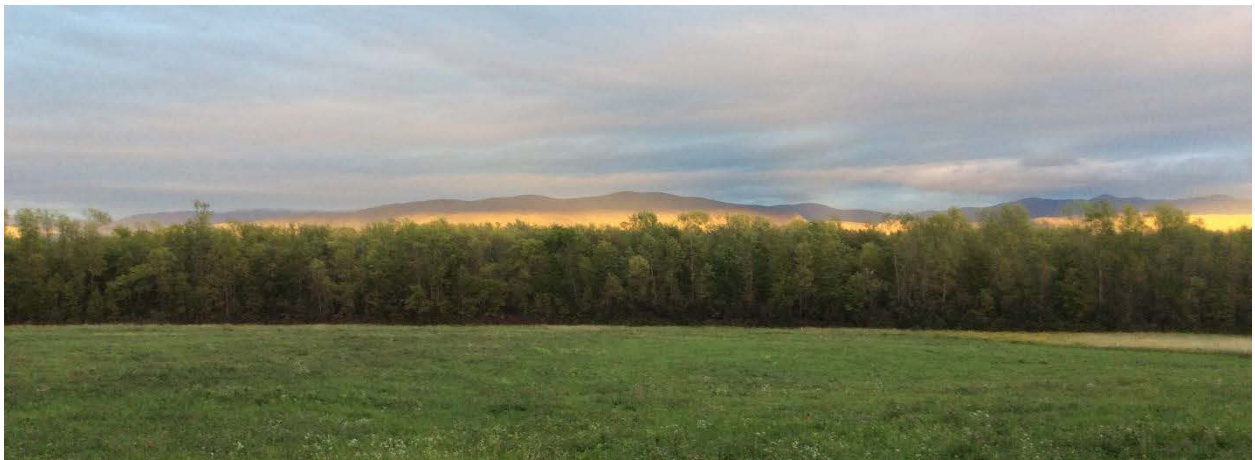


An Ecological Inventory of Cornwall, Vermont

For the Town of Cornwall

By Brett Engstrom
Consulting Botanist and Ecologist
Marshfield, Vermont

19 May 2015



Late afternoon departure from Cornwall Swamp

INVENTORY SUMMARY

An ecological inventory of the town of Cornwall, Vermont, was conducted from 2013-2015 to find and describe the areas of highest ecological value, including natural communities of state and local significance, species of greatest conservation need, large and more intact forest blocks, riparian areas of special importance for watershed health, and potential connectivity habitat. Initiated by the Cornwall Conservation Commission for the town, and funded through a Vermont State Municipal Planning Grant, the town, and other grants, the inventory's first phase included landscape analysis where existing data were compiled and analyzed with the assistance of a Middlebury College student intern and the Geography Department's GIS lab. Also, a site list and map prioritized for field visits was made, a first public forum was held, and nine local residents interviewed. The inventory's second phase included site visits to properties where landowner permission was obtained, a second public forum, and preparation of final products, including a report, maps, and GIS layers.

Thirteen of the 17 sites visited during the inventory are ecologically significant. To be designated ecologically significant a site must include a natural community of state-level significance or a species of conservation importance on the state-level. The ecological significance of all these sites are further enhanced by their occurrence in larger and more intact forest blocks containing a variety of locally significant ecological features. Intact refers to areas that were forested in 1940 (based on aerial photographs), and thus were likely never or only briefly cleared for agriculture or pasture. All 13 ecologically significant sites are described in the report condensed into 11 site descriptions. A total of 18 natural community types split evenly between upland and wetland types are now known from Cornwall. Ten of the 18 natural community types in Cornwall have examples significant on the state-level. While many of the communities encountered during the inventory have just one or two occurrences in town, multiple occurrences of mesic maple-ash-hickory-oak forest, transition hardwoods limestone forest, and the clayplain forest community types all point to the prevalence of limestone bedrock and clay soils in a town positioned in the bottom of the Champlain Valley. These upland natural communities are all relatively small (less than 100 acres) in comparison with the extensive (3,500+ acres) forested wetland natural communities of Cornwall Swamp. Thirty rare, threatened, and/or endangered species (21 plants and 9 animals) are now known to occur in Cornwall, including one grassland bird species that has not been observed in town since 1992. This includes all the rare plant and animal species known prior to the inventory, plus 10 new plant species that were discovered during 2014 field visits.

A GIS analysis resulted in two maps that show which areas could most benefit from improvement to protect water quality and provide flood hazard abatement. No field checks were made to confirm those analyses. Given that forest is the highest quality vegetation buffer that provides for the most ecological functions, one map highlights areas with frequently flooded soils that are currently agricultural field or non-actively managed grassland. A second map highlights stream segments needing forest buffers. The final map produced through GIS analysis and augmented by wildlife observations of local residents, shows potential connectivity habitat between eight forest block and landscape districts in Cornwall and adjacent towns.

TABLE OF CONTENTS

INVENTORY SUMMARY	ii
List of Figures & Tables	iv
Acknowledgements	v
INTRODUCTION	1
LANDSCAPE CONTEXT	2
METHODS	5
RESULTS	6
Landscape Analysis	6
Site Field Inventory.....	8
Riparian Areas of Special Importance	14
Potential Connectivity Habitat.....	18
SITE DESCRIPTIONS	21
The Ledges (#2 & 3)	22
Snake Mountain Southend & Snake Mtn. Road West (#5 & 65)	26
Lemon Fair Middle (#8).....	30
The Ledges North (#10).....	34
Dr. Bingham’s Woods (#23).....	38
The Gully Forest Block (#27)	42
DeLong Hill East – north (#46)	46
Douglas Pond & Woods (#53).....	50
Swamp Westside Hills (#68)	54
Cornwall Swamp Middle (#70)	58
Middlebury Swamp (#42).....	62

SOURCES.....	66
Digital Data Layers.....	67
APPENDICES	68
Appendix 1. Explanation of Legal Status and Information Ranking.....	68
Appendix 2. Guidelines for State-significance	69

List of Figures:

Figure 1. Physical map of Cornwall, Vermont	3
Figure 2. Map of all inventory sites on prioritized site list.....	7
Figure 3. Map of ecologically significant sites in Cornwall.....	10
Figure 4. Vegetation types of frequently flooded soils	16
Figure 5. Small streams needing natural vegetation buffering	17
Figure 6. Forest block and landscape districts showing potential connectivity habitat.....	19

List of Tables:

Table 1. List of sites visited during the inventory	9
Table 2. Natural communities and features documented at inventory sites	12
Table 3. Summary of rare, threatened, & endangered species of Cornwall	13
Table 4. Descriptions of the eight landscape/forest blocks districts of Cornwall	18

ACKNOWLEDGEMENTS

I am very grateful to the town of Cornwall for requesting this inventory in its town plan, to the Planning Commission and Select Board for their encouragement and support, and to the Cornwall Conservation Commission for initiating and supervising it. I sincerely thank the numerous residents of Cornwall who gave permission to visit their properties. As my primary contacts during the inventory, Conservation Commission members Mary Dodge and Marc Lapin were especially helpful in landowner contact and keeping the inventory moving forward. I am also very grateful for their graciously hosting me when working in town. Bill Hegman at Middlebury College's GIS lab and student intern Kris Falcones were especially helpful in gathering and analyzing digital data at the beginning of the project, and for providing maps for the first town forum. I thank these local residents who gave interviews during the first stage of the inventory: Barney Hodges, Steve Pratt, Marc Ringey, John Roberts, Stu Johnson, Annie Wilson, Marc Lapin, Lawrence Pyne, and Ian Worley. Finally, I am deeply grateful to the town of Cornwall for giving me the opportunity to explore and document the town's ecologically diverse and beautiful natural areas.

INTRODUCTION

This report contains the results of a town-wide ecological, or natural resources, inventory for Cornwall, Vermont. The inventory assesses habitat for species of greatest conservation need, natural communities of state and local significance, potential connectivity habitat, and riparian areas important for water quality and flood hazard abatement. Supported by the town through a State Municipal Planning Grant, and other sources, including the Vermont Community Foundation Small and Inspiring Grant, Davis Conservation Fund, New England Grassroots Environment Fund Grow Grant, and Ben & Jerry's Community Action Team Grant, the inventory was initiated in June 2013, and concluded in May 2015. The preliminary landscape analysis was conducted in summer and fall of 2013 in conjunction with student intern Kris Falcones under the supervision of geography faculty member Bill Hegman at Middlebury College's GIS lab. The bulk of the field work took place during the summer and fall of 2014.

Cornwall is perhaps best known for its agriculture. Endowed with naturally fertile soils and the Champlain Valley's moderate climate, the town has been farmed for over two centuries. Within the last 50 years, however, the value of the town's natural assets have come to light. The town has two outstanding natural areas – Cornwall Swamp and The Ledges – which have long been recognized for their ecological significance. Though well-known by local residents for its wildlife and wildness, Cornwall Swamp was first recognized by scientists as an important ecological area when H.W. "Hub" Vogelmann described it in his second report to the state Central Planning Office on the natural areas of Vermont (Vogelmann, 1969). Subsequently, in 1974 the National Park Service designated it as a National Natural Landmark. Then starting in the 1980s Cornwall Swamp and nearby swamps along Otter Creek were explored by botanists and ecologists who quickly recognized the wetlands as New England's finest and most extensive swamp complex. Also in the 1980s, The Ledges was first recognized as an outstanding example of a limestone cliff natural community. Both Cornwall Swamp and The Ledges were included as natural areas of state-significance during the Fish & Wildlife Department's 1993 inventory of natural areas of western Addison County (Lapin, 1993).

While these two important natural areas in Cornwall have received due attention by the state and conservation community through the long-term land acquisition process in Cornwall Swamp, and more recent land acquisition by the Middlebury Area Land Trust at The Ledges, the rest of the town's natural resources have scarcely been inventoried. With this background, guided by the Town Plan, the town Conservation Commission initiated this ecological inventory of Cornwall. The results in the following report will hopefully demonstrate the value of this inventory.

LANDSCAPE CONTEXT

Framed by Otter Creek and Lemon Fair River in the midst of the Champlain Valley, Cornwall is a landscape rich in valley bottom silt and clay soils, extensive floodplain wetlands, and limestone ledges (Figure 1). That it sits in the Champlain Valley at elevations ranging from a mere 140 feet along the Lemon Fair to a maximum of 580 feet on top of DeLong Hill means its climate is very moderate compared to the hill country and mountains typical of the rest of Vermont. This is why hickories and various oaks are such a common part of the forest communities in Cornwall, yet unheard of in many parts of Vermont.

Being in the Champlain Valley biophysical region, Cornwall shares many landscape characteristics and the same climate with the rest of the Champlain Valley. Its bedrock foundation is dominated by limestone and a magnesium-rich limestone known as dolostone. To say that Cornwall has a lot of limestone bedrock is an understatement: it is loaded with limestone! Based on a GIS perusal of the new state bedrock geologic map, Cornwall is one of the most, if not the most, limestone-rich towns in Vermont. And Vermont probably has more limestone than any other state in New England. The only areas in town that are not limestone dominated are the small piece of Monkton quartzite rock formation in the northwest corner of town, and a band of slate running north-south down the middle of town. Contrarily, this slate belt forms the ridges at the north end of town on which Cider Mill Road and Ridge Road run, yet underlies Cornwall Swamp at the south end of town.

A series of north-south oriented hills and ridges form the low relief of Cornwall. For the most part these have steeper west slopes as a result of being formed through thrust-faulting. The highest of these thrust-fault hills in the Champlain Valley is located just a short distance to the north at Snake Mountain. The hill in the northwest corner of town is the tail end of the Snake Mountain highland where Cambrian (half a billion years old) quartzite is thrust westwards up over much younger shale bedrock. Though many of the hills in town have low ledges, the most impressive limestone exposures occur at The Ledges. South of where Route 125 cuts through this ridge are the prominent, west-facing limestone cliffs. The numerous rocky limestone hills in town produce prime environmental conditions for the frequently encountered transition hardwoods limestone forest natural community, and the lime-loving rare plants, during the inventory.

While bedrock is the primary basis for most topographic relief, soil covers most bedrock and becomes a principal physical characteristic of a landscape. As with many other parts of the Champlain Valley and especially in Addison County, clays and silts dominate the soils. These heavy soils were deposited in the bottom of the Champlain Valley when a greatly expanded and much deeper version of Lake Champlain filled the valley as the glaciers melted 10,000 years ago. At one point this great glacial lake became an arm of the ocean known as the Champlain Sea. The repeated occurrences of rare clayplain natural communities, including mesic and wet clayplain forests and sand-over-clay forest, encountered at Cornwall sites during the inventory are directly tied to these heavy glacial lake bottom sediments. And in inverse fashion, clay over sand deposits allowed a minor tributary stream to cut the steeply incised ravine in town known by some as “The Gully”.

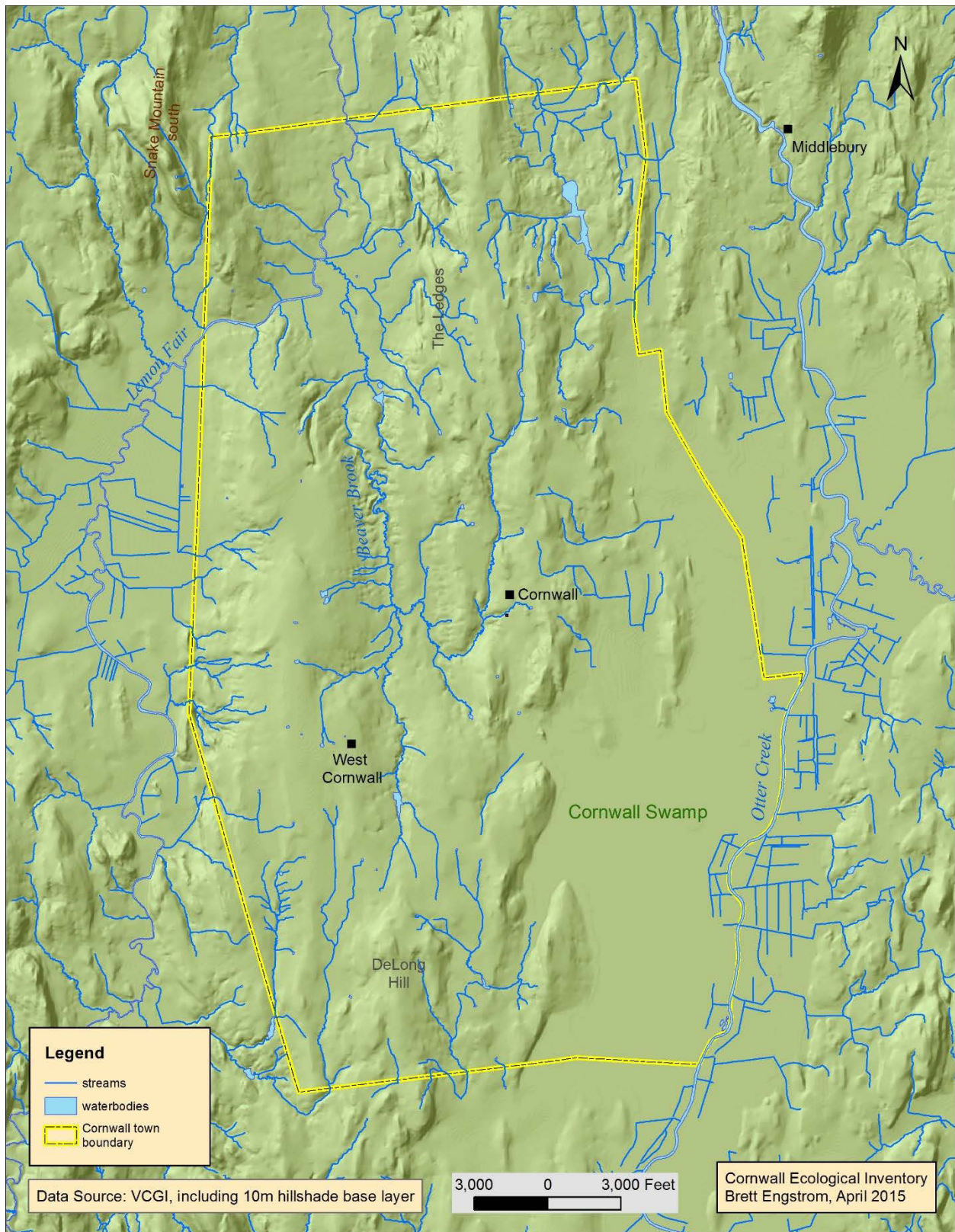


Figure 1. Physical map of Cornwall, Vermont

To complete Cornwall's landscape context, cultural and biological characteristics must be added to the physical features. The town's pastoral landscape has a long history. The landscape's predominance of plowed, and often drained, fields has led to the near disappearance of once common forest communities, such as clayplain forest. In turn, the landscape's remaining native forests reside in those places which were not arable, such as the rocky hills and wetlands. Relegated to small patches in many cases, these places are the refugia for most of the native plants and animals, including some of the most vulnerable species.

The widespread clearing of forest for agriculture has led to open ground on field margins and in abandoned fields that is prime habitat for invasive species, such as common buckthorn, Morrow's honeysuckle, and wild parsnip. These exotic species thrive in sunny or partly sunny settings at the expense of native plants. As the results of this inventory clearly show, sites that have remained continuously forested for 75 years or more tend to rebuff these invasives. Yet the widespread abundance of these species in Cornwall, as well as the entire Champlain Valley, means that they can quickly colonize open ground and edges wherever they occur, at the expense of our native species. Conservation of the intact native forests in Cornwall is therefore all the more critical for the maintenance of the town's biodiversity.

METHODS

The methods used to conduct this ecological inventory had four components: landscape analysis, field inventory, public forums, and final report and maps. The landscape analysis included compilation and analysis in GIS of existing information relevant to the ecological inventory. The compilation and analysis were conducted with the assistance of Middlebury College intern Kris Falcones under the supervision of the college's GIS lab director Bill Hegman. The Natural Heritage Information Project (NHIP) of the Vermont Fish & Wildlife Department was a major source of information on previously documented natural communities and rare species in Cornwall. At the same time, relevant spatial data, including aerial photographic imagery, was assembled from online sources, especially the Vermont Center for Geographic Information and the Vermont Natural Resources Atlas. Surface waters, wetlands, soils, digital elevation models, bedrock geology, and surficial geology were the principal types of physical feature spatial data used in the landscape analysis. Biological and ecological data included NHIP data mentioned above, wildlife road crossing, Ecological Habitat Blocks of NHIP, Wildlife Linkage Habitat, vernal pools, and critical wildlife habitat (i.e. bear mast, deer wintering grounds, etc.). A list of digital data sources and other documents consulted is given in the Sources section at the end of the report. Additional information on Cornwall's wildlife and natural features was gained during local resident interviews and the first public forum.

The primary product of the landscape analysis is a list of sites prioritized for field inventory based on their potential for significant ecological and wildlife values. Using the town parcel data layer, the Conservation Commission in collaboration with the town clerk established parcel ownership for all parcels within the high and medium priority sites. Conservation Commission members then contacted landowners of these sites. Higher priority sites (primarily medium-high to high), or in some cases parts of sites where landowner permission was obtained, were visited during the 2014 field season, May-October. One site, The Ledges, was also visited in the 2013 field season.

Field inventory involved documenting the ecological characteristics of a site via a walking route designed to capture the diversity of natural communities and landscape features. Using a GPS receiver, waypoints and tracks were taken to geographically document both common and significant ecological features. Observations and data on species composition, vegetation structure, and soils of natural communities, and rare plant and animal populations, were recorded in personal field books. Natural communities were typed according to the current Vermont natural community classification: Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont (Thompson and Sorenson 2000), while plants searched for included those found on the NHIP's "Rare and Uncommon Vascular Plants of Vermont", which includes both federally- and state-listed threatened and endangered species. Documentation of the rare plants included collection of a voucher specimen and/or photographs. Rare Plant and Animal Forms were filled out for the rare species discovered during site visits and sent to NHIP.

GIS was critical for the inventory's riparian area and potential connectivity habitat analysis. Working in the ArcGIS 10.2 environment, existing soil, stream, wetland, and 2012 imagery data were analyzed to map important riparian areas and potential connectivity habitat.

RESULTS

Landscape Analysis

As described in the Methods section, many different sources of data were used to create a map and list of sites prioritized for potential ecological significance and field inventory. Seventy-nine sites were mapped (Figure 2). Sites were prioritized for field assessment in five classes, ranging from High to Low, with roughly half of the sites in the Medium to High classes, and the other half in the Low-Medium to Low classes. The inventory's lengthy site list accompanies this report as an Excel spreadsheet document (Sites List – final, Cornwall Ecological Inventory 2015) for future reference. Information from local residents obtained during interviews and the first public forum are incorporated into the sites list spreadsheet, and roughly half of the notes taken from residents have been typed up into a digital document not included in this report.

As shown on Figure 2, almost all of the sites are forested or woodlands since forest is the natural vegetation type of the Cornwall landscape, as is true for most of temperate eastern North America. Some sites include open wetlands, which are a less prominent natural vegetation type of the landscape. The fields, pasture, and orchards have important agricultural values, as well as important values for wildlife. But it is the forests that harbor the native fauna, flora, and natural communities that were the focus of this inventory. Many of the wildlife species that utilize the agricultural lands rely on forest for cover, denning, and other life requirements.

In general the larger the forest block, the higher the priority for field inventory. Basic principles of conservation biology show that the smaller the forest patch becomes, the greater its biological and ecological diversity limitations. It is partly a simple function of size (less land = less habitat and smaller populations), and partly a function of the increased probability of invasive species encroachment with increased edge in proportion to forest interior. Also, the age of the forest patches was another factor in site priority. Sites that had the greatest proportion of continuously forested land were given higher priorities. This was determined by examining the 1942 aerial photographs of Cornwall. Known or potential ecological values, such as natural communities and species of greatest conservation need, including rare, threatened, and endangered species, as well as significance for wildlife, were also used in prioritizing sites.

Six sites were already known to have state-significant ecological features prior to the inventory:

- Beaver Brook Clayplain (part of site #27)
- Cornwall Swamp (sites #69-77), part of the Otter Creek Swamps
- DeLong Hill (historical rare plant site, presumed site #46 or vicinity)
- Gorham Farm (part of site #79)
- Middlebury Swamp (site #78), part of the Otter Creek Swamps
- The Ledges (site #2)

Except for Gorham Farm (Site #79), all of these sites were revisited as part of this inventory. Revisits were made to verify historically known species, and to expand the ecological knowledge of the sites. The significant ecological features of these known sites are included in the site descriptions introduced in the following section of the report.



Figure 2. Cornwall ecological inventory map of all sites on prioritized site list. Those visited in 2014 are shaded.

Additionally, data from Fish & Wildlife Department's NHIP contain prior information on several species of greatest conservation need from areas in Cornwall other than the preceding sites. They include documented observations of the following rare, threatened, and endangered animal species:

- Indiana bat (*Myotis sodalis*) –federally- and state-endangered known from the Lemon Fair Valley along West Street
- Giant floater (*Pyganodon grandis*) – state-threatened freshwater mussel known from the Lemon Fair River
- Creek heelsplitter (*Lasmigona compressa*) – rare freshwater mussel known from the Lemon Fair River and Otter Creek
- Grasshopper sparrow (*Ammodramus savannarum*) –state-threatened bird known from along Peet Road
- Upland sandpiper (*Bartramia longicauda*) – state-threatened bird known from along Peet Road

Site Field Inventory

A total of 17 sites were visited during the inventory (Figure 2). As shown in Table 1, the majority (13) of these visited sites are ecologically significant, meaning they contain one or more state-significant natural communities and/or species, plus locally significant ecological features. As defined by the Agency of Natural Resources, state-level significance is designated for occurrences of all rare, threatened, and endangered animal and plant species; and rare and/or exemplary natural communities. Explanations of species' and natural communities' rarity ranking and state-significance guidelines are provided in Appendix 1 and Appendix 2. Locally significant ecological features include those natural communities, landscape features (such as springs and ledges), uncommon plants and animals, and wildlife habitat that adds ecological diversity to a site, but do not rise to state-level significance. These ecologically significant sites include 10 high priority sites, plus three lesser priority sites. The four sites lacking state-significant features were all listed as medium priority sites.

As shown on Figure 3, these 13 ecologically significant sites are spread throughout town. Included on the Figure 3 map are all six sites known prior to the inventory to have state-significant ecological features. The 13 ecologically significant sites visited as part of the inventory are described in the Site Descriptions section of the report. Note that there are only 11 site descriptions because sites #3 and 65 have been combined with adjacent sites #2 and 5, respectively. The information for each site description includes a site map, description, and photographs. The description contains summary information on the site's significant features broken down into three natural feature sets: 1) natural communities and other natural features, 2) rare, threatened, and endangered species, and 3) wildlife habitat. Following the summary information is the description narrative, and comments and ecological management considerations.

Table 1. List of sites visited during the inventory. Highlighted sites have at least one feature of ecological significance on the state-level, plus locally significant features.

Site Number	Site Name	Location	Visit Priority
2	The Ledges	South of RT. 125, east of Hamlin Rd.	M
3	The Ledges South	Part of same forest block south of The Ledges	H
5	Snake Mountain Southend	North of Rt. 125/Snake Mtn. Rd. jct.	H
8	Lemon Fair Middle	Both sides Lemon Fair ~1 mi. north of Rt. 125	H
10	The Ledges North	Between Rt. 125 and Ledgemont Lane	H
23	Dr. Bingham's Woods	Woods to either side of Beaver Brook north of Rt. 74	H
25	Beaver Brook Woods South of Sperry Rd.	Beaver Brook upstream (south) of Sperry Rd.	M
26	Beaver Brook Woods North of Sperry Rd.	Beaver Brook downstream (north) of Sperry Rd.	M
27	The Gully Forest Block	West side of Beaver Bk. south of Foote Farm	MH
29	Beaver Brook-Ledges Connection	North of Tulley Rd., east of Beaver Bk.	M
36	West Cornwall Ridge - Central N. Woodlot	Between West & N. Bingham St., ~0.8 mi. north of Rt. 74.	M
46	DeLong Hill East-north	East of Wooster Rd.-South Bingham intersection	H
53	Douglas Pond and Woods	From pond at Douglas Rd. northwest up towards corner DeLong & Park Hill intersection	H
65	Snake Mountain Road West	Wooded area immediately west of Snake Mtn. Rd. Described in conjunction with site #5	LM
68	Swamp Westside Hills	Hills on west side of Cornwall Swamp, north of Scove Hill	H
70	Cornwall Swamp Center	Central portion of Cornwall Swamp northeast of Scove Hill	H
78	Middlebury Swamp	Portion of Otter Creek Swamps wetland complex N. of Morse Rd.	H

As shown in Table 2, a total of 18 natural communities split evenly between upland and wetland types are now known from Cornwall. These natural communities are as described in Vermont's natural community classification book *Wetland, Woodland, Wildland* (Thompson and Sorenson, 2000), with the addition of two natural communities (Wet Clayplain Forest and Sand-Over-Clay Forest) newly described by the Fish & Wildlife Department's NHIP. This table contains six other natural features that do not fit into the natural community classification, but add unique ecological characteristics to the landscape. Table 2 also shows at what sites the natural communities and other features occur, and shows the natural communities that are significant on the state-level. Most of the state-significant natural community types were documented from Cornwall prior to the inventory, especially the forested wetlands of Cornwall and Middlebury Swamps. State-significant examples of mesic maple-ash-hickory-oak forest and transition hardwoods limestone forest are newly documented as part of this inventory. The natural

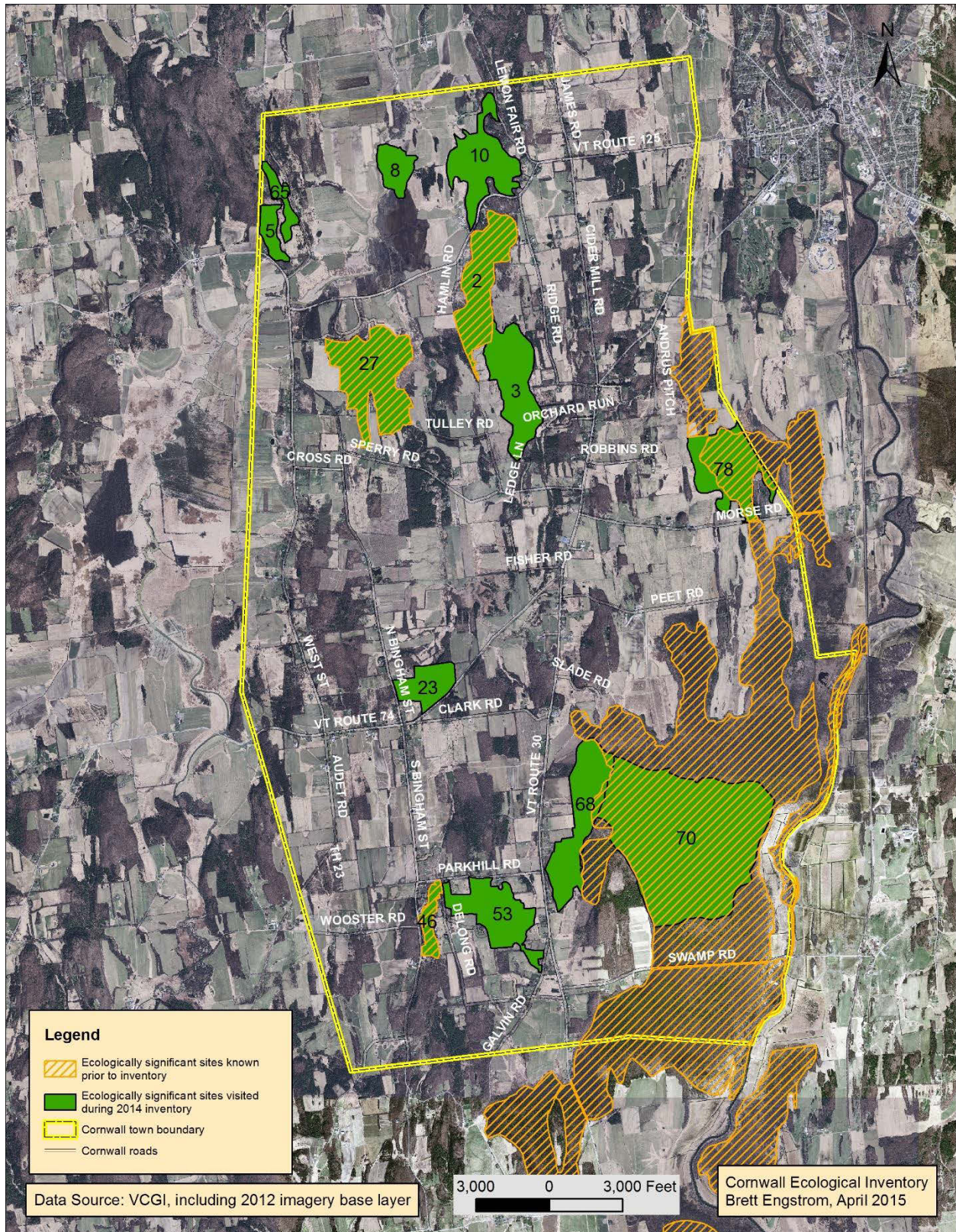


Figure 3. Ecologically significant sites in Cornwall, including all sites with natural communities significant on the state-level, and rare, threatened, and endangered species.

communities shown in the table that are not of state-level significance are significant on the local level, i.e. within town. While many of the communities have just one or two occurrences in town, the several occurrences of mesic maple-ash-hickory-oak forest, transition hardwoods limestone forest, and the clay forest type communities all point to the prevalence of limestone bedrock and clay soils in a town positioned in the bottom of the Champlain Valley. These upland natural communities are all relatively small: less than 100 acres and most less than 20 acres. While the forested wetland natural communities are largely restricted to just one site, this site - Cornwall Swamp - is so large (3,500+ acres) that it occupies a major portion of the southeast quarter of town.

A summary of all rare, threatened, and endangered species that are now known from Cornwall is presented in Table 3. These species are on the 2014 Rare and Uncommon Native Vascular Plants of Vermont list (VT Fish & Wildlife Department NHIP), except for the red-root flat sedge, which is a new species for the state of Vermont. Totalling 30 species (21 plants and 9 animals), this includes all the plant and animals species known prior to the inventory, plus 10 new plant species that were discovered during the 2014 field inventory. Of the 30 species shown in the table, seven plants and four animals are listed by state statute as Threatened, while two animals are Endangered. In addition to its state endangered status, the Indiana bat is federally listed as Endangered. The blue-winged and golden-winged warblers were not in the NHIP database, but are reported by local resident Ian Worley, a naturalist well-acquainted with Cornwall's bird life. Not included on this list is pignut hickory (*Carya glabra*), which was reported from The Ledges many years ago. According to the original documentation, confirmation of identity of the single tree observed in 1988 was needed. The presence of the pignut hickory at The Ledges has never been confirmed despite repeated inventory work at the site, including the 2014 ecological inventory.

Twelve of the 21 rare, threatened, and endangered plants are wetland species and nine are plants of upland habitats. While most of the sites have only one or two rare plants, with its nine rare plants Cornwall Swamp – a huge wetland - is a biodiversity standout. With five rare plants, The Ledges has the greatest biodiversity of upland sites. The great majority of rare plants occur at only one or two sites. The short-styled snakeroot, however, is exceptional in that it was found at seven sites in Cornwall during the 2014 inventory. This snakeroot was historically known from Cornwall from 1898 and 1937 herbarium specimens, the first from “DeLong's Ledge”, presumably the same site as the inventory's DeLong Hill (#46). Though never abundant at any one site, its repeated occurrence in Cornwall is likely linked to the prevalence of limestone bedrock and its associated transition hardwoods limestone forest natural community.

Excepting the four-toed salamander and eastern small-footed bat known from Cornwall Swamp, all of the rare animals are known from sites other than the 13 ecologically significant sites described in this report. This is largely due to the fact that these animals occur in habitats that were not the focus of this inventory, namely the agricultural grasslands (grasshopper sparrow and upland sandpiper), successional woodlands (golden-winged and blue-winged warblers), and the rivers (creek heelsplitter and giant floater freshwater mussels). Ranging from 1988 to 2002, the grassland bird records are quite old.

Table 2. Natural communities and features documented at Cornwall inventory sites. Highlighted communities are significant on state-level.

Natural Community	The Ledges 2 & 3	Snake Mtn. S 5 & 65	Lemon Fair Mid 8	The Ledges North 10	Dr. Bing. Woods 23	The Gully 27	DeLong Hill 46	Douglas Pond & Woods 53	Swamp W.side Hills 68	greater Cornwall Swamp 70+	Midd. Swamp 78	Other Sites
rich northern hardwood forest					X							
temperate hemlock-hardwood forest	X			X		X						
mesic maple-ash-hickory-oak forest	X	X					X	X	X			X
transition hardwoods limestone forest	X	X		X			X	X	X			X
transition hardwood talus woodland	X											
mesic clayplain forest			X			X			X	X	X	
wet clayplain forest			X		X				X			
sand-over-clay forest					X	X		X				
temperate calcareous cliff	X			X		X						
silver maple-ostrich fern riverine floodplain forest										X		
red maple-black ash seepage swamp										X	X	
red or silver maple-green ash swamp			X							X	X	
red maple-northern white cedar swamp										X		
northern white cedar swamp										X		
shallow emergent marsh								X				
cattail marsh						X						
seep						X		X				
vernal pool	X											X
perched basin marsh	X											
shrub swamp	X											
spring	X		X					X				
high-gradient stream corridor						X						
erosional bank						X						
ravine					X	X						

Table 3. Summary of all rare, threatened, and endangered plant (shaded green) and animal (shaded red) species of Cornwall. T = Threatened, E = Endangered, LE = Legally Endangered on federal level. See Appendix 1 for description of state rankings and status.

Common Name	Scientific Name	S-Rank, Status	G-Rank, Status	The Ledges 2 & 3	Snake Mtn. S 5 & 65	Lemon Fair Mid 8	The Ledges North 10	Dr. Bing. Woods 23	The Gully 27	DeLong Hill 46	Doug. Pond & Woods 53	Swamp W.side Hills 68	greater Cornw. Swamp 70+	Midd. Swamp 78	Other Cornw. Sites
American hazelnut	<i>Corylus americana</i>	S2S3	G5						X						X
broad beech-fern	<i>Phegopteris hexagonoptera</i>	S2	G5									X			
cuckoo flower	<i>Cardamine dentata</i>	S2	GNR										X		
eastern jacob's ladder	<i>Polemonium van-bruntiae</i>	S2, T	G3G4										X		
eastern manna-grass	<i>Glyceria septentrionalis</i>	S2	G5	X											
false hop sedge	<i>Carex lupuliformis</i>	S2	G4											X	
green adder's mouth	<i>Malaxis uniflora</i>	S2	G5										X		
green dragon	<i>Arisaema dracontium</i>	S2, T	G5										X		
harsh sunflower	<i>Helianthus strumosus</i>	S2S3, T	G5	X											
lily-leaved twayblade	<i>Liparis liliifolia</i>	S1, T	G5										X		
ram's head lady's-slipper	<i>Cypripedium arietinum</i>	S2, T	G3										X		
red-root flat sedge	<i>Cyperus erythrorhizos</i>	new	GNR			X									
Seneca snakeroot	<i>Polygala senega</i>	S2S3	G4G5				X								
shorthusk	<i>Brachyelytrum erectum</i>	S2S3	G5	X							X	X			
short-styled snakeroot	<i>Sanicula canadensis</i> var. <i>canadensis</i>	S2S3, T	G5T5	X	X			X		X	X	X		X	
sprout muhlenbergia	<i>Muhlenbergia sobolifera</i>	S2	G5				X								
squarrose goldenrod	<i>Solidago squarossa</i>	S2S3	G4?	X											
swamp fly-honeysuckle	<i>Lonicera oblongifolia</i>	S2	G4										X		
thin-flowered sedge	<i>Carex tenuiflora</i>	S1	G5										X		
troublesome sedge	<i>Carex molesta</i>	S1	G4		X					X					
white adder's-mouth	<i>Malaxis monophyllos</i> var. <i>brachypoda</i>	S2S3, T	G4Q										X		
blue-winged warbler	<i>Vermivora cyanoptera</i>	S3B	G5												X
creek heelsplitter	<i>Lasmigona compressa</i>	S2	G5												X
eastern small-footed bat	<i>Myotis leibii</i>	S1, T	G1G3										X		
four-toed salamander	<i>Hemidactylium scutatum</i>	S2	G5										X		
giant floater	<i>Pyganodon grandis</i>	S2S3, T	G5												X
golden-winged warbler	<i>Vermivora chrysoptera</i>	S3B	G4												X
grasshopper sparrow	<i>Annodramnus savannarum</i>	S1B	G5												X
Indiana bat	<i>Myotis sodalis</i>	S1, E	G2, LE												X
upland sandpiper	<i>Bartramia longicauda</i>	S2S3B	G5												X

Grasslands and shrublands are critical habitat for a wide variety of wildlife, including the four rare bird species known in Cornwall. Management information for grassland and shrubland wildlife, including the rare grasshopper sparrow, upland sandpiper, golden-winged warbler, and blue-winged warbler, is available online from the VT Fish & Wildlife Department (Northeast Upland Habitat Technical Committee 2006). Two areas in town were recognized during the resident interview process (Ian Worley and Lawrence Pyne) as being important successional wildlife habitat: the shrubby woodlands along Snake Mountain Road in the northwest corner of Cornwall, and the shrubby and young forest woodlands along the Lemon Fair.

Freshwater mussels, including the rare giant floater and creek heelsplitter, are both known from the Lemon Fair River, and the latter from Otter Creek. Additionally, living mussels and shell fragments for at least two mussel species, were observed in lower Beaver Brook downstream (north) of Sperry Road bridge. While not surveyed as part of this inventory, both the Lemon Fair and Otter Creek should be acknowledged as critical habitat for these rare freshwater mussels and as having a great diversity of fish and wildlife. More survey work is required to identify the mussel species along lower Beaver Brook. The abundance and diversity of aquatic life, including the rare mussels, is a function of water quality and riparian lands, which will be covered in the following results section on Riparian Areas analysis.

The federally-endangered Indiana bat recorded for Cornwall occurred in a very small woodland in the Lemon Fair Valley. While this is an important point location for the bat, conservation of this species likely hinges on the success of the local population in the local area, like Cornwall and the surrounding towns, and, importantly, regional factors, such as caves for hibernation, and disease, such as the recently devastating white-nose syndrome. One concrete way of helping this species is the conservation of roosting trees, such as the large trees with loose bark (shagbark hickory being the best example, but also including several other species), which requires action at multiple sites in an area (Vermont Fish & Wildlife 1988). According to VT Fish & Wildlife Department data, Cornwall is in the middle of the mapped summer range in Vermont.

Riparian Areas of Special Importance

Riparian areas are lands bordering rivers and streams. They include stream shores and banks, adjacent uplands and wetlands, as well as lands that are repeatedly flooded, or floodplains. All of these types of riparian areas are of critical importance for water quality protection, aquatic and terrestrial habitat protection, channel and floodplain stability, wildlife travel corridors, and flood hazard abatement (VT Agency of Natural Resources 2005a & b). Riparian areas are of highest ecological value when in a naturally vegetated state, which in Vermont means forested.

While a detailed analysis of riparian areas has been done as a part of a conservation plan for the Beaver Brook watershed (Landslide Natural Resource Planning & Middlebury Area Land Trust 2010), riparian areas analyses for the Cornwall inventory focused on the entire town. Using existing GIS soils and hydrography (surface waters, including streams, rivers, and lakes/ponds) data overlaying 2012 orthophotos, vegetation types in both floodplain areas and stream buffer

zones were analyzed for their vegetation types. The resulting maps show which riparian areas could most benefit from improvement to protect water quality and watershed health.

The first step in analyzing riparian areas analysis involved typing vegetation that occurs within the frequently flooded soils of Cornwall into one of five vegetation classes: agricultural field, non-active (not actively managed) grassland, wetland, successional woodland, and forest. Woody vegetation types, both forest and successional woodland, and wetlands best promote watershed health, as detailed above, while agricultural fields are of lesser value for watershed health. As shown in the Figure 4 map, the areas where there is the most field in flooded soil areas is along the Lemon Fair, Beaver Brook along Route 74, headwaters of Bascom Brook upstream and downstream of Wooster Road, and the old fields along Otter Creek downstream (north) from Swamp Road. It is important to note that there are inaccuracies in the soil data. For example, the lowest reach of Beaver Brook, just before it joins the Lemon Fair, is typed as a non-flooded Livingston clay, which is highly unlikely given that it is at a lower elevation than adjacent mapped flooded soils. Also, some of the muck soils of Cornwall Swamp do flood when Otter Creek overflows its banks, yet are not mapped as flooded soils. This is all to say that the areas shown as frequently flooded soils are rough boundaries and not to be interpreted as definitive.

The second step in analyzing riparian areas involved determining which stream segments run through fields and therefore are in the greatest need of having naturally vegetated buffers. The resulting map (Figure 5) highlights where field vegetation dominates the 50-foot riparian buffer zone, or 50 feet to either side of the stream. Wetlands, even if open (non-wooded) are not included in the highlighted field buffer zones since they have an important role in watershed health on all levels. The Lemon Fair River and Otter Creek buffers are not shown on this map because they are covered in the flooded soils riparian areas map (Figure 3). The intermittent streams segments and ditches are depicted in red. While a 50-foot naturally vegetated buffer is recommended by the Agency of Natural Resources for most streams, a narrower buffer is adequate for small, stable intermittent streams (VT Agency of Natural Resources 2005a). Based entirely on aerial photograph interpretation, the Vermont Hydrography Dataset (VHD) stream data used in the analysis has inaccuracies. Paths of small stream channels, especially where passing through forests, can be incorrectly mapped, and some intermittent streams can be missed altogether. Field verification is needed for any work in stream buffers or floodplains.

Both of these riparian maps point out areas needing forested or other naturally vegetated buffers and floodplains. The riparian areas most important for watershed health are the wetlands, and the forested and woodland areas in floodplains. In both cases, the bigger the better. Cornwall Swamp is the preeminent riparian area in Cornwall because it is an enormous forested wetland in the floodplain of Otter Creek. The lower half of Beaver Brook is the second most important riparian area in town because it has significant wetlands and floodplain woodlands, largely forested buffer zones, and passes through one of the largest forest blocks in town. Though in compromised condition, the Lemon Fair is an important riparian area because it has one of the most extensive floodplains in town. And on a landscape level, all the large forest blocks are

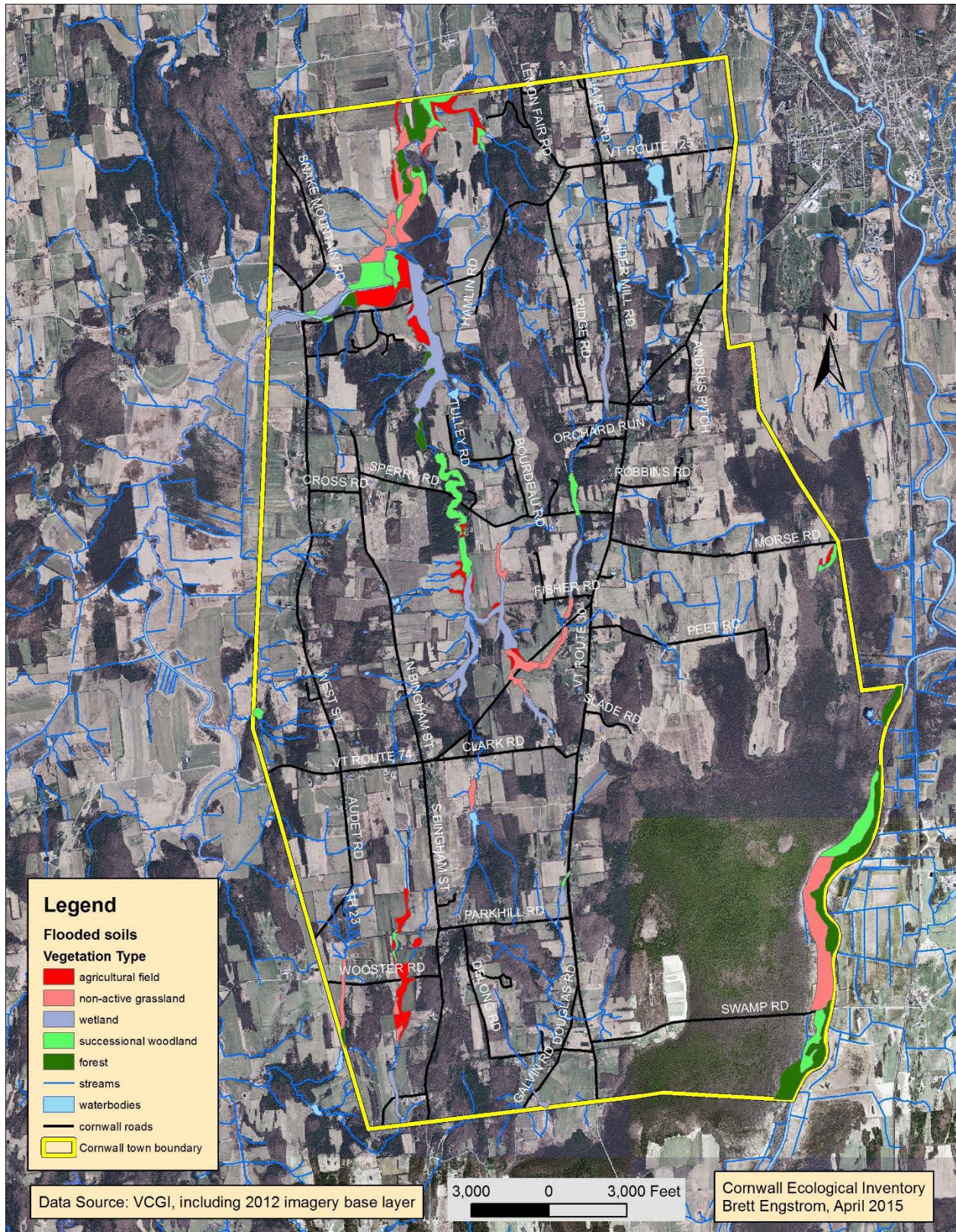


Figure 4. Vegetation types of frequently flooded soils in Cornwall.

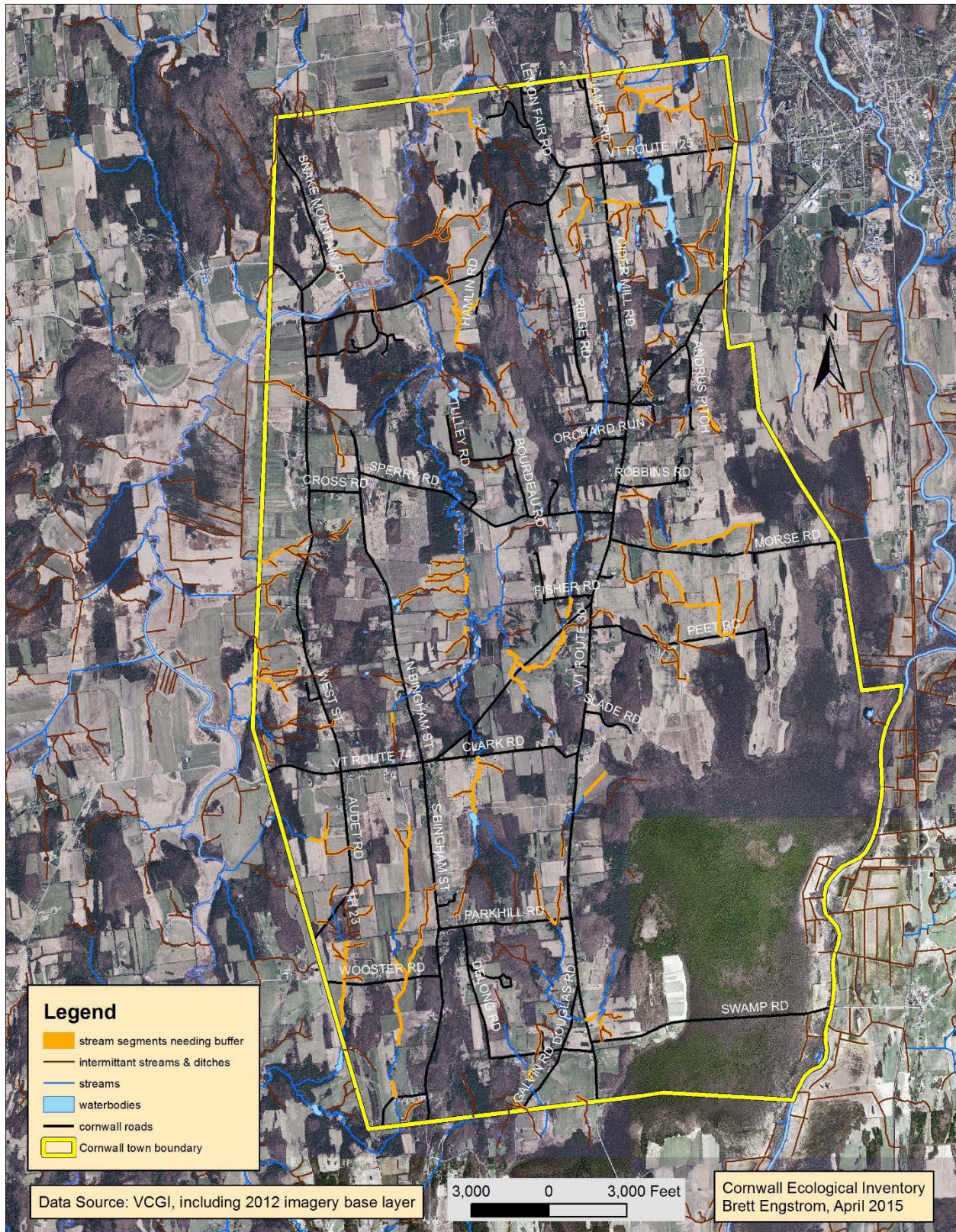


Figure 5. Small streams needing natural vegetation buffering in Cornwall.

important for watershed health even if they have few and short stream lengths. Forests enhance water quality, flood hazard abatement, and many other stream-related characteristics, so more forested land leads to better watershed health.

Potential Connectivity Habitat

On a landscape level, maintaining natural communities and native biota depends on the ability of plants and animals to naturally move around. This is especially true of landscapes where suitable habitats become restricted to patches, and populations of any single patch may face local extirpation for a whole host of reasons. Furthermore, wildlife may move across the landscape seasonally, seeking food or cover in different habitats.

In order to analyze potential connectivity habitat in Cornwall, eight landscape districts were drawn based roughly on forest blocks, though in the case of the Lemon Fair valley the district corresponds to a combination of wetlands, floodplains, and woodlands (Table 4; Figure 6). Though there is overlap, these are different than the inventory sites designated during the primary landscape analysis. They are also different from the VT Fish & Wildlife Department's Ecological Habitat Blocks, which do not allow for roads to bisect blocks. These districts are contiguous forest areas occupying ridges or drainages that may be bisected by one or two town roads, but not by highways. Exceptions to the latter are Route 125's bisecting The Ledges, and to the west its bridge crossing of the Lemon Fair.

Table 4. Descriptions of the eight landscape districts of Cornwall listed in order of forest block size and condition (degree of fragmentation), except for the Lemon Fair which is a wetland/floodplain valley district.

#	District Name	Type	Description
1	Swamp – Otter Creek	Wetlands/ floodplain	Enormous swamp complex along Otter Creek ranging from Rt. 30 south to Cornwall Swamp to other swamps
2	Snake Mountain	Highland	Quartzite ridge system in NW corner of town that ranges N to Snake Mountain proper. Only small portion of district in Cornwall
3	The Ledges	Uplands	Major limestone ridge system that extends from Sperry Road N into Weybridge; bisected by Route 125. Connected to Beaver Brook district at Beaver Brook
4	Beaver Brook	Stream & uplands	Beaver Brook drainage and adjacent uplands from Route 74 downstream (N) to Route 125. Connected to The Ledges district at Beaver Brook
5	DeLong Hill	Uplands	The greater DeLong Hill area in SW part of town. Ranges from reservoir N of Clark Road S through Douglas Ponds & Woods site and DeLong Hill proper, into Whiting.
6	West Cornwall Ridge	Uplands	Small forest block sandwiched between West Street and N. Bingham, N of West Cornwall.
7	Lemon Fair	River, wetlands/ floodplain	Not a forest block, but a distinct landscape unit featuring the river its floodplain and wetlands. Only a portion in Cornwall.
8	Cider Mill Ridge – Ledge Creek	Uplands & streams	Highly fragmented. Includes Ledge Creek headwaters from Cobbs Corners N to Route 125; ridge of Cider Mill Road, and headwaters of Beaver Brook

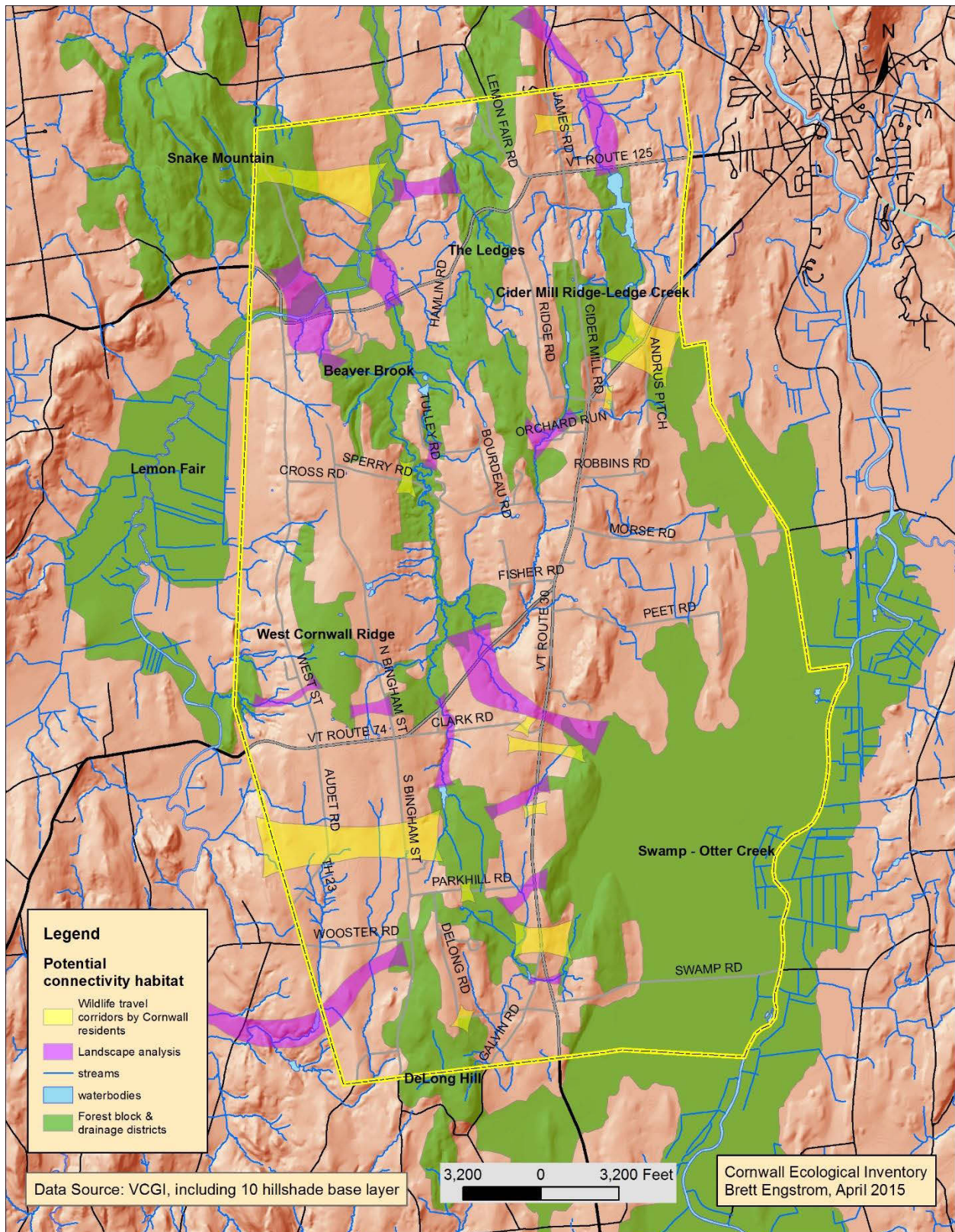


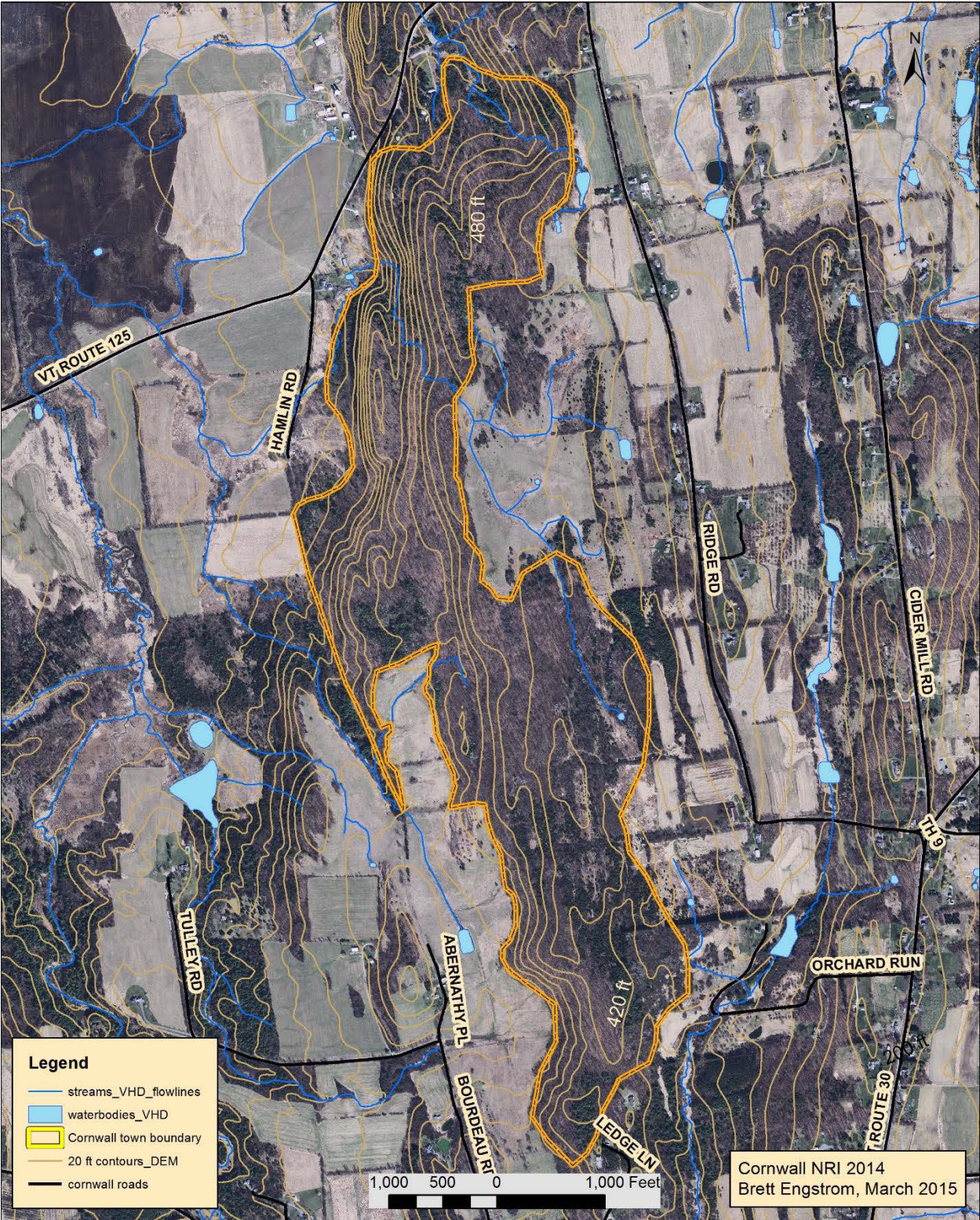
Figure 6. Cornwall forest block and landscape districts showing potential connectivity habitat based on residents' wildlife travel corridor notes and inventory landscape analysis in GIS.

These districts can be thought of as source areas of biodiversity. They contain the most extensive areas of forests containing the greatest diversity of both natural communities, and native plant and animal species. The potential connectivity areas in Figure 6 show wildlife travel corridors described by Cornwall residents during interviews and at the 2013 public forum, as well as zones that provide connectivity between districts based on landscape analysis. In most cases, the landscape analysis shows shortest distance between districts with the least number of road crossings, while in other cases the connecting habitat follows stream drainages that go the greatest length in connecting districts. Streams are natural travel corridors for many species of wildlife, especially those whose lives are closely tied to aquatic life and habitat. In the southwest part of town a couple of the mapped connectivity habitat zones lead towards the upper reaches of the Lemon Fair, which is not shown as a district since it lies outside of Cornwall.

It is important to recognize that the mapped connectivity habitat derived from landscape analysis is conjecture, and has no field observations to back it up. While this connectivity analysis follows basic principles of conservation biology, field data, including observations of wildlife (personal and through the use of wildlife cameras strategically placed) and wildlife sign, are needed to document the use of the connectivity habitat.

SITE DESCRIPTIONS

The Ledges (#2 & 3), Cornwall, VT



Site: The Ledges (#2 & 3)

Location: South of Route 125 and east of Hamlin Rd.

Information Sources: Brett Engstrom site visits in 2013 (June 20, July 15, Aug. 8) and 2014 (Sept. 9 and Oct. 10). Data from the VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program); Biological Natural Areas of Western Addison County by Marc Lapin, 1993

Land Ownership: Middlebury Area Land Trust and privately owned lands

Significant Features:

Natural Communities & other features: Temperate Calcareous Cliff*, Transition Hardwoods Limestone Forest*, Transition Hardwood Talus Woodland, Temperate Hemlock-Hardwood Forest, perched basin marsh, shrub swamp, vernal pool, spring

Rare, Threatened, & Endangered Species: short-styled snakeroot (*Sanicula canadensis* var. *canadensis*), harsh sunflower (*Helianthus strumosus*), shorthusk (*Brachyelytrum erectum*), eastern manna-grass (*Glyceria septentrionalis*), squarrose goldenrod (*Solidago squarrosa*)

Wildlife Habitat: Part of largest upland forest block in town - important to a wide variety of forest dwelling animals

*State-significant occurrence

Site Description: Driving east on Route 125 across the Lemon Fair flats, The Ledges are the west-facing limestone cliffs and forested ridge that one readily sees straight ahead. While quite skinny, the 350 acres of this rocky forest is notable both as the largest single block of upland forest in Cornwall, and as a site of unusually high biodiversity significance. Not only are the cliffs and the apron of rocky woods in the talus below the cliffs significant examples of uncommon natural communities in Vermont, but the rocky limestone forest found above the cliffs is unusually extensive and contains remarkably few invasive plants, hence significant on the state-level. While predominantly high and dry ridge lands, small water-related features, such as a spring, small perched marsh and shrub swamp, and vernal pool, provide important ecological/habitat diversity to the site.

Two state-threatened plants - short-styled snakeroot and harsh sunflower - are among the five newly documented rare species at the site. No less than ten uncommon plants are also found in this diverse limestone site, including species such as black maple (*Acer nigrum*), yellow oak (*Quercus muehlenbergii*), fragrant sumac (*Rhus aromatica*), purple-stem cliffbrake (*Pellaea atropurpurea*), and slender muhlenbergia (*Muhlenbergia tenuiflora*). Many other lime-loving plants that are largely restricted to the limestone, marble, and related carbonate rocks of the Champlain and Vermont Valleys are found here at The Ledges, such as hackberry (*Celtis*

occidentalis), walking fern (*Asplenium rhizophyllum*), moonseed (*Menispermum canadense*), and four-leaved milkweed (*Asclepias quadrifolia*).

The importance of the site for wildlife was seen in the well-established game trails cutting through the woods, and in the presence of forest interior songbirds, like scarlet tanager, red-eyed vireo, and hermit thrush, that migrate to the tropics and sub-tropics in the winter. The presence of a raven family early in the summer suggested that this iconic bird of the north nests on the cliffs, their preferred nesting habitat. Pending a spring return visit, the vernal pool basin observed in the fall might be critical wildlife habitat as a breeding area for some salamander and frog species. The fingernail clams observed in the dry pool are indicator species of vernal pools.

Comments & Ecological Management Considerations: The state-significant natural communities at The Ledges and almost all of the rare and uncommon plants occur at The Ledges because of the site's limestone bedrock. This is literally a limestone biodiversity showcase. As the second largest forest block (first upland forest block) in town, it is inherently important for a diverse suite of animals, including the large mammals, such as deer and bobcat; a variety of forest interior breeding songbirds; and some of the less conspicuous forest denizens, such as salamanders. Also, this site has some large trees, particularly shagbark hickory, which are known to be roosting habitat for the federally-endangered Indiana bat (*Myotis sodalis*). Since there are relatively recent records for Indiana bat less than two miles both to the west and east of The Ledges, the forests and adjacent fields could be habitat for this endangered species.

The Ledges (sites #2 & 3) are the east portion of a much larger Ecologic Habitat Block (VT Fish & Wildlife Department's 2011 analysis) which includes three other inventory sites to the west: Beaver Brook-Ledges Connection site (#29), Lower Beaver Brook (#28), and The Gully Forest Block (#29). This forested area, bisected by the naturally-vegetated Beaver Brook corridor, is the largest predominantly upland forest block in Cornwall. While its 783 acres is relatively small compared to the extensive forest blocks in the Green Mountains and the Northeast Kingdom, it is a relatively large forest block for the heavily agricultural southern Champlain Valley landscape.

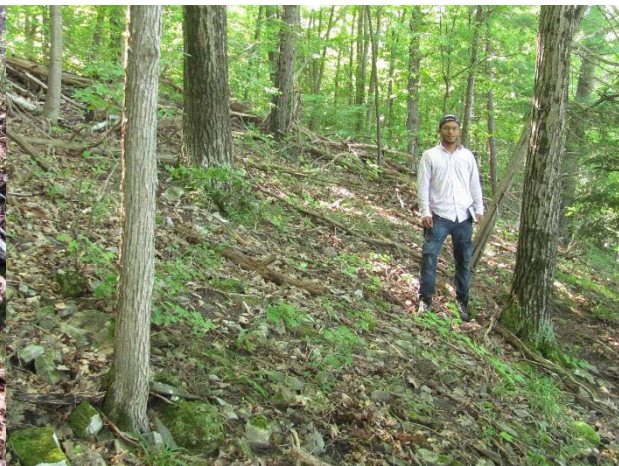
A portion of this site has been conserved through purchase by the Middlebury Area Land Trust. More conservation of this ecologically important site in Cornwall should be promoted. Conservation easements on adjacent parcels to the MALT land would add protection from development.

Photos from The Ledges, Cornwall, VT

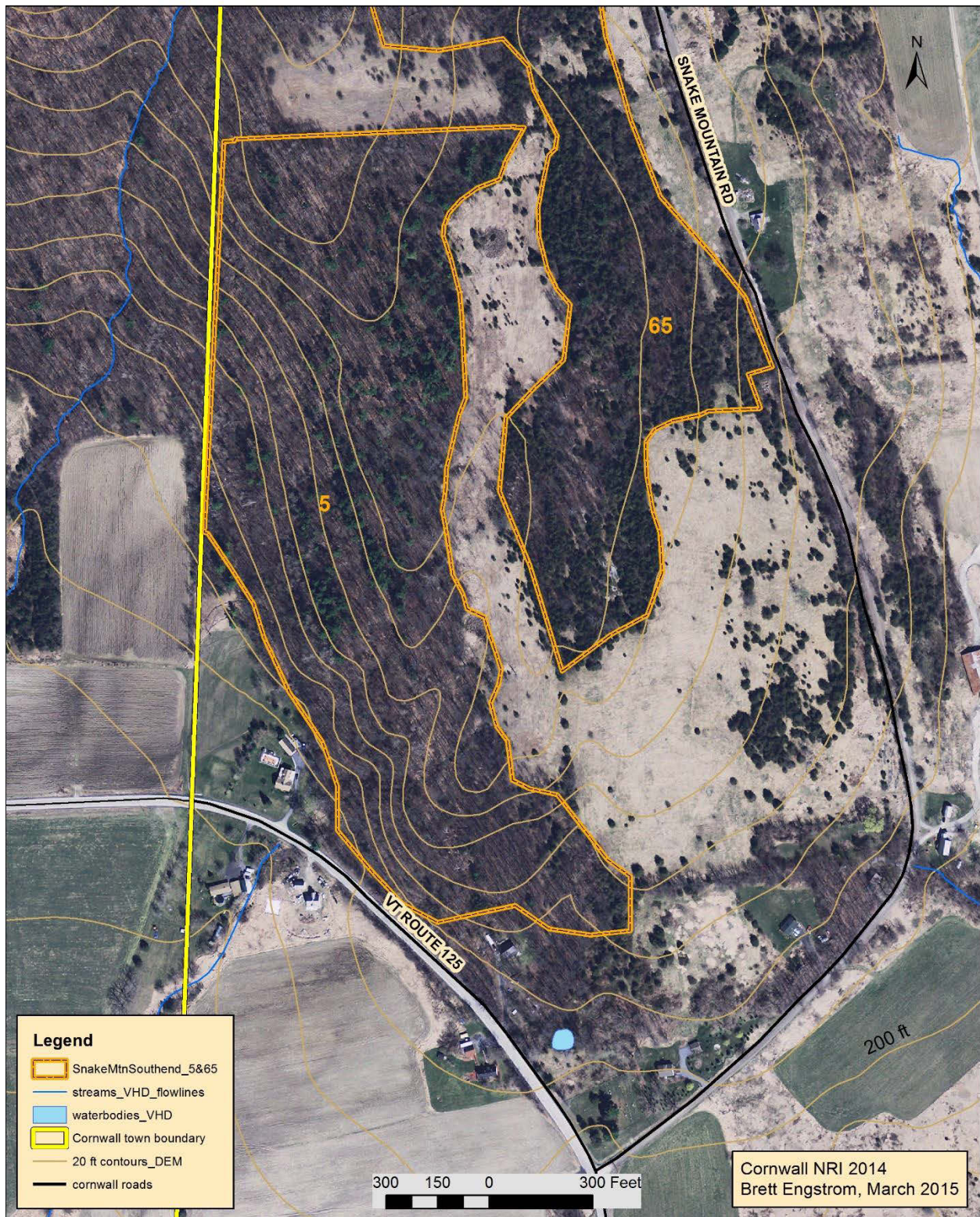
Temperate Calcareous Cliff



Transition Hardwoods Limestone Forest



Snake Mountain Southend & Snake Mtn. Rd. West (#5 & 65), Cornwall, VT



Site: Snake Mountain Southend (#5 and part of 65)

Location: North of Route 125 and west of Snake Mountain Rd. in the northwest corner of town

Information Sources: Brett Engstrom site visit, June 21, 2014; VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program) data from adjacent site in Bridport; 2013 interview with local resident and naturalist Ian Worley

Land Ownership: Privately owned lands

Significant Features:

Natural Communities & other features: Mesic Maple-Ash-Hickory-Oak Forest, Transition Hardwoods Limestone Forest

Rare, Threatened, & Endangered Species: short-styled snakeroot (*Sanicula canadensis* var. *canadensis*), troublesome sedge (*Carex molesta*)

Wildlife Habitat: Part of Snake Mountain South forest habitat block – one of the largest in the greater Cornwall area – which is less than one mile from the Snake Mountain habitat block, one of the largest and most ecologically significant in the Champlain Valley. To the northwest in Bridport, this block contains important vernal pools. Legacy hickories and oaks provide mast and potential bat roosting habitat. Successional mixed woodlands potential habitat for two rare warblers in Vermont.

Site Description: As its name suggests, this site is the south end of a rugged hill sometimes referred to as Snake Mountain South. Like Snake Mountain to the north, this quartzite hill is the ancient product of a thrust fault, where older rock has been pushed up over younger rock. This quartzite of the Monkton geological formation is unlike many quartzites in that it contains beds of limestone which greatly enhances the fertility its associated soils. The high fertility is expressed most vividly on the steep, rocky, west-facing slope where a small band of Transition Hardwoods Limestone Forest appears. After a short break, this diverse forest type continues in a band on the east side of the mountain crest in adjacent Bridport. A single stem of the state-threatened short-styled snakeroot was seen in these rich woods. This plant is part of a population that has been recorded on the mountain just over the town line in Bridport. Several uncommon sedges, including *Carex hitchcockiana*, *C. formosa*, and *C. laxiculmis* occur in this limestone forest and fertile forest at toe of slope.

With deeper fertile soils, much of the more gently sloping terrain that is forested is a Mesic Maple-Ash-Hickory-Oak Forest natural community. Though not extensive, and of variable age, portions of the forest are intact and have few invasive species. This top portion of the mountain was forested in the 1942 aerial photos and same vintage U.S.G.S. topographic map. As found at other places in town, these sites that were forested in 1942 tend to have few invasive species, especially common buckthorn (*Rhamnus cathartica*) and Morrow's honeysuckle (*Lonicera morrowii*), which are ubiquitous in the shrubby old field sites.

Included in this report because of its same ownership, the south half of the Snake Mountain Road West site (#65) is just such an old field woodland. Dominated by eastern redcedar (*Juniperus virginiana*) and common buckthorn, this woodland has a very weedy vegetation, though it also includes many natives, the most surprising being the rare troublesome sedge, which according to some references can be weedy in habit. Though small and weedy, an ecologically diversifying element of these woodlands are small quartzite slab openings. This type of successional woodland is prime habitat for two rare warblers in Vermont: blue-winged warbler (*Vermivora cyanoptera*) and golden-winged warbler (*V. chrysoptera*). According to local resident Ian Worley, these two closely-related species and their hybrids occur in numbers in similar habitat on the east side of Snake Mountain Road less than half a mile to the north. Both of these species are included in the Fish & Wildlife Department's *Wildlife Action Plan* as Species of Greatest Conservation Need.

Scattered throughout the successional and mature mesic forest are at least a couple dozen "legacy trees." These large shagbark hickory, white oak, and bur oak are generally around two feet in diameter, though the oaks ranged from three to four feet in diameter. These obviously older trees are important as wildlife mast trees, and the large exfoliating bark plates of the hickories are potential roosting habitat for bats. Given recent records of the Indiana bat from less than half a mile away, it is very possibly that these legacy trees could provide important habitat for this federally-endangered species. A nearby wet meadow which lies in between sites 5 and 65 provides good potential foraging habitat for bats.

These two inventory sites (#5 & 65) are the very south end of the 980-acre Ecologic Habitat Block (VT Fish & Wildlife Department's 2011 analysis) that lies mostly in adjacent Bridport. This is an important forest habitat block for the southern Champlain Valley, made even more significant for wildlife because of its close proximity to Snake Mountain, whose 3,000+ acres make it a premiere upland Habitat Block for the southern Champlain Valley.

Comments & Ecological Management Considerations: While of contrasting conditions, the wooded portions of these two sites would best serve wildlife and ecological habitats if kept in a wooded state: the Snake Mountain Southend site as the native forests types described above, while the Snake Mountain Road West site should be considered for early successional forest management. Summer inventory for blue- and golden-winged warblers and other early successional woodland birds in the latter site, and for bats in both woodland types, would help guide management at both sites.

Photos from Snake Mountain Southend (#5), Cornwall, VT

White oak and shagbark hickory legacy trees – potential roosting habitat for Indiana bat



Lemon Fair Middle (#8), Cornwall, VT



Site: Lemon Fair Middle (#8)

Location: Both sides of Lemon Fair about one mile north of Route 125

Information Sources: Brett Engstrom site visit on October 9, 2014; 2013 interviews with local residents Lawrence Pyne and Ian Worley

Land Ownership: Privately owned lands. Only parcel with landowner permission was visited.

Significant Features:

Natural Communities & other natural features: the Lemon Fair River; unusual seepage Wet Clayplain Forest with springs, Mesic Clayplain Forest remnant, green ash-silver maple floodplain forest

Rare, Threatened, & Endangered Species: giant floater (*Pyganodon grandis*) – a freshwater mussel; red-root flatsedge (*Cyperus erythrorhizos*) – new to Vermont

Wildlife Habitat: Some years a major waterfowl and shorebirds site during migration; mast producing large bur and white oaks (*Quercus macrocarpa* and *Q. alba*); marshes and early successional habitat important for wildlife

Site Description: Part of what locals refer to as “Lake Lemon Fair,” this site is defined by the river that greatly widens during flood stages into what appears to be a lake. While the floodway gets some fine sediment deposits during floods, the great majority of the flooded areas and adjacent uplands have heavy clay and silty clay soils deposited in the bottom of the glacial lake, or at times an arm of the sea, which filled the Champlain during glacial melt some 10,000 years ago.

Most of the uplands are still actively farmed in the Lemon Fair valley. This site contains a 3-4-acre remnant Mesic Clayplain Forest dominated by white oak and hickories, plus several mature bur oak growing in adjacent successional clayplain forest. These nut-producers are a great food source during mast years for a wide variety of wildlife, most notably for deer and turkey. The west side of the river has a 14-acre green ash dominated floodplain forest. This occurrence probably fits best into Lakeside Floodplain Forest type as described in the most current Vermont natural community classification, though it is along a river. As seen on both old and recent aerial photographs, this floodplain forest contains an oxbow channel which is an abandoned river channel.

Though the non-native reed canary grass (*Phalaris arundinacea*) dominates the wet meadows, river banks, and small drainages leading down to the river, the exposed silty/clayey river shore supports a variety of native wildflowers and sedges, including many annuals. The red-root flatsedge, a native annual sedge species, was discovered during my autumn visit. This is a new species for the Vermont flora.

Slightly upslope to the east of the river out of the floodway, there is an isolated 2-acre forest patch with a trace of clayplain forest and an unusual seepage forest with two springs. This woodland is composed of a hardwood canopy, including green, white and black ash (*Fraxinus pensylvanica*, *F. americana*, and *F. nigra*), bur oak, basswood (*Tilia americana*), and American elm (*Ulmus americana*), with an understory dominated by unusually large poison sumac (*Rhus vernix*), speckled alder (*Alnus incana*), panicled dogwood (*Cornus racemosa*) and others. This seepage forest also contained a vigorous population of wild black currant (*Ribes americanum*), a shrub that can be found in many rich swamps of the Champlain Valley, but is uncommon to rare elsewhere in Vermont. The lush groundcover here was a mix of native sedges, ferns, and herbs, the principal species being lake sedge (*Carex lacustris*), sensitive fern (*Onoclea sensibilis*), and rough-stemmed goldenrod (*Solidago rugosa*). The soil in this seepage woods was a good 10 inches of black muck over saturated clay.

According to a local sportsman and naturalist both attest to it as being a haven for wildlife, the mix of wet meadows and a variety of woodland types bordering the Lemon Fair makes this a wildlife haven. Furthermore, it is a strikingly beautiful place. During the autumn visit, the river seemed to hardly flow, its waters that unusual milky olive green color characteristic of the streams cutting through clays in Cornwall.

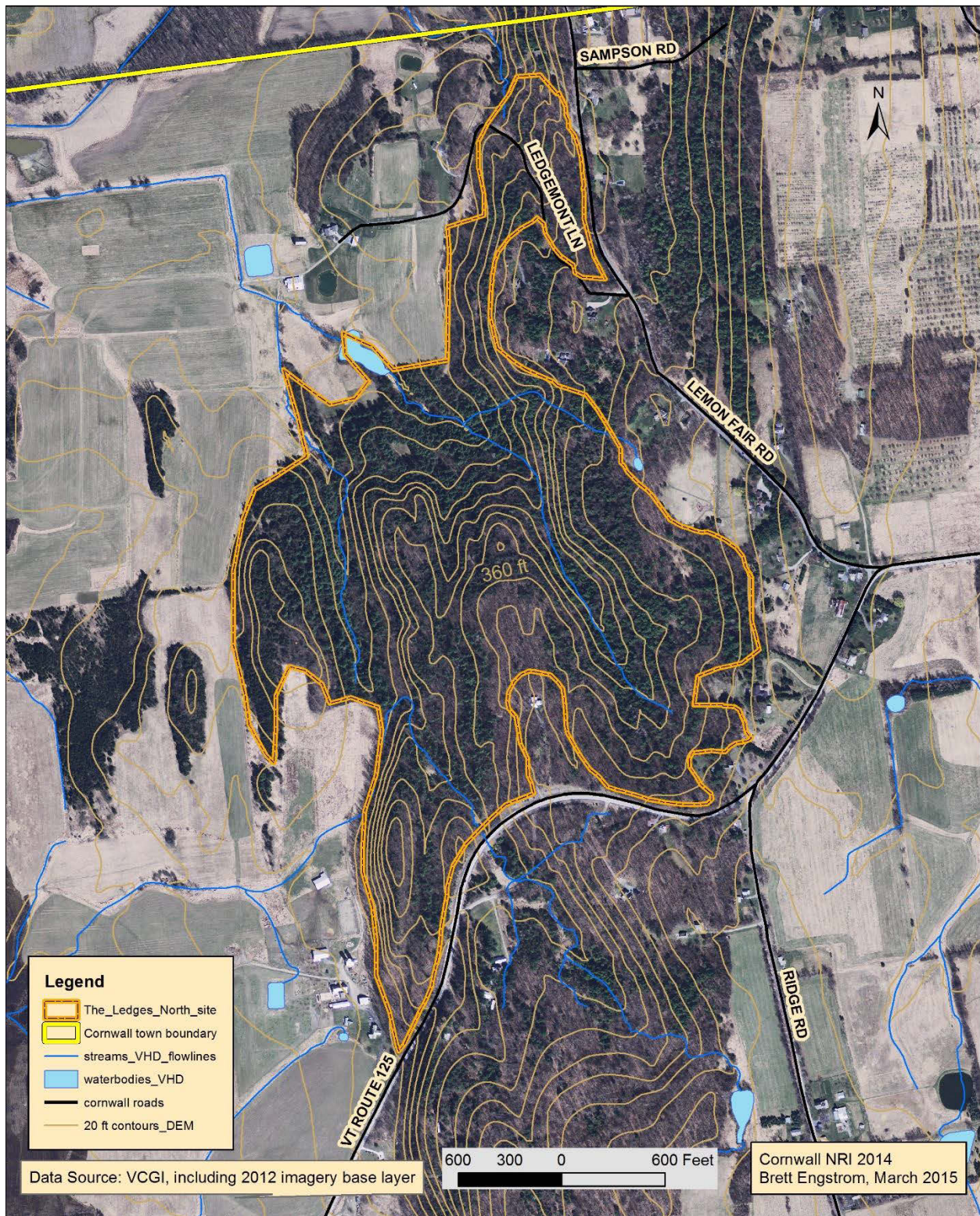
Comments & Ecological Management Considerations: Woodlands are rare along the Lemon Fair, so the remnant woodlands at this site and the site not visited downstream (#9) on the west bank are important for wildlife and ecological diversity of the river valley. The river itself is a unique aquatic feature that is important for Giant Floater, a state-threatened freshwater mussel, which is known from the Lemon Fair both upstream and downstream from this site. Protection and promotion of these woodlands and floodplains are important measures to conserve the Lemon Fair's wildlife and ecological values. Conservation of the river and its floodplain is in progress through fee purchase parcels in the state's Lemon Fair Wildlife Management Area, and conservation easements held by Vermont Land Trust, especially in the adjacent towns of Bridport and Weybridge.

What is believed to be Troublesome Sedge (*Carex molesta*) was observed during the late-season site visit. A midsummer site visit is needed to confirm this rare species in Vermont.

Photos of Lemon Fair Middle site (#8)



The Ledges North (#10), Cornwall, VT



Site: The Ledges North (#10)

Location: Forest block north of Route 125 and southwest of Lemon Fair Rd.

Information Sources: Brett Engstrom site visit on October, 10, 2014

Land Ownership: Privately owned lands. Only parcels with landowner permission were visited.

Significant Features:

Natural Communities & other features: Transition Hardwoods Limestone Forest*, Temperate Calcareous Cliff*, Temperate Hemlock-Hardwood Forest

Rare, Threatened, & Endangered Species: Seneca snakeroot (*Polygala senega*), sprout muhlenbergia (*Muhlenbergia sobolifera*) – a grass

Wildlife Habitat: One of the largest upland forest block in town - important to a wide variety of forest dwelling animals- with four small tributary drainages to the Lemon Fair River and three small class 2 wetlands.

*State-significant occurrence

Site Description: This continuation of The Ledges rocky ridge system north of Route 125 contains many of the same natural communities associated with the same limestone formation as south of Route 125. Though small in extent, the limestone forest and cliff natural communities located in the southern-most portion of the site meet the requirements of state-level significance because of their close proximity to the same communities south of Route 125. Both of these are uncommon natural communities in Vermont.

The Ledges North has a high diversity of rare and uncommon plants. Both rare plants found at this site occur in the limestone forest on top of the shaded cliff. While neither of these rare species were observed at The Ledges site to the south, many of the uncommon plants, like the yellow oak, fragrant sumac, and sedges, were observed at both sites. All of these rare and uncommon plants are strongly associated with limestone. To the list of uncommon plants at this site Back's sedge (*Carex backii*) is added.

Adding to ecological diversity of the site is a small hemlock-hardwood forest located on the north end of the visited southern hill, several headwater drainages, and a couple small wetlands. The rugged topography to the north suggests more ledges and landscape complexity which adds to the importance of the site for wildlife and a greater diversity of fauna and flora.

As was the case in most other upland forests in town, areas that were forested in the 1942 aerial photos at this site are the most natural today. This can be seen most readily in the distribution of woody invasive plants, like common buckthorn (*Rhamnus cathartica*) and Morrow's honeysuckle (*Lonicera morrowii*), where the buckthorn and honeysuckle are often rampant in the understory of successional and secondary (i.e. post-agricultural) woods and scantily present in

the continuous forest. Forest edges are often rank with these invasives. The 1942 aerial photos show that most of this site was wooded at that time, which suggests that the forest might be in a relatively healthy condition.

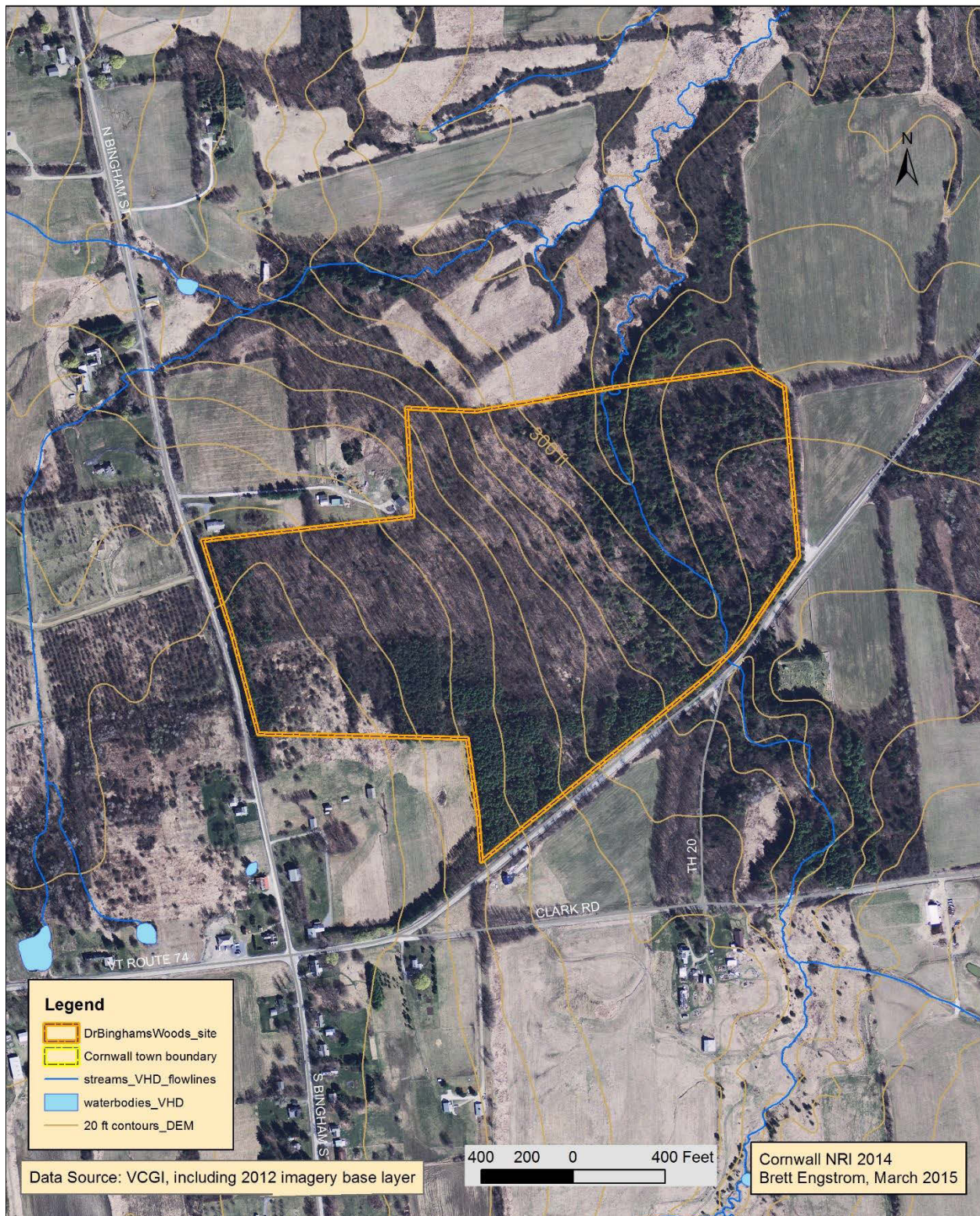
Comments & Ecological Management Considerations: Unfragmented by roads and development, this ~150-acre site is a large block of upland forest for the town of Cornwall. Forests of this extent are important for a wide array of birds that depend on deep woods, like many of the songbirds that migrate from the tropics to Vermont to breed in the summer. Protection of this site from encroaching development should be promoted.

Only a small area in the southern-most tongue of this site was visited during the inventory. Inventory of other portions of the site where landowner permission was obtained is recommended to complete its assessment.

Transition Hardwoods Limestone Forest in October at The Ledges North (#10)



Dr. Bingham's Woods (#23), Cornwall, VT



Site: Dr. Bingham's Woods (#23)

Location: Woods to either side of Beaver Brook north of Route 74 in West Cornwall

Information Sources: Brett Engstrom site visit on July 8, 2014; 2013 resident interviews (Marc Ringey & Steve Pratt); Beers' 1871 Atlas of Addison County; VT Dept. of Fish & Wildlife

Land Ownership: Privately owned land

Significant Features:

Natural Communities & other features: Sand-Over-Clay Forest*; Rich Northern Hardwood Forest; Wet Clayplain Forest; ravine with clear water brook

Rare, Threatened, & Endangered Species: short-styled snakeroot (*Sanicula canadensis* var. *canadensis*)

Wildlife Habitat: High potential as wildlife linkage habitat. Abundant deer sign noted in ravine bottom.

*State-significant occurrence

Site Description: At 73 acres, this relatively small patch of woods stands out clearly in the 1942 photos as mature, intact, mixed forest. Both Marc Ringey and Steve Pratt remarked on these woods as being unique, and about the hemlock in the ravine. The site features a beautiful wooded ravine and adjacent gently sloping terrain with a variety of soils. A mix of mature hemlock, red maple, and other hardwoods of Sand-Over-Clay Forest dominates the sandy loam soils east of the ravine and on the upper slopes of the ravine. This is a rare natural community in Vermont. Like most of the forest at this site, this Sand-Over-Clay Forest is remarkable for its lack of invasive plants. In contrast, the forest edges and forest adjacent to this "continuous forest" is rank with common invasives, particularly common buckthorn (*Rhamnus cathartica*) and Morrow's honeysuckle (*Lonicera morrowii*). Many of the trees are notable for their height, especially in the ravine where some hemlock appeared over 100 feet tall. A lone, very large (over two feet in diameter) pitch pine (*Pinus rigida*) growing in the midst of the sandy soil woods is highly unusual: it might be the only pitch pine in Cornwall.

As it passes through the shady ravine, the south branch of Beaver Brook is more steeply graded and contains gravel bars loaded with distinctive purple Monkton quartzite pebbles. It was remarkably clear during the midsummer field visit and had minnows. A small alluvial fan associated with a tributary ravine contains an unusual patch of youthful sugar maple, white ash, basswood, and hickories with lush groundcover indicating seepage. Also in the ravine bottom is a very odd deep pool of water in a trench. Over three feet deep and loaded with logs and sticks, its dark waters are like a black hole of sorts. Though springs are marked on old historical maps in this vicinity, this pool is certainly not a spring given its dark, warm waters.

West of the ravine the forest grades from a mature Rich Northern Hardwood Forest, through a short stretch of Transitional Hardwoods Limestone Forest associated with limestone outcrop, up into a mature sugar maple forest containing a few large, old trees. The soils on this side of the ravine are much heavier, ranging from clay to silt loam in texture. Besides the lack of invasives, the most remarkable aspect of the forests on the west side is a bench seepage zone that supports a forest unlike any other encountered in town. This seepage woodland, which classifies as a Wet Clayplain Forest, has a scattered large yellow birch and shagbark hickory high canopy with a dense small tree understory dominated by musclemore (*Carpinus caroliniana*). The wet clay soil is lushly vegetated with woodland horsetail (*Equisetum sylvaticum*), sensitive fern (*Onoclea sensibilis*), and jumpseed (*Tovara virginiana*), and wetland sedges.

The three uncommon sedges (*Carex albursina*, *C. hitchcockiana*, and *C. laxiculmis*) found at the site appeared in the limestone forest and other fertile soils – all typical habitat.

Uncharacteristically, the rare short-styled snakeroot appeared in the less fertile sandy soils of the mixed wood east of the ravine.

Comments & Ecological Management Considerations: Though not a large forest block, Dr. Bingham's Woods is an important piece of intact, natural forest in the upper Beaver Brook drainage. The lack of invasives noted at the site is not a random coincidence. While so much of the successional and secondary (post-agricultural) forest in town is rampant with invasive woody plants, the forests that have been continuously forested since at least 1942, and probably never cleared for agriculture, contain few invasives. A continuation of the current management of light timber harvest will likely keep the woody invasive species out, especially if large breaks in the canopy are not created. By remaining undeveloped, this forest will continue to be important wildlife linkage habitat in the Beaver Brook watershed.

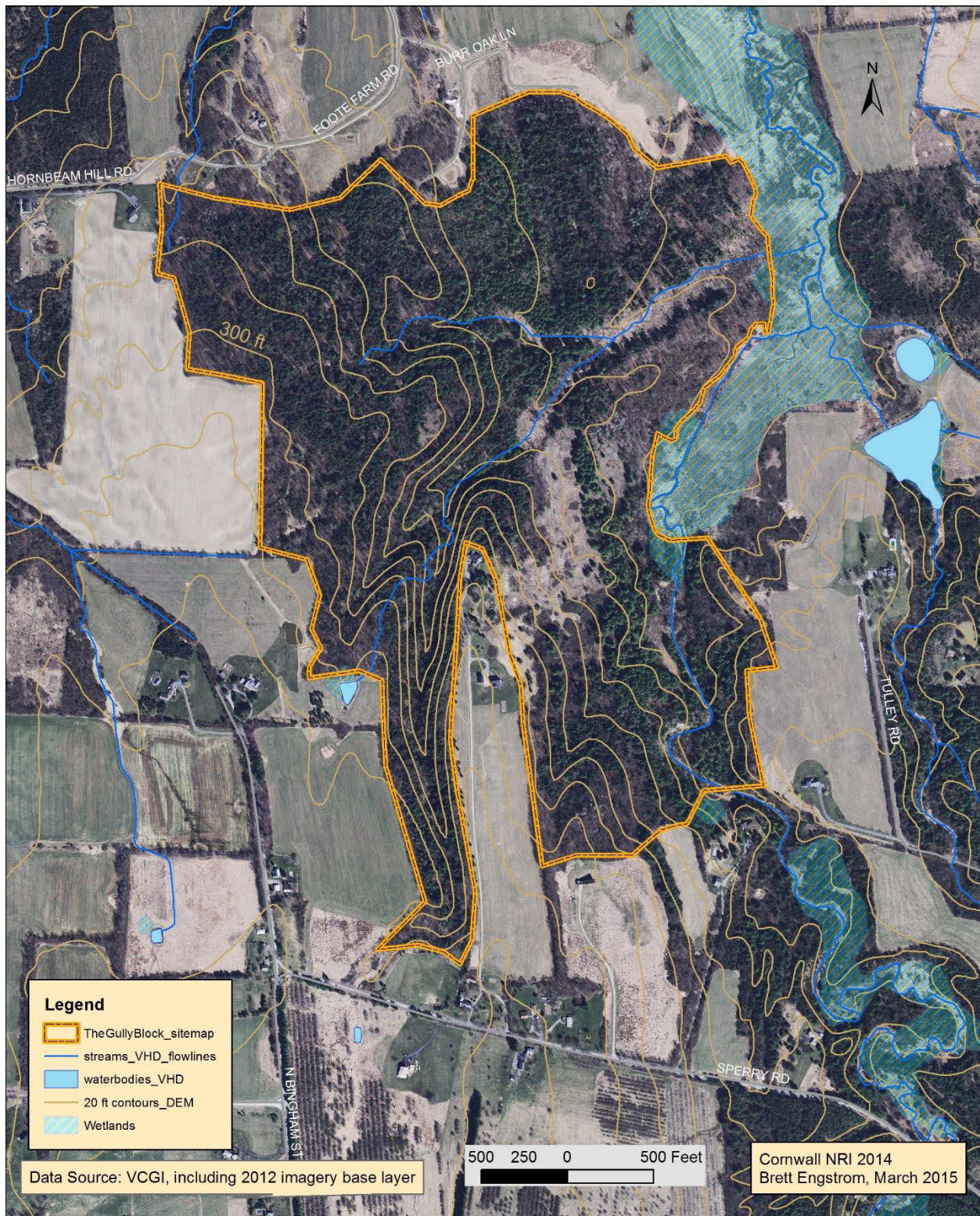
The unusual bench seepage forest needs to be revisited to determine whether it might be classified as a Wet Clayplain Forest.

The section of Beaver Brook passing through Dr. Bingham's Woods is likely one of the most natural stream sections in town. Unfortunately, the Route 74 culvert for Beaver Brook is incorrectly graded. Its downstream end has 1+-foot waterfall and plunge pool which blocks fish and other aquatic organisms to freely pass upstream.

Photos from Dr. Bingham's Woods (#23), clockwise from upper left: Temperate Hemlock-Hardwood Forest in sandy loam soils; hardwood seepage forest groundcover; stream gravel with Monkton quartzite pebbles; south branch Beaver Brook in ravine.



The Gully Forest Block (#27), Cornwall, VT



Site: The Gully Forest Block (#27)

Location: West side of Beaver Brook northeast of the north end of North Bingham St.

Information Sources: Brett Engstrom site visits in 2014 on June 22 and July 9; data from the VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program); 2013 resident interviews (Marc Ringey & Steve Pratt)

Land Ownership: Privately owned lands

Significant Features:

Natural Communities & other features: Temperate Hemlock-Hardwood Forest, Mesic Clayplain Forest*, Sand-Over-Clay Forest*, Temperate Calcareous Cliff, Cattail Marsh, Seep, high-gradient stream and riparian corridor, erosional bank, ravine

Rare, Threatened, & Endangered Species: American Hazelnut (*Corylus americana*)

Wildlife Habitat: Part of largest upland forest block in town - important to a wide variety of forest dwelling animals; borders Beaver Brook and riparian wetlands, important habitat for otter, beaver, and other wildlife requiring aquatic environments

*State-significant occurrence

Site Description: This sloping clayplain area is dissected by several stream drainages, the largest locally referred to as "The Gully". It features examples of two rare natural communities in Vermont: Mesic Clayplain Forest and Sand-Over-Clay Forest. Based on 2014 field work, the Mesic Clayplain Forest occurrence is now roughly 55 acres, which is a five-fold expansion from the 11-acre occurrence originally mapped in 2005. Dominating the north portion of the site, the clayplain forest is well-drained and has a canopy dominated by a mix of hemlock, sugar maple, American beech, and other hardwood species. Uncharacteristically, transition hardwoods, such as oaks and hickories, are infrequent. The forest in this well-drained portion contrasts with the wetter portion of clayplain to the east, both canopy and groundcover. Because it has been continuously forested for over 75 years (and likely never cleared), the clayplain forest has remarkably few invasive plants. This stands in sharp contrast with the successional woodlands which are rife with invasive honeysuckle and buckthorn.

While the ravines have forest similar to the clayplain areas, the soil textures in them vary inversely from the clayplain. The Gully abruptly cuts 80 feet or more down through clay above to sand below. The lower portion of this ravine appears as pristine forest, with towering maples and hemlock shading an intermittent stream. Logs of large fallen trees span the ravine bottom in places. Pockets of enriched soils on the lower slopes feature indicator species such as blue cohosh (*Caulophyllum thalictroides*), silvery glade fern (*Deparia acrosticoides*), and bulblet fern (*Cystopteris bulbifera*). In contrast the upstream portion of the ravine is in a more disturbed

condition containing old dumped metal pieces and yard wastes, plus exotic plants. The forest in this ravine is perhaps best classified as Temperate Hemlock-Hardwood Forest.

The lower stretch of Beaver Brook along the east side of The Gully Forest Block contains a one-third-mile segment of high-gradient stream, or quickwater, which is unique in the town of Cornwall. The stream cuts into a high erosional bank on the outer side of one bend, while a short distance downstream it bumps into a small limestone cliff. The cobble and boulder-bedded stream below the cliff runs straight for 500 feet and is bordered by narrow alluvial meadow vegetation containing largely native grasses, sedges, and wildflowers.

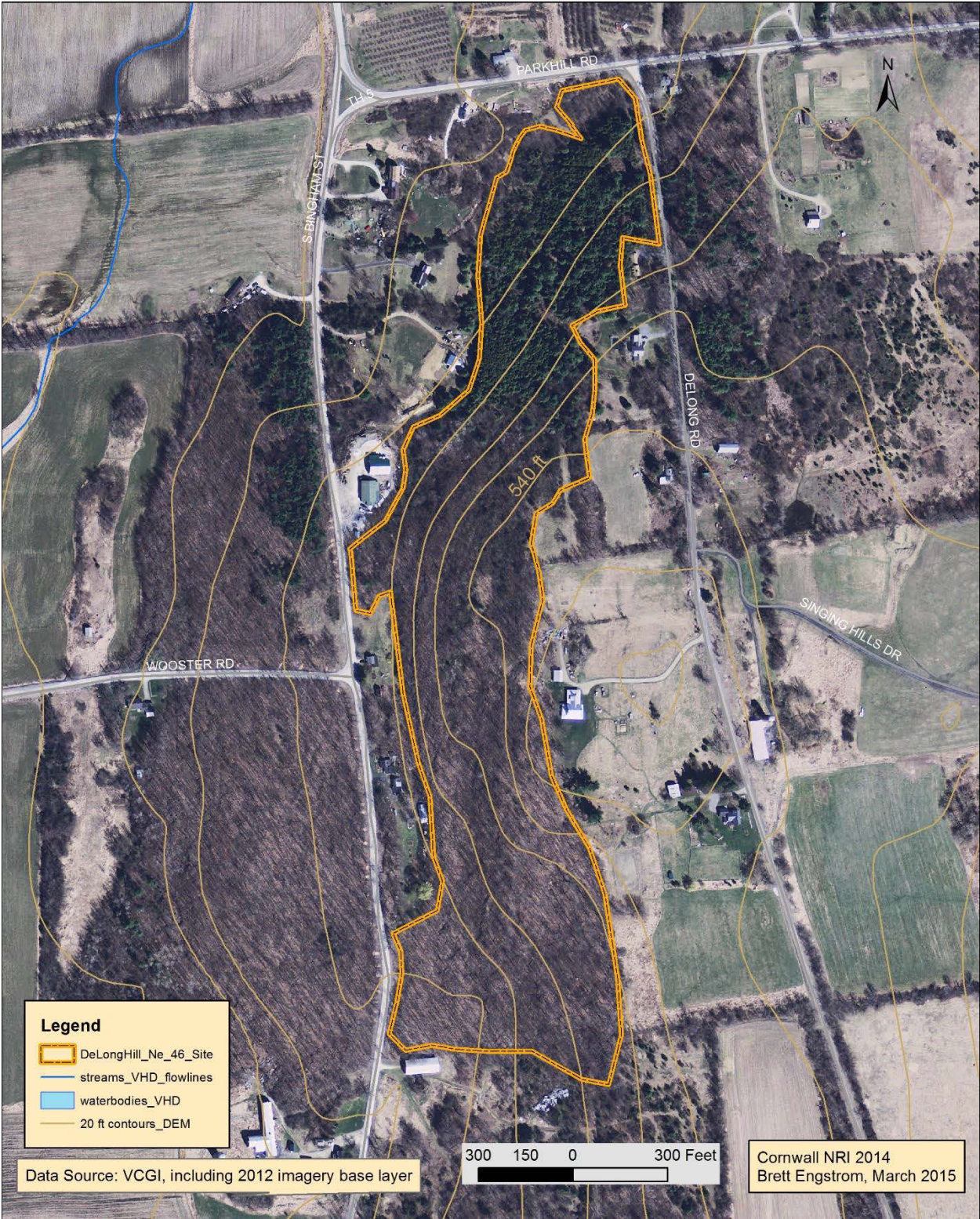
Other features that add ecological diversity to the site include Seep and Cattail Marsh natural communities, and extensive alluvial meadows, all bordering Beaver Brook. The mature clayplain forest, ravine forest, successional clayplain forest, and variety of riparian features make this great wildlife habitat. Its importance for wildlife was noted by several residents. One interesting resident observation was that fox used the sandy soils in some of the ravines for denning because of the easy digging. I observed well-established game trails crossing The Gully, and otter and beaver sign along Beaver Brook. Such relatively large blocks of forest are important breeding areas for birds that migrate to the tropics and subtropics during the winter, such as red-eyed vireo, hermit thrush, and eastern wood pewee. All three of these species were observed in the clayplain forest. A wood pewee nest was discovered high in a ravine maple during the early July field visit.

Comments & Ecological Management Considerations: The Gully Forest Block (#29) is the west portion of a much larger Ecologic Habitat Block (VT Fish & Wildlife Department's 2011 analysis) which includes three other inventory sites to the east: Lower Beaver Brook (#28), Beaver Brook-Ledges Connection (#29), and The Ledges (#2 and 3). This forested area, bisected by the naturally-vegetated Beaver Brook corridor, is the largest upland forest block in Cornwall. While its 783 acres is relatively small compared to the extensive forest blocks in the Green Mountains and the Northeast Kingdom, it is a relatively large forest block for the heavily agricultural southern Champlain Valley landscape. While conservation easements occur on a couple parcels in The Gully site, protection of more parcels, especially those containing clayplain forest, would promote and conserve the wildlife and ecological values of this important Habitat Block.

Photos from The Gully Forest Block (#27), clockwise from upper left: Mesic Clayplain Forest, seep, straight quickwater stretch of Beaver Brook, The Gully forest



DeLong Hill North-east (#46), Cornwall, VT



Site: DeLong Hill East - north (#46)

Location: South of Parkhill Rd., between South Bingham St. and DeLong Rd.

Information Sources: Brett Engstrom site visit in July, 15, 2014; data from the VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program); 2013 resident interview with Marc Ringey

Land Ownership: Privately owned lands. Only parcels with landowner permission were visited.

Significant Features:

Natural Communities & other features: Transition Hardwoods Limestone Forest, Mesic Maple-Ash-Hickory-Oak Forest, limestone slabs and solution cavities

Rare, Threatened, & Endangered Species: short-styled snakeroot (*Sanicula canadensis* var. *canadensis*), troublesome sedge (*Carex molesta*)

Wildlife Habitat: North end of the greater DeLong Hill Ecologic Habitat Block, third largest upland forest block in town.

Site Description: With a summit elevation at 580 feet, DeLong Hill has the distinction of being the highest point in town. However, since there are several places over 500 feet in elevation in town it is not a standout summit. This 35-acre site is the forested rocky west-facing slopes of this limestone hill. Looking at the 1942 aerial photographs one can see the big open limestone slabs in the partly wooded north half of the site. Though weedy in places, the locally significant limestone forest at this site has all the species that seem characteristic of the Transition Hardwoods Limestone Forest natural community found elsewhere in Cornwall, including many of the same rare and uncommon species associated with the rocky limestone habitat. Small colonies of the rare short-styled snakeroot (also state-threatened) and Troublesome Sedge occur in these woods, as well as the uncommon Hitchcock's Sedge (*Carex hitchcockiana*) and Slender Muhlenbergia (*Muhlenbergia tenuiflora*). Interestingly, the short-styled snakeroot was collected from this hill over a century ago, in 1898.

To the south of the limestone forest, the gentle southwest-facing slope has deeper soil and transitions into a Mesic Maple-Ash-Hickory-Oak Forest, now currently managed as a sugarbush. To the north the ground that was open pasture in 1942 aerial photos is now dense successional woodlands of almost impenetrable invasive buckthorn (*Rhamnus cathartica*) and honeysuckle (*Lonicera morrowii*). These successional thickets are also found in the middle of the limestone forest associated with the large, weedy slab openings. Characteristic of limestone country, solution cavities can be found scattered throughout the site. One slot-shaped cavity was close to ten feet deep – deep enough to think about the presence of caves in the vicinity. Marc Ringey said that he had heard that there was a cave on the hill, though he was not certain that it was DeLong Hill.

While quite narrow, the wildlife values of this site are enhanced by it being part of a 280-acre forest block that extends south into Whiting. Furthermore, the Cornwall Swamp and adjacent wetlands to the south are only about one mile away, though roads, including Route 30, lie in between. Onsite, a major game trail was observed crossing diagonally uphill through the limestone forest, and a woodchuck or fox burrow was noted. rufous-sided towhee and catbird were heard in the dense shrub thickets at the site's north end.

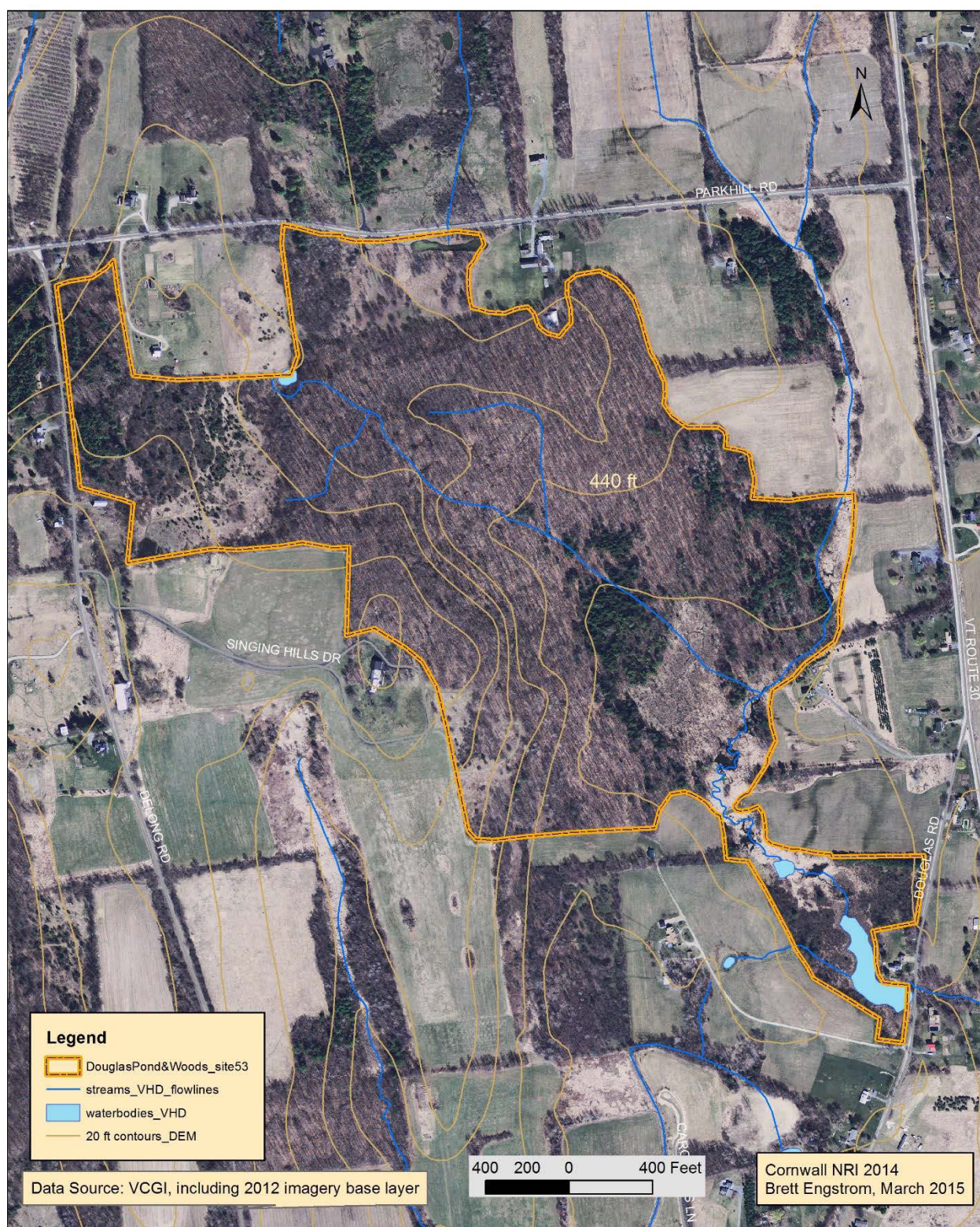
Comments & Ecological Management Considerations: While seemingly kept in check in the closed canopy limestone forest (areas which were forested in the 1942 aerial photos), woody exotics, especially the invasive honeysuckle and buckthorn, are a major issue in the successional woodlands and young forest that was open pasture 80 years ago. These invasives crowd out native species thereby diminishing the diversity and condition of the native species, and the quality of the limestone forest natural community.

The site's wildlife and ecological values are best conserved if development takes place closest to the roads, thereby maintaining a forest interior habitat. Single-tree selection timber management is suggested in order to reduce the size of canopy openings in which invasive plants thrive.

Photos from DeLong Hill East-north (#46), clockwise from upper left: Transition Hardwoods Limestone Forest, solution cavity, short-styled snakeroot (in center), and limestone forest with a Pennsylvania Sedge (*Carex pensylvanica*) lawn.



Douglas Pond and Woods (#53), Cornwall, VT



Site: Douglas Pond and Woods (#53)

Location: Pond (at Douglas Pond Rd.) and woods up drainage to northwest

Information Sources: Brett Engstrom and Marc Lapin site visit on July 16, 2014. Data from the VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program); 2013 resident interviews (Annie Wilson, Steve Pratt, Marc Ringey)

Land Ownership: Privately owned lands. Only parcels with landowner permission were visited.

Significant Features:

Natural Communities & other features: Mesic Maple-Ash-Hickory-Oak Forest, Transition Hardwoods Limestone Forest, Sand-Over-Clay Forest, Hemlock-Balsam Fir-Black Ash Seepage Swamp, Shallow Emergent Marsh, Seep, springs

Rare, Threatened, & Endangered Species: short-styled snakeroot (*Sanicula canadensis* var. *canadensis*), shorthusk (*Brachyelytrum erectum*)

Wildlife Habitat: Important wildlife habitat with diversity of uplands, wetlands, and one pond; two wildlife travel corridors nearby, including one connecting with Cornwall Swamp and the extensive Otter Creek Swamps complex

Site Description: Though only a modest 150-acres in size, this site contains an impressive diversity of both upland and wetland habitats and natural communities. The bulk of the upland forests are mature hardwoods of the Mesic Maple-Ash-Hickory-Oak Forest natural community. The Stetson soils supporting this forest are well-drained fine sandy loams grading to gravelly sands at depth. Along a minor drainage, and in a cove at the base of the drainage, the soil is obviously highly fertile, with a lush herbaceous groundcover including enrichment indicators such as moonseed (*Menispermum canadense*), blue cohosh (*Caulophyllum thalictroides*), and glade fern (*Diplazium pycnocarpon*). In these highly fertile areas sugar maple and basswood dominate the canopy, which in places was measured at 110 feet! A small pocket of large sugar maple below the ledges had the characteristics of old-growth. The state-threatened short-styled snakeroot and the rare shorthusk grass occurred in these rich pockets, and in an adjacent pocket of Transition Hardwoods Limestone Forest associated with limestone ledges.

Downslope from the fertile hardwood forest is a band of Sand-Over-Clay Forest that wraps around the large wetland upstream from Douglas Pond. With a mix of white pine, red maple, beech, red oak, and birches, this rare natural community has acidic sandy soils overlying clay. In an area close to the wetlands, the canopy is dominated by large hemlock. Remarkable about all of the upland forests was the almost complete lack of buckthorn, honeysuckle, or other invasive species. These woody invasives are common in most forests in Cornwall, especially those that were cleared for agriculture.

A series of springs occurs in the middle of the forest. The spring-fed drainages coalesce and form a Seep natural community which occupies a 25-30-foot wide drainage. This drainage flows directly into a small seepage swamp that is best characterized as a Hemlock-Balsam Fir-Black Ash Seepage Swamp natural community, though it has no balsam fir. The swamp has a mixed canopy of hemlock, black ash, and musclewood (*Carpinus caroliniana*) of mostly young, pole-sized trees. Scattered patches of spicebush (*Lindera benzoin*) give the swamp a more southern character. The swamp has shallow (8 inches) muck soil. A large beaver marsh sits adjacent the swamp. The snags in this open wetland suggest that before the beaver impounded the drainage it was a swamp similar to the adjacent, extant swamp. The marsh now has a luxuriant growth of cattail, reed canary grass (*Phalaris arundinacea*), and a diverse mix of wetland grasses and sedges.

During the inventory's preliminary interviews, several residents remarked on the wildlife at the pond and in the wetlands and forests upstream from the pond. Otter, beaver, turkey, and deer were noted, with bobcat and even a catamount reported from along Route 30 nearby. Wildlife travel corridors were reported both due east of the site, leading directly to Cornwall Swamp, and crossing DeLong Road to the southwest.

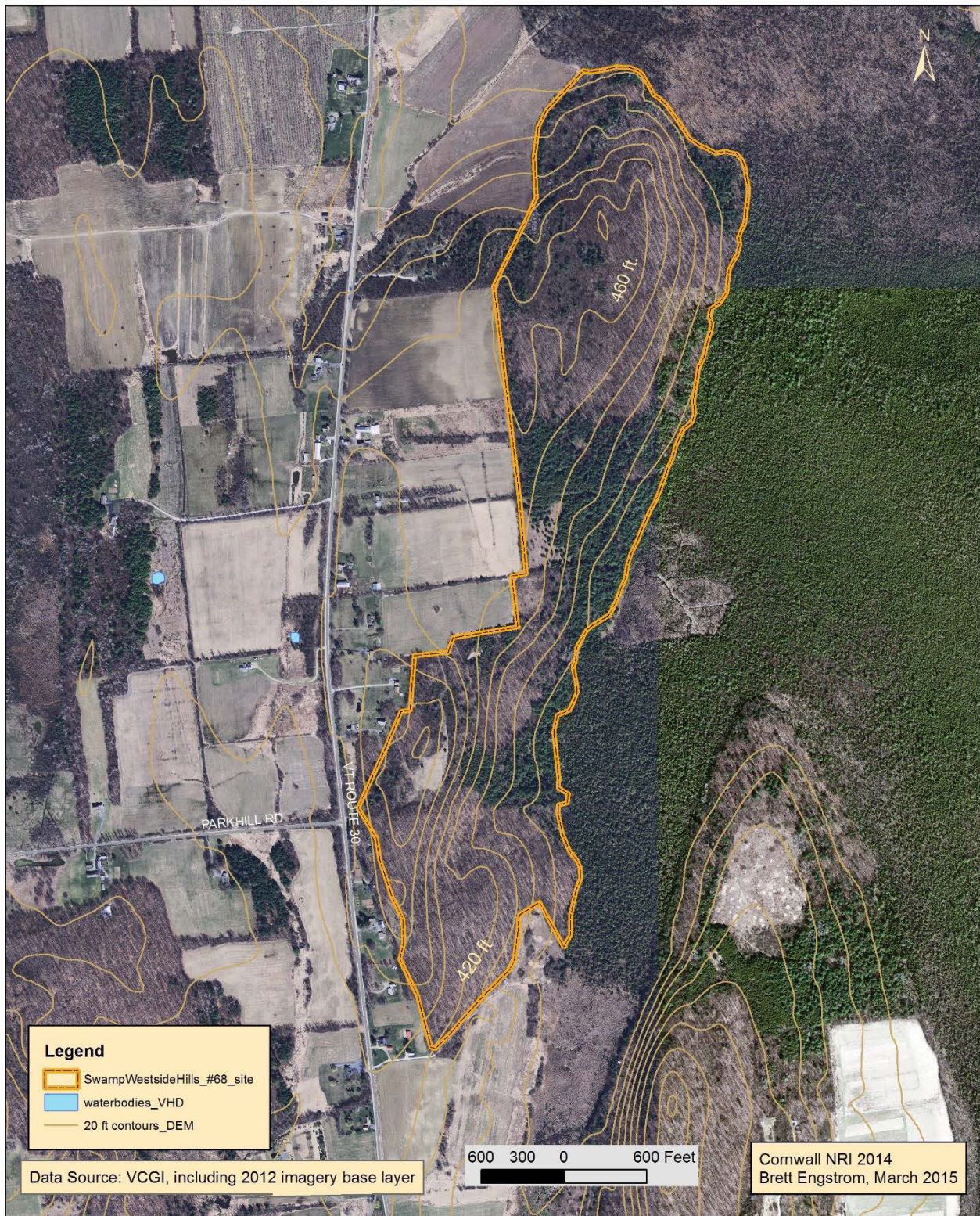
Comments & Ecological Management Considerations: Douglas Pond is an artificially created pond that is owned by the town. It once was managed as a pond for swimming. The pond level dropped at some point in the past and the man-made beaches and exposed shoreline are now thick with invasive buckthorn and honeysuckle. While this is no longer a public swimming pond, Douglas Pond increases the value of the whole site as wildlife habitat.

While no single natural community rises to the state level of significance, combined they form a diverse and integrated natural community complex, with surprising variety in soils, topography and hydrology. And the lack of invasive plants in the uplands was truly remarkable. The site's springs are one of the headwaters of the Douglas Pond drainage which feeds directly into Cornwall Swamp after passing under Route 30. Being a headwater tributary to the regionally significant Cornwall Swamp is of ecological significance on its own. In sum, this is a highly significant site locally and warrants protection from development.

Photos from Douglas Pond and Woods (#53), clockwise from upper left: Mesic Maple-Ash-Hickory-Oak Forest, “rich cove” of preceding forest natural community, spring-fed Seep drainage, Hemlock-Balsam Fir-Black Ash Seepage Swamp without the fir



Swamp Westside Hills (#68), Cornwall, VT



Site: Swamp Westside Hills (#68)

Location: Hills west of Cornwall Swamp, excluding Scove Hill

Information Sources: Brett Engstrom site visit in May 14, June 23, Sept. 15, 2014; Vermont Fish & Wildlife data; 2013 resident interviews (Steve Pratt, Marc Ringey)

Land Ownership: Privately owned lands

Significant Features:

Natural Communities & other features: Mesic Maple-Ash-Hickory-Oak Forest*, Transition Hardwoods Limestone Forest, Wet and Mesic Clayplain Forest

Rare, Threatened, & Endangered Species: short-styled snakeroot (*Sanicula canadensis* var. *canadensis*), shorthusk (*Brachyelytrum erectum*), broad beech-fern (*Phegopteris hexagonoptera*)

Wildlife Habitat: Upland portion of the largest Ecologic Habitat Block in Cornwall; contains mapped deer wintering area; immediately adjacent huge forested wetland; variety of large mammals reported for the area

*State-significant occurrence

Site Description: Rising one hundred plus feet vertically above Cornwall Swamp, the limestone hills that constitute this site feature a state-significant example of Mesic Maple-Ash-Hickory-Oak Forest that occurs in three areas separated by bands of dense northern white cedar (*Thuja occidentalis*) that colonized old fields. Though some of this mesic, or moist, hardwood forest is young as a result of recolonizing old fields, the bulk of it is composed of mature sugar maple, bitternut hickory, and a variety of other hardwoods. Overall it is a “rich” forest - a forest that supports a wide variety of woodland wildflowers, ferns, and sedges requiring highly fertile soils. When I visited the north hill in mid-May, spring wildflowers carpeted the forest floor, including four violet species, trout lily (*Erythronium americanum*), lime-loving sedges, emerging maidenhair fern (*Adiantum pedatum*), and sugar maple seedlings. The uncommon Hitchcock’s sedge is unusually abundant in these rich woods. Embedded in the matrix mesic forest, the Transition Limestone Hardwoods Forest occurs as small patches associated with low limestone knolls and ledge. The state-threatened short-styled snakeroot appeared to prefer these rocky limestone areas to the less rocky areas.

While rampant in the successional woodlands adjacent to the west, the invasive common buckthorn and Morrow’s honeysuckle are surprisingly scarce in the majority of the upland which has been forested continuously since at least 1942. This holds true as well for the narrow band of clayplain forest bordering the swamp at the toe of the slope. The clay soils in this band range from moist to wet. They support a high diversity of upland and wetland trees and herbs, many showing an affinity to highly fertile soils. In one wet clay area, the canopy was an odd mix of northern and southern tree species, including northern white cedar, balsam fir, basswood, yellow

birch, bur oak, and bitternut hickory. The rare broad beech-fern discovered at this site grows in the mesic clay forest while the shorthusk (a grass) is in both the mesic clay forest and the other rich mesic forest upslope.

While the familiar coyote and deer were observed at the site during the 2014, some of the rarely observed large mammals, including both bobcat and catamount, have been reported from farmlands adjacent the forest.

Comments & Ecological Management Considerations: The Swamp Westside Hills site is the upland portion of the largest Ecologic Habitat Block (VT Fish & Wildlife Department's and Vermont Land Trust 2011 analysis) in Cornwall. At over 3,500 acres, this uninterrupted forest block dwarfs all the other forest blocks in town. As such, these hills act as a wide buffer to the state-significant wetlands of Cornwall Swamp and therefore help form a representative piece of the formerly widespread upland-wetland landscape characteristic of the east side of town.

Most of the forest on the site's south hill has a conservation easement and is currently managed as a sugarbush. The north hill warrants similar protection to maintain or enhance its ecologically important forest natural community and state-threatened plant.

If either Mesic Maple-Ash-Hickory-Oak Forest and/or Transition Hardwoods Limestone Forest occurs on nearby Scove Hill, that acreage could be considered part of the same natural community type occurrence on the Swamp Westside Hills.

Photos from Swamp Westside Hills (#68), starting from upper left clockwise: spring wildflower display in Mesic Maple-Ash-Hickory-Oak Forest; view of same natural community mid-summer; humus-rich topsoil in preceding forest; Mesic Clayplain Forest



Cornwall Swamp Center (#70) and adjacent swamp sites, Cornwall, VT



Site: Cornwall Swamp Center (#70)

Location: Large central portion of swamp east of Scove Hill

Information Sources: Brett Engstrom site visit on Sept. 11, 2014. Data from the VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program); 2013 resident interviews (Steve Pratt, Marc Ringey)

Land Ownership: Mostly public and private conservation organization (The Nature Conservancy) owned lands

Significant Features:

Natural Communities & other features: Red Maple-Northern White Cedar Swamp*, Northern White Cedar Swamp*, Mesic Clayplain Forest. In adjacent parts of swamp: Red or Silver Maple-Green Ash Swamp*, Red Maple-Black Ash Seepage Swamp*

Rare, Threatened, & Endangered Species: swamp fly-honeysuckle (*Lonicera oblongifolia*) and white adder's-mouth (*Malaxis monophyllos* var. *brachypoda*) observed during 2014 inventory; and four-toed salamander (*Hemidactylium scutatum*), plus several more plant species, known from the swamp but not observed in 2014

Wildlife Habitat: Largest Ecological Habitat Block in Cornwall (including surrounding parts of the swamp) and one of the largest wetlands in the Champlain Valley; major mapped deer wintering area; only noted bear habitat in Cornwall

*State-significant occurrence

Site Description: Cornwall Swamp is an outstanding wetland on local, state, regional and national levels. It is one of the largest and most ecologically significant forested wetlands in the northeastern United States and adjacent Canada. Sitting adjacent to, and largely in the floodplain of, Otter Creek, it is major part of the extensive Otter Creek Swamps wetland complex that extends from Brandon north to Cornwall-Middlebury. While its importance as a wetland has been long known and studied by state wildlife staff, scientists, and naturalists, I spent a day in the swamp for the Cornwall natural resources inventory to reacquaint myself with it after almost 20 years since having been there.

Entering the swamp from Scove Hill there is a narrow band of mesic clayplain forest bordering the wetland. In some places this is a rich forest with a great diversity of herbs and woody plants, including many bur oak – a signature tree of the clayplains – while in others, especially where formerly open field, it is just the opposite – species poor both woody and herbaceous.

In just a few steps to the east, feet get wet on the periphery of the vast Red Maple-Northern White Cedar Swamp that covers the majority of the wetland. While the mossy hummocks are dry, the proportionally larger hollows have some standing water much of the year. Saturated

organic soil, known as muck, rules the swamp and quickly it becomes over stick probing depth of three feet. Red maple forms a scattered supercanopy at 45 feet, while a near continuous cover of pole black ash, yellow birch, northern white cedar, and American elm form a second canopy ± 30 feet high. While not necessarily dense, the tall shrub layer in the swamp demands attention for it contains poison sumac (*Rhus vernix*) whose branches with toxic-to-touch leaves are often at face height. Shrubbery less than three feet tall is not prevalent, though the rare swamp fly-honeysuckle, which is often a low shrub, can be found scattered throughout this section of the swamp. The groundcover is a variable mix of wetlands herbs, sedges, and ferns.

Less than one-thousand feet into the swamp the cedar becomes a canopy dominant, in some places forming near impenetrable thickets of leaning, pole-sized stems. In this dense cedar-thicket shade various *Sphagnum* and other moss species dominate both hummock and hollow of the forest floor. Though wet, the hollow bottoms generally lack standing water suggesting that this cedar-dominated section of the swamp occupies marginally higher ground. Most of the plant diversity in this area centers in and around small canopy openings, and includes species such as bog goldenrod (*Solidago uliginosa*) and the rare white adder's mouth (an orchid). Black spruce (*Picea mariana*) also appears in the cedar swamp, as do some impressive white pine that tower above the cedar.

A small flock of warblers, along with a resident chickadee, flitted around in the cedar and other tree canopies on the autumn visit. Using the swamp as a feeding stopover, their presence links the north with the tropics and subtropics where they will spend the winter.

While a naturalist's delight for its native diversity and remoteness, physically moving through the swamp is slow going, especially given the many wondrous natural diversions. So only small portions of the swamp are typically walked in a day, leaving other days to come back and explore different areas.

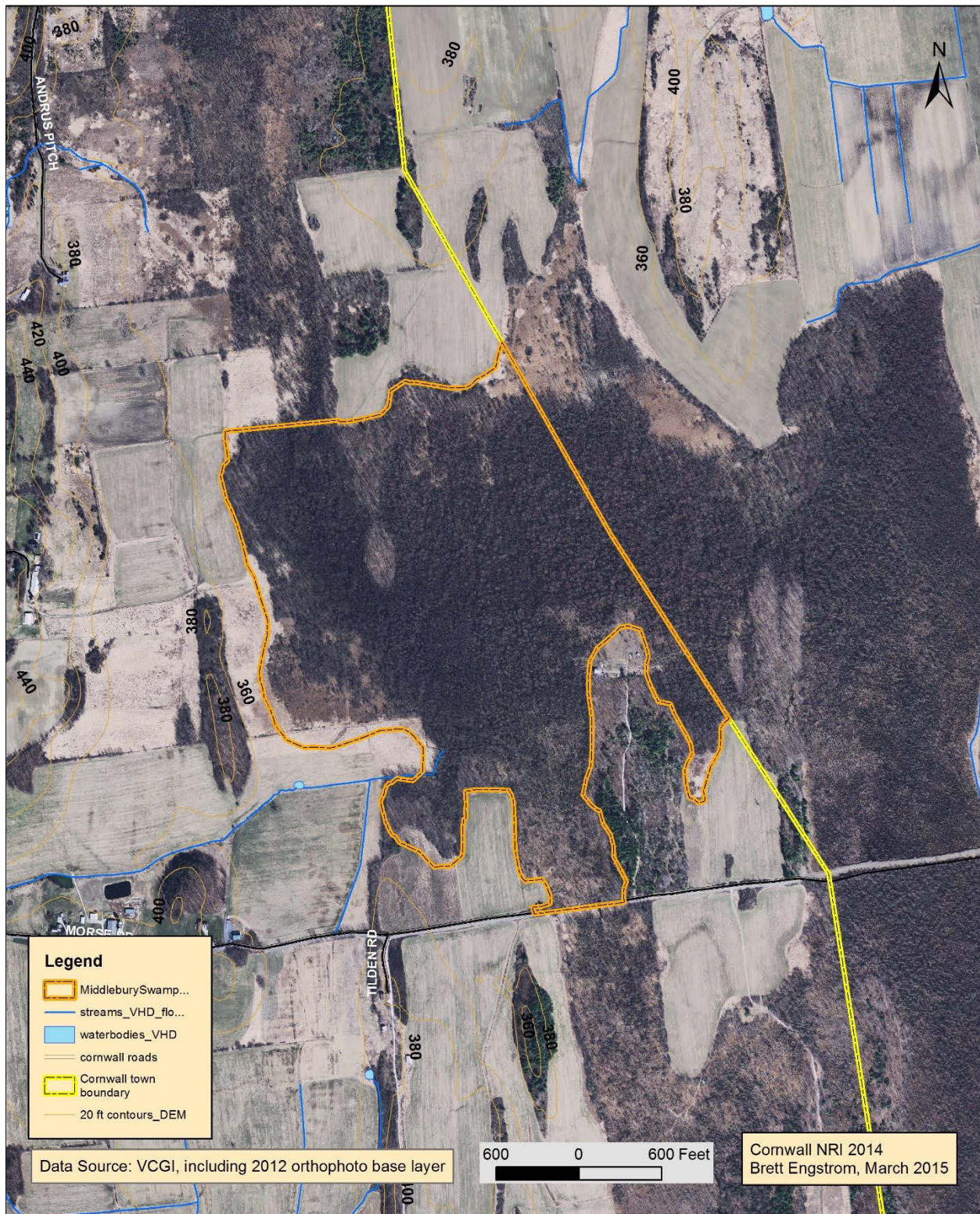
Comments & Ecological Management Considerations: Because it has been recognized as a regionally significant natural area, a good portion of Cornwall Swamp has been conserved through fee purchase by the State of Vermont and The Nature Conservancy. It has a complex ownership, so protection is an ongoing process. Acting like a huge blotter, the swamp and adjacent floodplain are recognized as an important mechanism for flood hazard abatement along Otter Creek, serving an important protective function for Middlebury's infrastructure.

As the largest and wildest forest block in Cornwall by far, Cornwall Swamp is a major wildlife area for the town. Because of its size and unfragmented character, it can act as a "source" or production area for a wide variety of wildlife to leave and inhabit riskier and less productive habitats in town. Although there are undoubtedly other small, scattered patches elsewhere, it is the only mapped deer wintering area in Cornwall.

Photos from Cornwall Swamp Center (#70), clockwise from upper left: Red Maple-Northern White Cedar Swamp; poison sumac in fruit and beginning to turn color; Northern White Cedar Swamp; time to leave the swamp



Middlebury Swamp (#78), Cornwall, VT



Site: Middlebury Swamp (#78)

Location: Large swamp straddling the Middlebury town line north of Morse Rd.

Information Sources: Brett Engstrom Sept. 10, 2014, site visit. Data from the VT Fish & Wildlife Department's Natural Heritage Information Project (Natural Heritage Program)

Land Ownership: Privately owned lands. Only parcels with landowner permission were visited.

Significant Features:

Natural Communities & other features: Red or Silver Maple-Green Ash Swamp*, Red Maple-Black Ash Seepage Swamp*, Mesic Clayplain Forest

Rare, Threatened, & Endangered Species: false hop sedge (*Carex lupuliformis*), short-styled snakeroot (*Sanicula canadensis* var. *canadensis*)

Wildlife Habitat: Excluding the portion in Middlebury, one of the largest Ecological Habitat Blocks in Cornwall; medium-high Wildlife Suitability Ranking; large population of uncommon blue-spotted salamander (*Ambystoma laterale*); abundant wildlife reported by local residents during public forum

*State-significant occurrence

Site Description: Straddling the Middlebury town line, Middlebury Swamp is the north end of the enormous Otter Creek Swamps complex that stretches all the way down to Brandon. Though partially blocked by Morse Rd., it drains south into Cornwall Swamp, hence should be thought of as the north arm of Cornwall Swamp. An axillary channel drains the swamp directly into Otter Creek south of Morse Road in adjacent Middlebury. Though not mapped as frequently flooded soil, all indications are that this swamp floods when Otter Creek and Cornwall Swamp flood. Also hydrologically connected, Middlebury Swamp North Extension site #79 is a part of Middlebury Swamp.

Middlebury Swamp is a combination of Red or Silver Maple-Green Ash Swamp and Red Maple-Black Ash Seepage Swamp natural communities, with a peninsula of Mesic Clayplain Forest. The tree species that are part of the natural community names are the easiest way to distinguish the two communities apart. At least at this site, the latter swamp type tends to be in the wetter, central portion of the swamp where there are deep muck soils; the former on saturated clayey soil or shallow mucks. The Red or Silver Maple-Green Ash Swamp often has high canopy of mature maples and a very open understory with scattered winterberry thickets. The lush fern groundcover is dominated by sensitive and cinnamon ferns. In places lake sedge (*Carex lacustris*) forms large glades. Water pools in shallow depressions unpredictably throughout the swamp. The small population of rare false hop sedge was found growing in one of these pools. In contrast the Red Maple-Black Ash Seepage Swamp has a very broken high canopy of red maple and a thick lower canopy of pole black and green ash, yellow birch, and American elm. The

groundcover in this swamp community has the same ferns, plus a variety of sedges (*Carex crinita*, *C. bromoides*, and *C. lupulina*) and wetland herbs. Unlike the other swamp natural community type, the frequent hummocks in this swamp support a variety of mosses.

As part of the large Otter Creek swamp complex, these maple-ash swamps are recognized as significant on the state-level. Occupying a low peninsula jutting into the swamp from the north, the 5-acre Mesic Clayplain Forest is not large enough to be considered significant on the state-level, though it certainly is a locally significant natural community. Lacking invasive plants, it appears to be a very natural example of clayplain forest.

The state-threatened short-styled snakeroot was found growing in a narrow band of clayplain forest on the west side of the swamp. This is an unusual site for the species. It appears to be most closely associated with the upland limestone forest communities in the several other places in Cornwall where it was found during the inventory. Two uncommon plants are also known from Middlebury Swamp: long-fruited snakeroot (*Sanicula trifoliata*), which occurs in the clayplain forest peninsula; and yellow water-crowfoot (*Ranunculus flabellaris*), which is known from the east side of the swamp in Middlebury (Marc Lapin personal communication).

A great variety of wildlife has been observed in the vicinity of the swamp. Local residents Pat and John Fitzpatrick have observed turkey, moose (occasionally), bear, bobcat (regularly), red fox, and many birds, including transient eagles and hawks. Also, the swamp is undoubtedly a haven for amphibians. Wood frog, gray tree frog, and American toad were all observed in the swamp during the 2014 field visit. Blue-spotted salamander, an uncommon species of special concern in Vermont, occurs in abundance crossing Morse Rd. in the spring.

Comments & Ecological Management Considerations: Though woody invasives and reed canary grass occur abundantly on swamp margins, remarkably few invasives were observed in the swamp's interior. Increasing the forested buffer zone around the swamp would help maintain the swamp's natural condition and absorb runoff from adjacent agricultural fields. Middlebury Swamp, as part of the huge Cornwall/Otter Creek Swamp complex, plays an important role in flood hazard abatement along Otter Creek.

Photos from Middlebury Swamp (#78), clockwise from upper left: Red or Silver Maple-Green Ash Swamp; lake sedge (*Carex lacustris*) glades of preceding swamp; Red Maple-Black Ash Swamp in center of wetland; false hop sedge growing in pools of Red or Silver Maple-Green Ash Swamp



SOURCES

Landslide Natural Resource Planning & Middlebury Area Land Trust. 2010. Beaver Brook Watershed, Cornwall, VT, Conservation Plan.

Lapin, Marc. 1993. Biological Natural Areas of Western Addison County. Nongame & Natural Heritage Program, Vermont Department of Fish & Wildlife, Agency of Natural Resources, Waterbury, VT.

Northeast Upland Habitat Technical Committee. 2006. Managing Grasslands, Shrublands, and Young Forests for Wildlife. Massachusetts Division of Fisheries and Wildlife. Accessed online 3/26/2015 at:

http://www.vtfishandwildlife.com/BOOKS.CFM?libbase_=Managing_Grasslands_Shrublands_and_Young_Forests_for_Wildlife

Thompson, E.T. and Sorenson, E.R. 2000. Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont. The Nature Conservancy & Vermont Department of Fish & Wildlife.

Vermont Agency of Natural Resources. 2005a. Guidance for Agency Act 250 and Section 248 Comments Regarding Riparian Buffers. Accessed online 3/28/2015 at <http://www.anr.state.vt.us/site/html/buff/BufferGuidanceFINAL-120905.pdf>

Vermont Agency of Natural Resources. 2005b. Riparian Buffers and Corridors Technical Papers. Accessed online 3/28/2015 at <http://www.anr.state.vt.us/site/html/buff/buffer-tech-final.pdf>

Vermont Fish & Wildlife Department. 2008. Landowner's Guide to Indiana Bat Habitat. Accessed online 3/26/2015 at:

http://www.vtfishandwildlife.com/library/factsheets/nongame_and_Natural_Heritage/Landowner%27s_Guide_to_Indiana_Bat_Habitat.pdf

Vogelmann, H.W. 1969. Vermont Natural Areas. Central Planning Office and Interagency Committee on Natural Resources, Montpelier, Vermont.

SOURCES - Digital Data Layers

CATEGORY	NAME	FILE	DATA DATE	CREATOR	PROXIMATE SOURCE
Biology	Element Occurrence Records	Significant_Natural_Communities	2013	VT F&W - NHIP	VTNR Atlas
Biology	Element Occurrence Records	Rare_Threatened_Endangered_Species	2013	VT F&W - NHIP	VTNR Atlas
Biology	Vernal Pools Data	Available only online			VTNR Atlas
Biology	Deer Wintering layer	Deer_Wintering_Areas		VCGI	VTNR Atlas
Biology	Indiana Bat Summer Range	Indiana_Bat_Summer_Range		VT F&W	VTNR Atlas
Biology	Grasslands and Shrublands Blocks				VTNR Atlas
Biology	Wildlife Road Crossings	ECOLOGIC_WCV_LINE.shp	2006	VT F&W	VTNR Atlas
Biology	Uncommon Species	Ecologic_UNCOMSPOF_poly		VCGI	VTNR Atlas
Cultural	UVA Lands	UVA_2012.gdb			Middlebury GIS lab
Cultural	Conserved Lands Layer	conserved_land			Middlebury GIS lab
Cultural	Town Parcel Data	parcel polygon			VCGI
Cultural	E911 roads	Emergency_RDS_line	2013	ask Bill	VCGI
Ecology	Vermont Significant Wetlands Inventory	Wetlands_VSWI		VCGI	VCGI
Ecology	National Wetlands Inventory	CONUS_wet_poly		USFWS	VCGI
Ecology	Rare Physical Landscapes				VTNR Atlas
Ecology	Habitat Blocks	Ecologic_HABITATBLKS_poly			VTNR Atlas
Ecology	Wildlife Linkage Habitat	EcologicHABITAT_WLH	2006	VT F&W	VTNR Atlas
Ecology	Uncommon Natural Communities	(see uncommon species data)			VTNR Atlas
Geology	State bedrock geological map	VTGeologicBedrock100K_Units - color definitions.lyr	2011	VGS, USGS	VGS
Geology	Surficial Geologic Map	Geologic_SURFICIAL62K_poly	2008	VGS	VCGI
Geology	Soils	Geologic_SO01_poly.shp	2011 (?)	NRCS	VCGI
Hydrology	Streams/Rivers	nhdflowline.shp	2008	VHD	VCGI
Hydrology	NHDWaterbody	NHDWaterbody.shp	2008	VHD	VCGI
Imagery	VCGI 2012	Individual ortho images dated 2012-03-27	2012	VCGI	VCGI
Topography	USGS 7.5' topographic quads	USA Topo Maps	1983	USGS	ArcGIS Online
Topography	Digital Elevation Model	Hillshade_10m	2012	VCGI	VCGI

APPENDIX 1

Explanation of Legal Status and Information Ranks*

State Rank and Global Rank - Value that best characterizes the relative rarity (abundance) or endangerment of a native taxon within Vermont's geographic boundary or throughout its range, respectively. Ranks are as follows:

- 1** - Very rare (Critically imperiled): At very high risk of extinction or extirpation due to extreme rarity (often 5 or fewer populations or occurrences), very steep declines, or other factors
- 2** - Rare (Imperiled): At high risk of extinction or extirpation due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors
- 3** - Uncommon (Vulnerable): Moderate risk of extinction/extirpation due to restricted range, relatively few populations or occurrences (often 80 or fewer), recent and widespread declines, or other factors
- 4** - General, regular, and apparently secure: May be locally uncommon or widely scattered but not uncommon on a statewide basis
- 5** - Common (Secure): widespread and abundant

H - Possibly extinct/extirpated: Missing; only historical occurrences but potential for rediscovery

X - Presumed extinct/extirpated: Not located despite intensive searches and little likelihood of rediscovery

U - Unrankable: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends

NR - Not ranked: Not yet assessed

NA - Not applicable. Element is not a suitable target for conservation for one of the following reasons: Hybrid, Exotic Origin, Accidental/Nonregular, Not Confidently Present, No Definable Occurrences

An indicator of uncertainty about the rank, either in the form of a range rank (e.g. S1S3) or a ? qualifier, may follow a numeric rank. For global ranks only, an appended T-rank indicates an infraspecies, and a qualifier after the rank in the form of a Q indicates questionable taxonomy.

State Status - Legal protection under Vermont Endangered Species Law (10 V.S.A. Chap. 123)

E = Endangered: in immediate danger of becoming extirpated in the state

T = Threatened: with high possibility of becoming endangered in the near future

PDL = Proposed for Delisting

PE = Proposed for Endangered Status (not legally protected by 10 V.S.A. Chap. 123)

PT = Proposed for Threatened Status (not legally protected by 10 V.S.A. Chap. 123)

RE = Recommended (by the Endangered Species Committee) for Endangered Status (not legally protected)

RT = Recommended (by the Endangered Species Committee) for Threatened Status (not legally protected)

RDL = Recommended (by the Endangered Species Committee) for Delisting

Federal Status - Legal protection under the federal Endangered Species Act, U.S. Fish & Wildlife Service

LE = Listed Endangered

LT = Listed Threatened

PDL = Proposed for Delisting

C = Candidate for Listing (not legally protected under ESA)

SC = Species of Concern (not legally protected under ESA)

*As excerpted from the "Rare and Uncommon Native Vascular Plants of Vermont" list produced by the Vermont Natural Heritage Inventory, VT Fish & Wildlife Department, 07 April 2015. Found online at this location:

http://www.vtfishandwildlife.com/library/Reports_and_Documents/NonGame_and_Natural_Heritage/Rare_Threatened_and_Endangered_Species%20%20---%20lists/Rare_and_Uncommon_Native_Vascular_Plants_of_Vermont.pdf

Appendix 2

Guidelines for State-significance

Natural Heritage Inventory

Vermont Fish & Wildlife Department

Initially drafted November 5, 1996, latest revision July 25, 2013

The following guidelines are for determining whether a particular area will be entered into the Vermont Fish & Wildlife Department's Natural Heritage Database as a species or natural community occurrence of statewide conservation significance. They are used in conjunction with the Natural Heritage Network's Element Occurrence Data Standard and Element Occurrence Specifications. These guidelines are primarily intended for staff and others providing Natural Heritage data to the Vermont Natural Heritage Inventory (VNHI)

These guidelines represent VNHI's default position on determining state-significance for a species or natural community Element Occurrence (EO). Any deviation from the guidelines needs to be clearly justified and documented either in these guidelines (see Exceptions Section) or in the Natural Heritage Database.

The terms state-significant and exemplary have been used synonymously in the past to describe important Natural Heritage Element Occurrences. The term exemplary is currently used in the Vermont Wetland Rules (Exemplary Wetland Natural Community, section 5.5) and includes all wetland natural community occurrences that VNHI determines to be state-significant.

Meeting any of the following criteria would constitute state-significance for the purpose of entering an Element Occurrence into the Natural Heritage Database.

PLANT SPECIES

- Presence of any S1, S2, or state-listed (Threatened or Endangered) species;
- Presence of any G3/S3 species (e.g. Ginseng, Hill's Pondweed).

Note that split-rank species default to the lower ranking, e.g. an S2S3 species is treated as S2 and mapped and tracked as an EO. S3 (but not S3S4) plant species are documented in the Natural Heritage Database with limited observational information but are not considered as state-significant.

ANIMAL SPECIES

- Known or suspected occupied breeding-season habitat for any S1, S2, or state-listed species;
- Known or suspected occupied breeding-season habitat for a G3/S3 species (e.g. West Virginia White);
- Known overwintering concentrations of S1, S2, or state-listed species;
- Known overwintering concentrations of G3/S3 species.

Note that split rank species default to the lower ranking, e.g. an S2S3 species is treated as S2 and mapped and tracked as an EO.

S3 and S3S4 animal species are documented in the Natural Heritage Database with limited observational information but are not considered as state-significant.

NATURAL COMMUNITIES

- Presence of an S1 or S2 natural community type with an EO Rank of A, B, or C;
- Presence of an S3 or S4 natural community type with an EO Rank of A or B;
- Presence of an S5 natural community type with an EO Rank of A.

Note that D-ranked S1 and S2 natural communities, C-ranked S3 and S4 natural communities, and B-ranked S5 natural communities may be tracked in the Natural Heritage Database, and may be considered state-significant, if their EO Rank has been downgraded due to a temporary lowering of their condition for which recovery is expected. Justification must be provided. C-ranked Vernal Pools are tracked regardless of whether their condition is downgraded and expected to recover because the primary basis for ranking vernal pools is amphibian breeding.

ASSOCIATIONS OF NATURAL COMMUNITIES

A site may be considered state-significant if it contains an association of natural communities for which ecologically intact examples are rare or declining in the state. There are typically strong ecological connections between the natural communities in these associations that relate to specific site characteristics, such as topography, soils, hydrology, or natural disturbance. In these cases, the association of natural communities is the state-significant feature, not necessarily all of the individual natural communities that are components of the association, although at least one component natural community should be state-significant. Examples include the following: Lake Champlain associations of Deep Rush Marsh, Lakeshore Grassland, Lakeside Floodplain Forests, Sand Beach, and Sand Dune, all closely tied to the ecological processes of flooding, wave action, wind, and sand deposition; and associations on calcareous hills of the Champlain Valley, including Mesic Maple-Ash-Hickory-Oak Forest, Dry Oak-Hickory-Hophornbeam Forest, and Temperate Calcareous Outcrop and Cliff, all tied to the warm, dry to mesic calcareous substrate of these hills.

EXCEPTIONS TO THE GUIDELINES

Great Blue Heron: While this species is ranked S3S4B, because of their concentrated nesting and vulnerability to human disturbance, VNHI does track Great Blue Heron rookeries.

Double-crested Cormorant: While this species meets the criteria for S2B it currently is not of conservation concern and is not tracked by VNHI. The species is considered a nuisance and its population in Vermont is being actively controlled. Under current conditions it is expected the population size would return to at least S4 levels if active control activities ceased.

American Eel: Though rare and of conservation concern, there are no definable occurrences to track due to their dispersed distribution while in their juvenile stage here. VNHI tracks observations as Independent Source Features.

Bryophytes: Most bryophyte S-ranks are provisional. VNHI will not track S3 bryophyte species, even as Independent Source Features, until further notice.