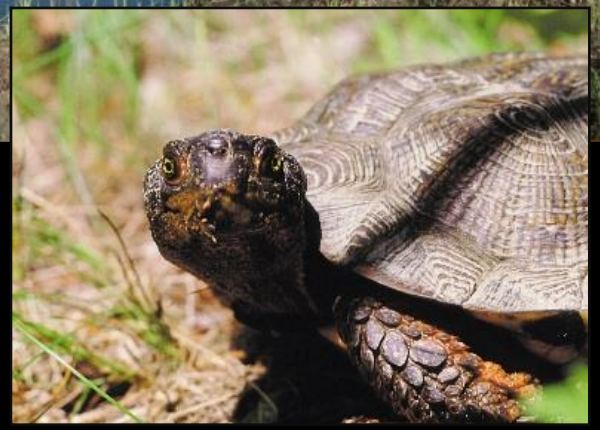
An estimated 24,000 to 43,500 species in Vermont!

How do we protect them all?



Coarse filter/fine filter approach to conservation

- *Well-recognized, efficient approach to conservation*
- *Originally a combination of natural communities & species conservation efforts*



We need coarser filters

Vermont Conservation Design

A practical, scientific vision for sustaining Vermont's ecologically functional landscape for the future.

- **Applies the coarse filter-fine filter approach**
- **Uses simple, recognizable features (forest blocks and riparian areas)**
- **Depends on thoughtful stewardship and management**

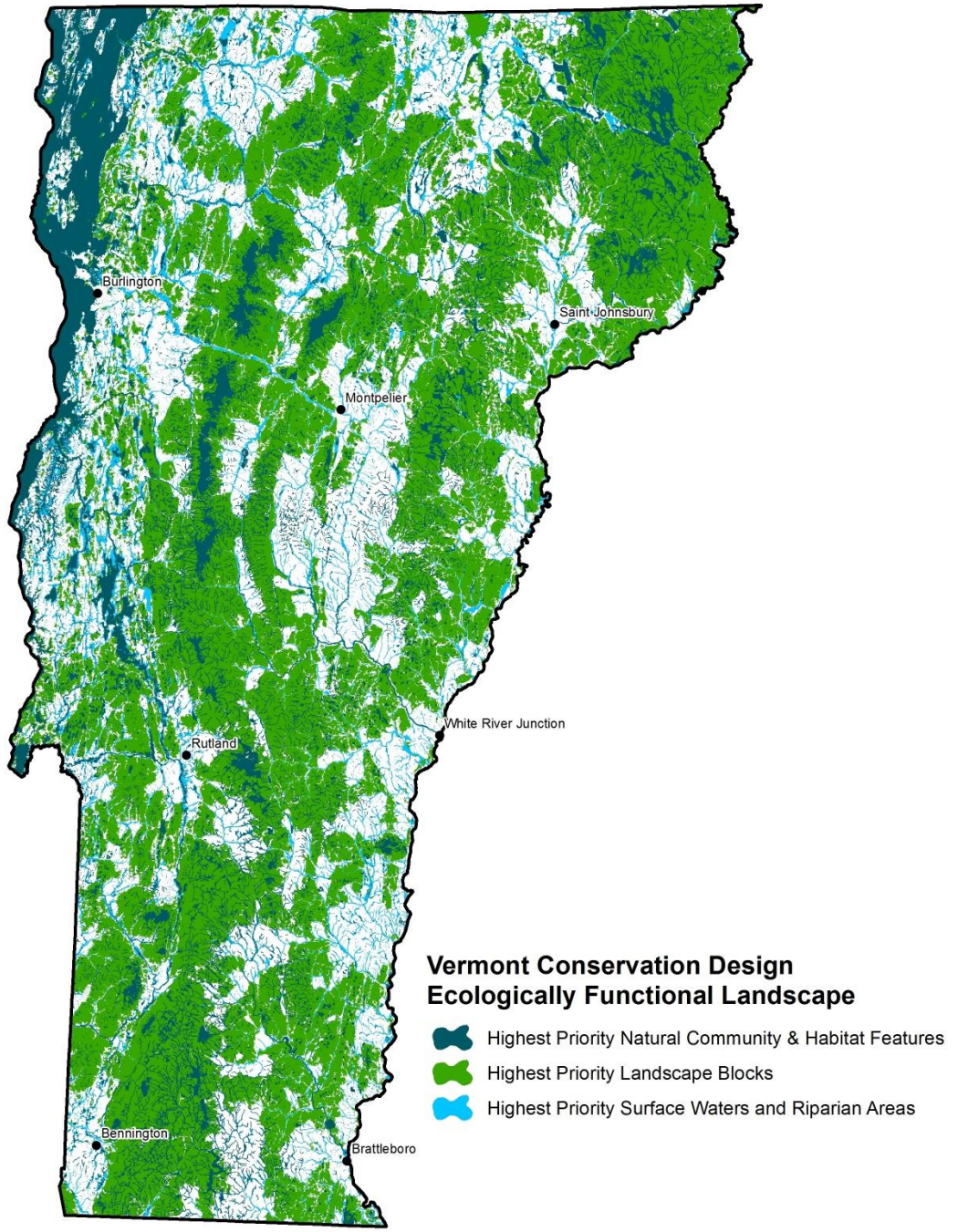
Collaborators:

VT Fish and Wildlife Department - lead
Vermont Land Trust
The Nature Conservancy
VT Department of Forests, Parks, & Recreation
VT Department of Environmental Conservation
Northwoods Stewardship Center
USDA Natural Resources Conservation Service
And many others

Ecologically Functional Landscape

- Intact
- Connected
- Diverse

A set of coarse-filter features which, if appropriately conserved and managed for their ecological functions, offer high confidence in maintaining biological diversity and ecological processes into the future.



Conservation Design at Three Scales

Landscapes

Interior Forest Blocks
Connectivity Blocks
Surface Waters and Riparian Areas
Riparian Areas for Connectivity
Physical Landscapes
Wildlife Road Crossings

Natural Communities

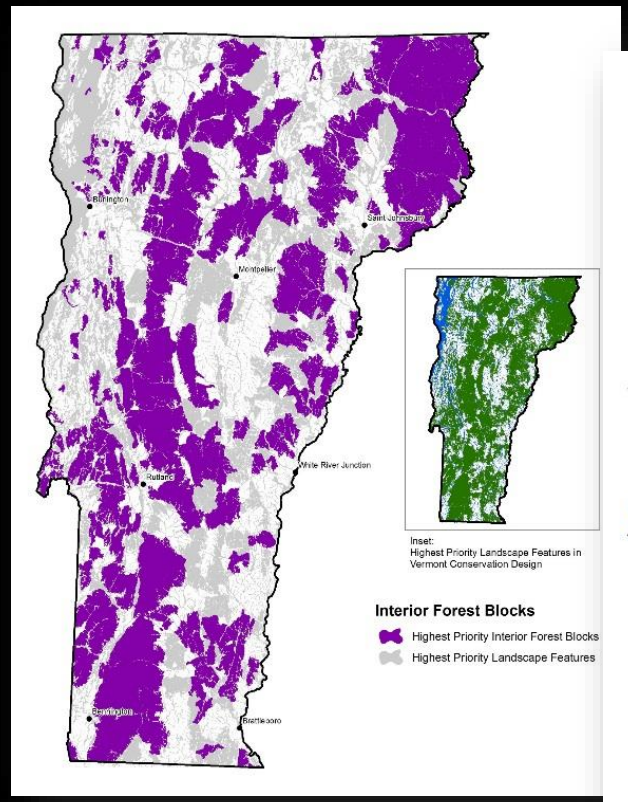
Natural Communities
Young and Old Forests
Aquatic Habitats
Wetlands
Grasslands/Shrublands
Underground Habitats

Species

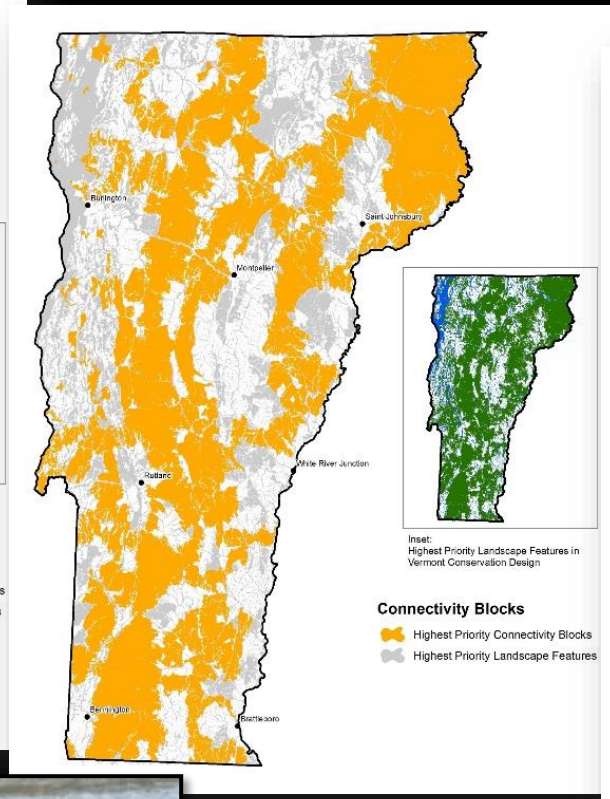
Species with very specific biological needs that will likely always require individual attention

Intact and Connected Forest Blocks, Surface Waters, and Riparian Areas

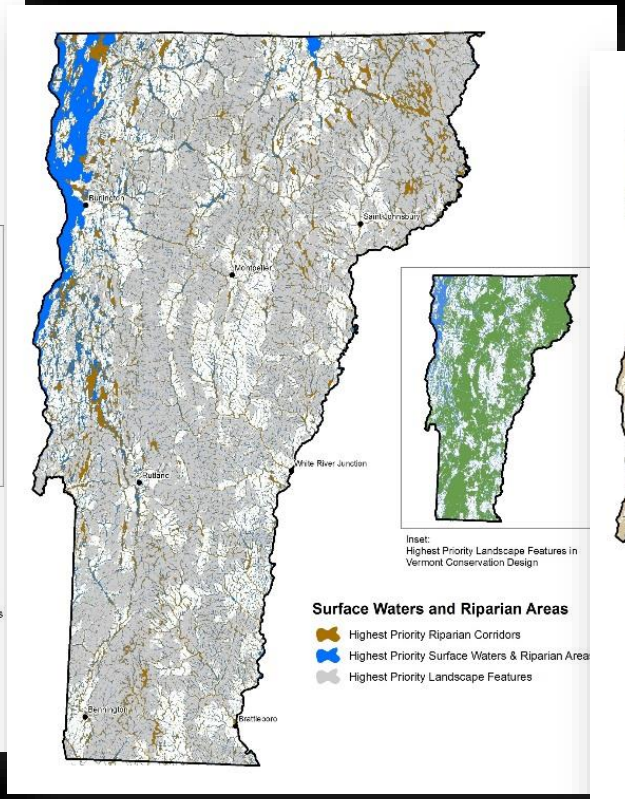
Interior Forest Blocks



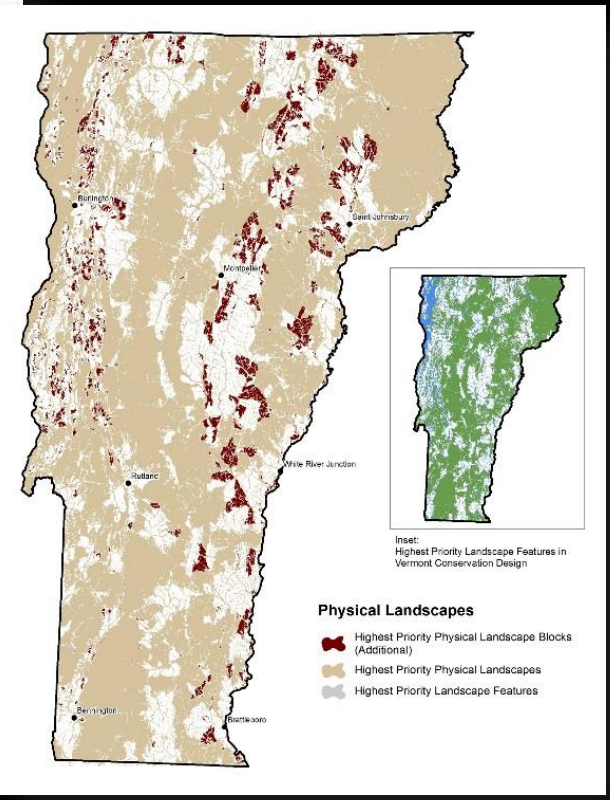
Connectivity Blocks



Surface Waters and Riparian Areas



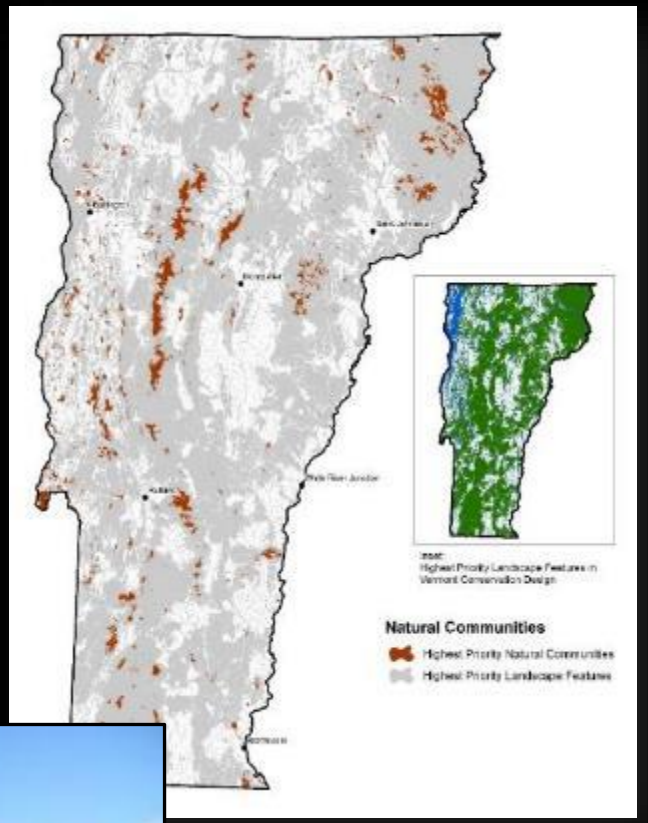
Physical Landscape Diversity

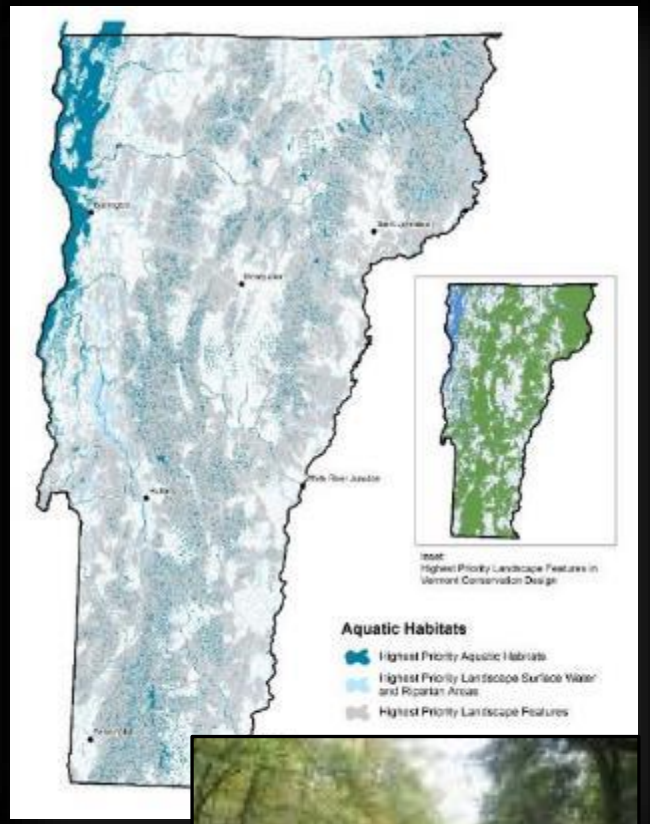


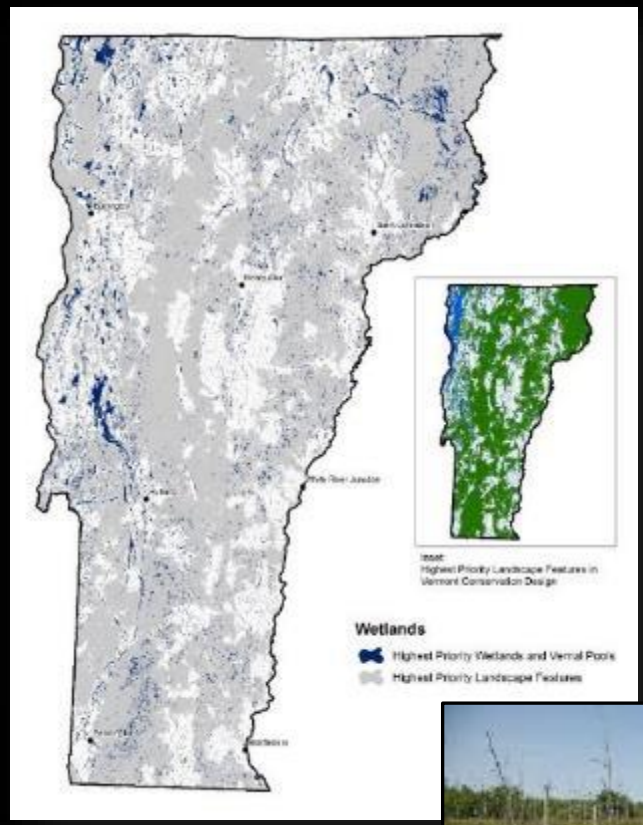
Wildlife Road Crossings

Maintain the specific functions of each element

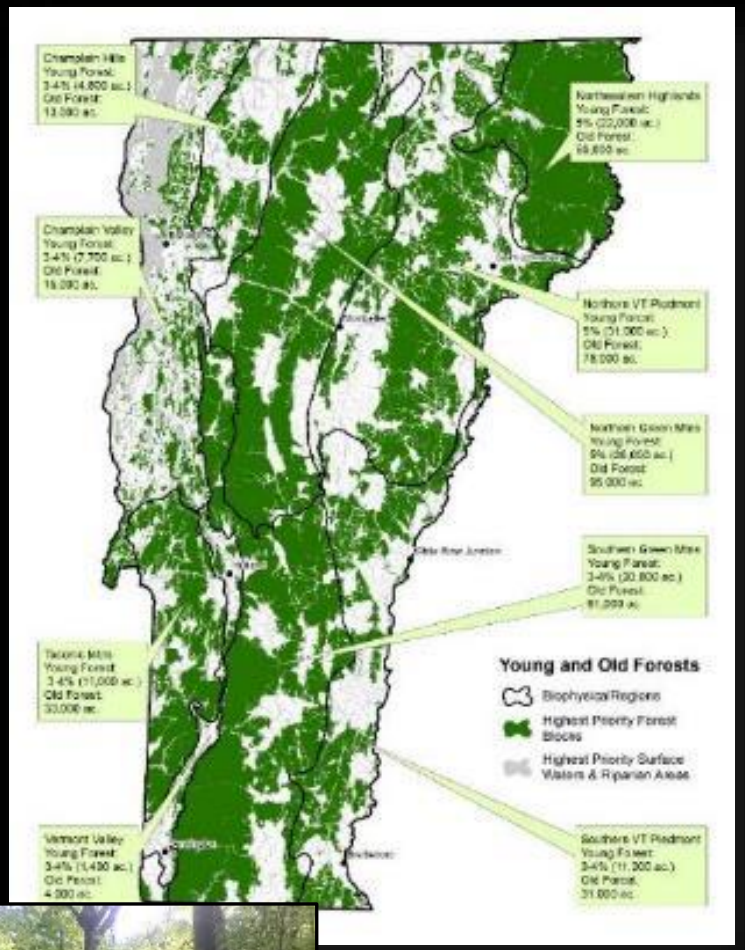
Terrestrial Natural Communities, Aquatic Habitats, Wetlands, & Caves

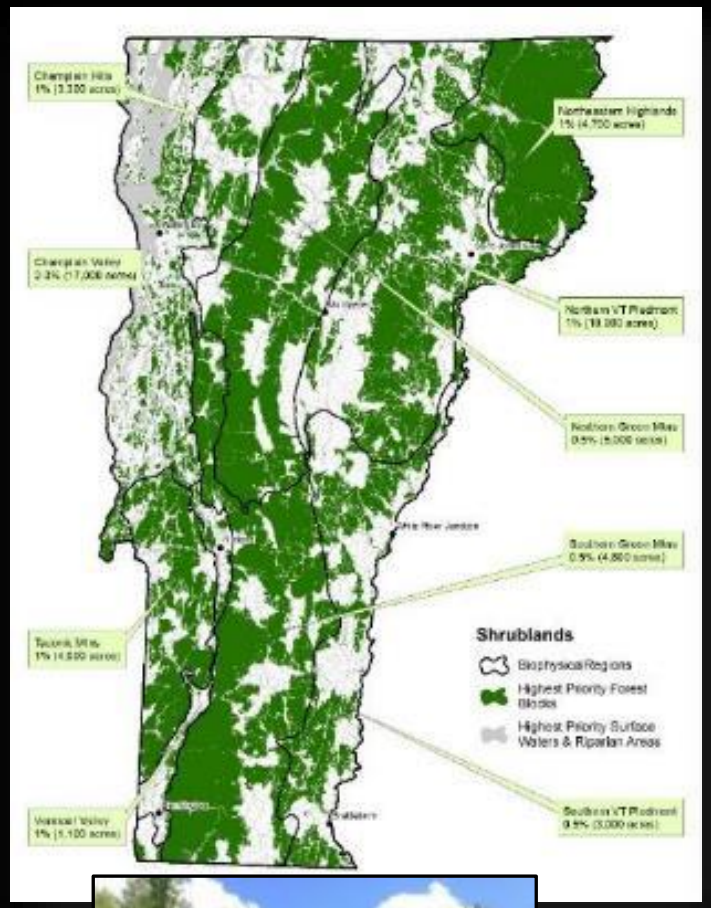


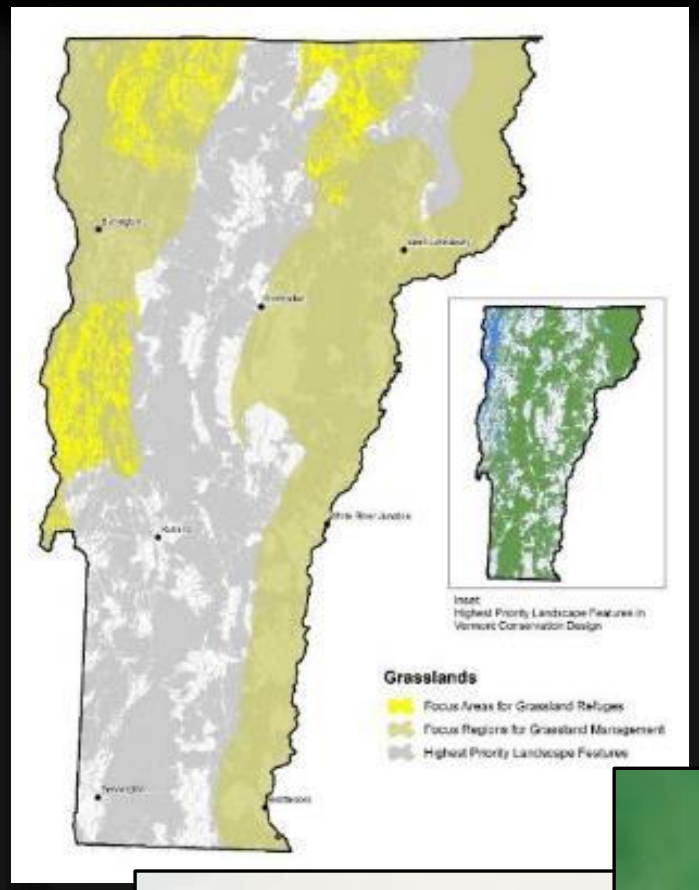




Young and Old Forests, Shrublands, Grasslands





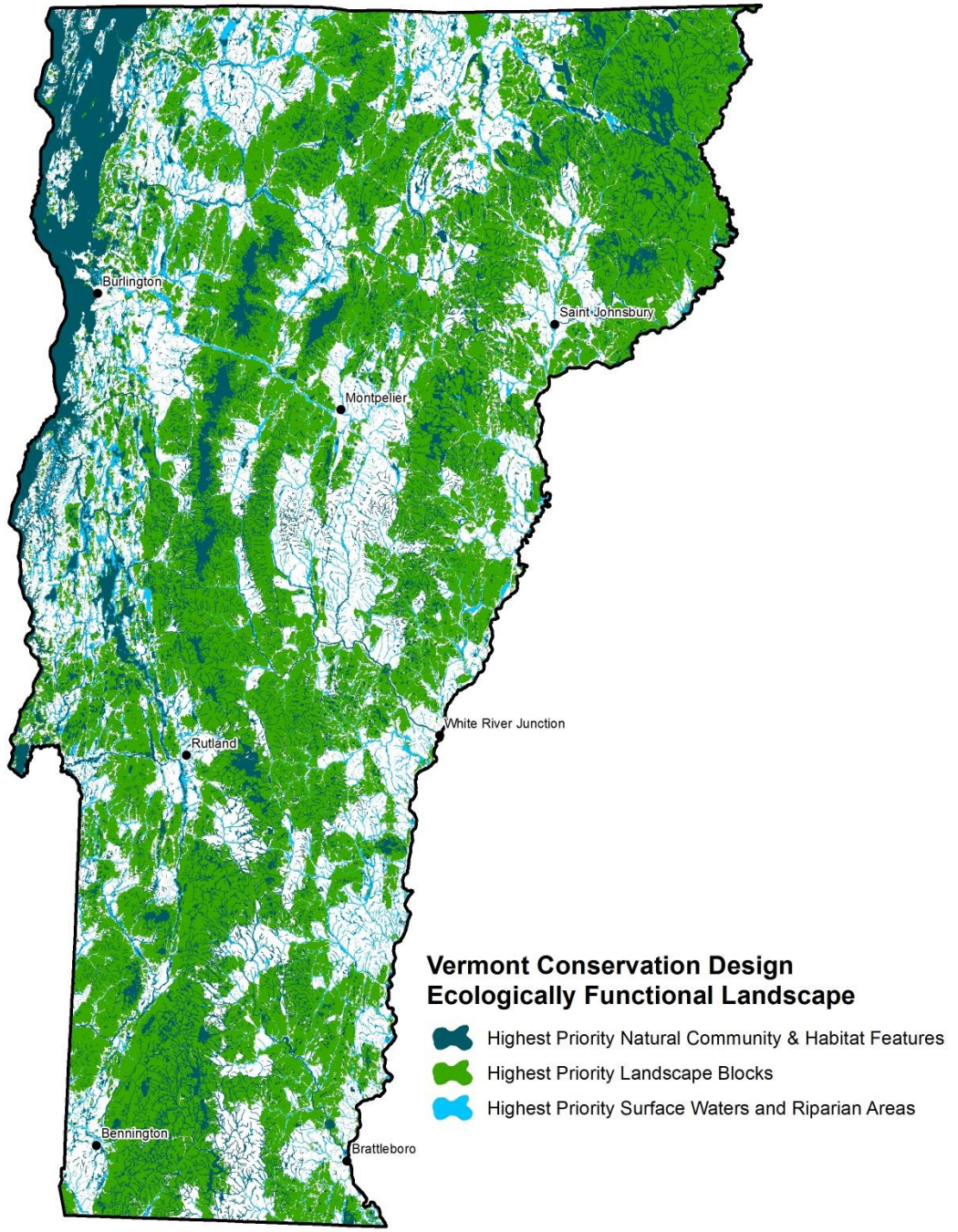


Vermont Conservation Design

Maintains an intact, connected and diverse natural landscape

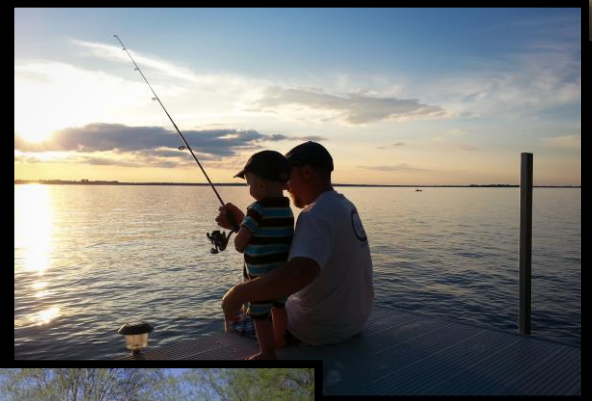
Conserves species and natural communities

Allows nature to adapt to a changing climate



Sustains more than biodiversity

- Outdoor recreation
- Clean water and air
- Sense of place and rural character
- Working farms and forests
- Nature’s benefits



Vermont Conservation Design

- Vision for the future of Vermont.
- Landowners and their decisions are key to success.
- All the features are needed for ecological function. *Balance of uses!*
- Need permanence for conservation and long term stability.

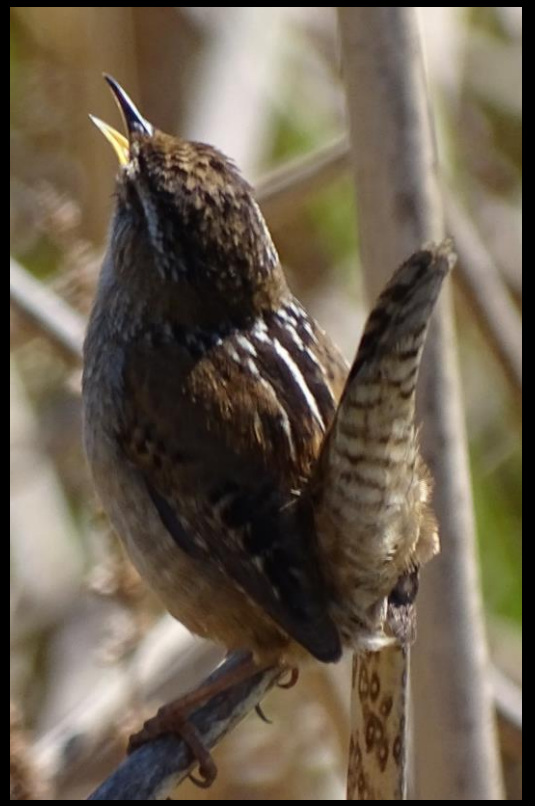
Photo by Susan Morse

How is Vermont Conservation Design Being Used

- VT Wildlife Action Plan (2015 and 2025) and Big Game Management Plan
- 2017 VT Forest Action Plan
- Land acquisition priorities
- State lands management
- Municipal planning technical assistance (including Act 171)
- Informs regulatory review by VFWD (Act 250 and Section 248)
- Riparian areas/floodplain restoration priorities
- Natural Heritage Inventory landscape condition assessment
- Inform regional landscape connectivity efforts

Other Applications of Vermont Conservation Design

- Potential revisions to Act 250 to include forest blocks and ecological connectivity (H.120 and S.112)
- An act relating to community resilience and biodiversity protection (H.606)
- Reserve Forests option added to Use Value Appraisal (H.697, now signed into law as Act 146)
- Vermont Climate Action Plan (https://climatechange.vermont.gov/readtheplan)



Thank you…

Links and Contacts:

Vermont Conservation Design
https://vtfishandwildlife.com/conserve/vermont-conservation-design

BioFinder
https://anr.vermont.gov/maps-and-mapping/biofinder

Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont
https://vtfishandwildlife.com/wetland-woodland-wildland

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Contact through VFWD Commissioner