IDENTIFICATION, ASSESSMENT, AND MAPPING
of
NATURAL COMMUNITIES
in
WOODSTOCK, VERMONT

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3 June 2008

Prepared for the Woodstock Conservation Commission with a Municipal Planning Grant from the Vermont Agency of Commerce and Community Development

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INTRODUCTION

This report describes the methods and results of an inventory of natural communities throughout the town of Woodstock, Vermont. The inventory includes the identification, assessment, and mapping of natural communities in Woodstock. The natural community map that is the primary product of this inventory accompanies this report in both large format hardcopy and GIS formats. The primary goals of this project are to provide town planning officials with both an accurate assessment of natural communities within the town, and an understanding of the significance of these natural communities on local and state levels.

A natural community is "an interacting assemblage of organisms, their physical environment, and the natural processes which affect them" (Wetland, Woodland, Wildland, Thompson & Sorenson, 2000). Examples of some common natural community types in Vermont are northern hardwood forest, shallow emergent marsh, and alder swamp. Natural communities are a means of ecologically describing a landscape. The description of natural communities in a town is a surrogate method for describing its biodiversity, for most species diversity is tied up in the various natural communities in a landscape.

This project was funded through a Vermont Local Planning Grant. I thank the town for supporting this project, and especially the Woodstock Conservation Commission for making it happen. Landowners who gave permission to visit their properties were vital to inventory. The Two River-Ottauquechee Regional Commission provided important support for the inventory. The GIS mapping component of this project, including printing of the large format maps, was made possible through use of the GIS lab, and the expertise of Dr. John DeLeo, Recreation Department faculty and GIS lab director, at Lyndon State College. NatureServe is acknowledged for use of vegetation mapping data from Marsh-Billings-Rockefeller National Historical Park. Finally, a special thanks goes to Josette and Steve Carter, present and former Woodstock Conservation Commission members, respectively, for their support on multiple levels during the inventory.

METHODS

The methods used for Woodstock's natural community inventory and map largely follow those used for The Berlin Pond Natural Community Mapping Project (Engstrom and Lapin 2005) and the natural community inventory for the city of Montpelier (Engstrom and DeLeo 2007). As with these other inventories, the natural community map was created in three phases: 1) landscape analysis/preliminary mapping, 2) field surveys, and 3) final map polygon digitizing. Natural community names used in the Woodstock natural community map are primarily those described in *Wetland, Woodland, Wildland* (Thompson and Sorenson 2000). Several unclassified types and variants were used in the map and are described in this report.

The first phase of the mapping process involved assembling digital map layers and other background inventory information on the town, including wetlands map, bedrock geologic maps, surficial geologic map, soils map, digital orthophoto quads, other digital photo imagery, stereo pairs of the best aerial photographs available, topographic maps (old and recent), previous inventory information (various Town reports, Fish and Wildlife Department's Nongame & Natural Heritage Program). References are listed in the final section of this report. A preliminary natural community polygon was assembled in a GIS layer using information from prior natural community related inventories in Woodstock, especially the wetlands inventory (Arrowwood 2004), Indian Tree Hill natural community inventory (Engstrom 2005), and vegetation map of Marsh-Billings-Rockefeller National Historical Park (NatureServe 2005), vernal pool mapping project (Woodstock Conservation Commission 2002). Leaf-off black and white aerial photographs, both the 1:18,000 VT-62-H 1962 series, and the ~1:33,500 CIW 1939 series, were viewed under stereoscope to help prepare a site map for field surveys. The Conservation Commission then contacted landowners for permission to visit the mapped sites for field survey.

The second phase of the inventory was field surveys. Thirty-one sites (including partial sites), plus 12 drive-by sites not on the site map, were visited during 16 field days between June 28 and November 8, 2007. Field observations were recorded in field books and GPS waypoints were taken to geographically document observation points. Additional information was gathered on rare plants encountered.

The third and final phase was the creation of the final natural community map. Polygons were digitized onscreen in ArcMap (ArcGIS 9.2) using black and white, leaf-off, 1996 digital orthophotos as background and GPS waypoints as reference points. Other digital images and map layers, as well as stereoscopic viewing of the 1939 and 1962 aerial photos, were used to help determine natural community boundaries. Attribute data was filled in for each polygon, including fields for ID number, site, natural community name (this is either the type, or variant name), natural community codes, field visitation, area (acres and hectares), state rankings (S_Rank, S_EORank), local rankings (L_Rank, L_EORank), rank comments, condition, description (2 fields), source of information, soils, and notes.

RANKING

Ranking a particular natural community occurrence is a way to rate the unit for its ecological, or biodiversity, significance. Ranking was done at both the State and Local (town) levels for this inventory. The following ranking methodology is quite a complex process. To a large extent, ranking relies on the amount of time spent on the ground assessing a given natural community occurrence. Since field time for this inventory was limited, the rankings are provisional.

A natural community occurrence is known as an "element occurrence", or EO, by the Vermont Department of Fish and Wildlife's Nongame and Natural Heritage Program (Heritage Program). It refers to the natural community at a particular location, which is shown on the natural community map as a particular polygon. Two types of ranking are used to determine significance at the state level: natural community type rank (State or S-rank) and EO rank. S-ranks for all natural communities in Vermont are published in *Wetland, Woodland, Wildland*, and can be found on the Department of Fish and Wildlife's website. S-ranks basically describe the rarity of a natural community type in Vermont. They range from S1 (extremely rare and vulnerable) to S5 (common, widespread). EO ranks on the state level are determined using Heritage Program ranking guidelines, which take into account an occurrence's condition, landscape context, and size. EO ranks range from A (excellent) to D (poor). An X rank denotes an extirpated occurrence. Significance at the State is a function of both rarity (S-rank) and State EO rank. For **S1 and S2** natural community types, all EOs with A, B, or C element occurrence ranks are considered of State significance. For **S3 and S4** natural community types, all EOs with A or B element occurrence ranks are significant on the State level. For S5 natural communities, the presence of EO with a rank of A is considered State significant.

Local (town) ranking methods closely follow the municipal ranking methods created for the city of Montpelier natural community inventory (Engstrom and DeLeo, 2007). As a first attempt, these local rankings are provisional and need more testing. They parallel state rankings in most respects. Like state ranks, Local ranks (L-rank) refer to a type's rarity within the Town. The ranks fall into four categories, roughly based on the number of occurrences of a particular natural community type in town:

Local (L) Ranks

- L1 = 1-5 occurrences
- L2 = 6-10 occurrences
- L3 = 11-20 occurrences
- L4 = 21+ occurrences and matrix forest types

Local EO ranks also parallel state EO ranks, except that size is not as significant a factor, and the condition and landscape context factors are not as stringent. They are described below.

Local (L) Element Occurrence (EO) Ranks

- A = **Good condition**, i.e. lacking artificial disturbance, invasive species, etc., and, for forests, better than average maturity. **Well-buffered** landscape context.
- B = **Average condition**, i.e. with some artificial disturbance, but species composition mostly natural, and, for forests, average maturity. **Well-buffered to fair** landscape context.
- C = **Altered condition** and composition in **fair** landscape context
- D = **Poor condition** and heavily altered composition in **poor** landscape context

Significance at the Local level parallel state level significance determinations in that the significance is a function of both rarity (L-rank) and Local EO rank. For **L1 and L2** natural community types, EOs with A, B, or C element occurrence ranks, and even some D-ranked occurrences if highly threatened, are considered of Local significance. For **L3, L4,** and **L5** natural community types, EOs with A or B element occurrence ranks are significant on the Local level.

Both state and local level ranks, EO ranks, are given for each occurrence (polygon) on the Woodstock natural community map. EOs (polygons on the map) of the same type within close proximity to one another (roughly within one-quarter to one-half mile) are considered as one EO for both state and local ranking purposes. Unclassified natural community types, i.e. not found in *Wetland, Woodland, Wildland*, as well as mapped water bodies (the Ottauquechee River and artificial ponds) are not ranked at the state level, or at the Local level. Unclassified types are sometimes given provisional Local ranks and significance. This is denoted by question marks after the ranks/significance.

As rough as they may be, all these rankings are an attempt to assign a biodiversity value to natural community occurrences based on their ecological condition and characteristics. They also helped determine the recommended areas important for biodiversity conservation which appear later in this report.

State and local rankings for the natural communities found in Woodstock are given in Table 1.

RESULTS

The primary product of this inventory is the natural community map of Woodstock (Figure 1). Created in GIS, the map in digital format is a set of three shapefiles consisting of polygon features (NCpoly_final, last revised 5/26/2008), line features (Rivershore_NCs, 6/2/2008), and point features (NCpoint_final, 5/26/2008). Points were used for very small features, usually one-quarter acre or less, while lines were used for long, narrow features along the Ottauquechee River. As described in the Methods section, these natural community shapefiles include attribute tables filled with information about each particular natural community feature, such as natural community name, size, description, soils, etc. These map shapefiles, plus shapefiles for GPS waypoints (FBEwaypts_Woodst_07), sites of significance for biodiversity (Biodivers_Signif_Sites), and rare, threatened, endangered and uncommon plants (RTE_plants_Woodstock), accompany this report on a CD. JPEG images of the maps also are found on the same CD. The Woodstock Conservation Commission has also received two large format (36x36") printed maps for display at meetings.

A total of 568 polygons, 36 lines, and 176 points form the natural community map. A summary of the natural community types and variants is shown in Table 1. The thirty-eight mapping units are broken down into 23 natural community types (as described in *Wetland, Woodland, Wildland*), 2 unclassified natural community types (seepage marsh and sloping seepage forest), 11 variants (3 classified and 8 unclassified), and 3 other mapping units (river, artificial pond, and perched wetland). One natural community variant name has been changed for convenience: Sugar Maple-White Ash-Jack-in-the-Pulpit Northern Hardwood Forest variant found in the Vermont classification is replaced by "Semi-rich Northern Hardwood Forest" in this inventory. While only one-third of the mapping units are upland types, upland natural communities account for 95% of the landscape. The uplands are dominated by Northern Hardwood Forest, a matrix natural community type.

It is important to note that natural communities do not necessarily reflect what is seen on the ground. What is presently a field is likely mapped as a Northern Hardwood Forest because the soils, hydrology, etc. would naturally support a Northern Hardwood Forest. A field is not a natural community since it is artificially maintained by people, and a conifer plantation is not a natural community since it an artifact of horticulture. Likewise parking lots, buildings, and other cultural features are mapped as natural community types based on the soil type that is found where these features occur. A natural community map is **not** the same as a vegetation map.

Figure 1. Natural community map of Woodstock, Vermont, based on 2007 inventory field and remote sensing work and former mapping inventories by the author and others. Created in ArcGIS, this is a small-scale version of a large print format map.

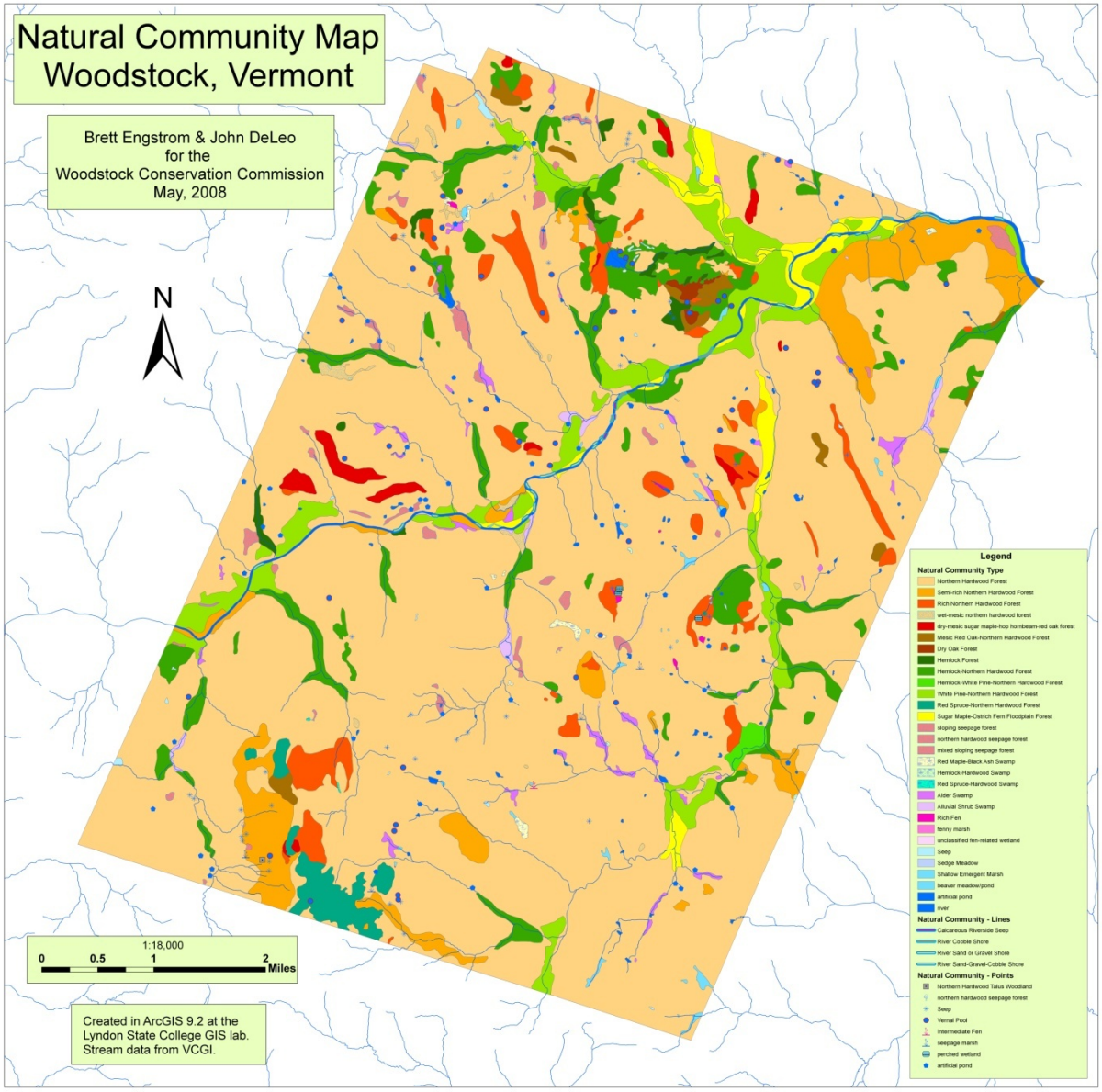


Table 1. Woodstock natural community summary table. Unclassified communities are not capitalized. # Features and Acres refer to polygon features, unless otherwise noted.

Natural Community Type or Variant	NC_Type	NC_Var	S-Rank	L-Rank	# features	Acres
UPLANDS						
Red Spruce-Northern Hardwood Forest	5	05	S4	L2	5	254.6
Northern Hardwood Forest	8	08	S5	L5	17	21606.4
Semi-rich Northern Hardwood Forest	8	08c	S5	L4	29	1287.5
White Pine-Northern Hardwood Forest	8	08e	S5	L3	28	1155.2
wet-mesic northern hardwood forest	8	08w		L3?	20	71.7
Rich Northern Hardwood Forest	9	09	S4	L4	48	752.6
Mesic Red Oak-Northern Hardwood Forest	10	10	S4	L2	10	145.2
dry-mesic sugar maple-hop hornbeam-red oak forest	10	10b	S4	L4	13	178.1
Hemlock Forest	11	11	S4	L3	14	125.7
Hemlock-Northern Hardwood Forest	12	12	S4	L4	65	1508.2
Hemlock-White Pine-Northern Hardwood	12	12a	S4	L4?	1	47.8
Northern Hardwood Talus Woodland	13	13	S3	L2	1 pt.	
Dry Oak Forest	19	19	S3	L1	2	32.3
WETLANDS						
Sugar Maple-Ostrich Fern Floodplain Forest	43	43	S2	L1	18	428.7
Red Maple-Black Ash Swamp	45	45	S4	L2	9	34.3
Red Spruce-Hardwood Swamp	52	52a	S3	L1	2	1.3
Hemlock-Hardwood Swamp	54	54a	S2	L2	7	7.1
Seep	55	55	S4	L4	17+52 pts.	19.2
Vernal Pool	56	56	S3	L3	53 pts.	
Intermediate Fen	62	62	S2	L1	1 pt.	
Rich Fen	63	63	S2	L1	8	9.1
unclassified fen-related wetland	63	63u		L2?	4	1.8
Shallow Emergent Marsh	64	64	S4	L3	31	41.4
beaver meadow/pond	64	64ac	S4	L3	7	20.3
fenny marsh	64	64f	S4?	L3?	5	4.9
Sedge Meadow	65	65	S4	L2?	1	0.4
River Sand or Gravel Shore	72	72	S3	L3	11 lines	5034 ft.
River Sand-Gravel-Cobble Shore	72	72/73	S3	L3	19 lines	4990 ft.
River Cobble Shore	73	73	S2	L2	7 lines	2441 ft.
Calcareous Riverside Seep	74	73/74	S1	L1	3 lines	612 ft.
Alluvial Shrub Swamp	77	77	S4	L3	13	69.6
Alder Swamp	78	78	S5	L4	42	157.6
seepage marsh	89	89		L1	4 pts.	
sloping seepage forest	90	90		L2?	19	105.0
northern hardwood seepage forest	90	90a		L2?	15+2 pts.	87.6
mixed sloping seepage forest	90	90ab		L2?	3	13.6
artificial pond	99	99ap			112+60 pts	85.9
river	99	99r			1	149.1
perched wetland	0	0			3 pts.	
				TOTAL	586 polys	28,402

Calcareous Riverside Seep was the only extremely rare (S1on the state-level) natural community found in Woodstock. Rare (S2) and uncommon natural communities include the following:

Rare (S2)	**Uncommon (S3)**
Sugar Maple-Ostrich Fern Floodplain Forest	Northern Hardwood Talus Woodland
Hemlock-Hardwood Swamp	Dry Oak Forest
Intermediate Fen	Red Spruce-Hardwood Swamp
Rich Fen	Vernal Pool
River Cobble Shore	River Sand or Gravel Shore

Many of the natural communities, such as Rich Northern Hardwood Forest, Rich Fen, and Calcareous Riverside Seep, are directly related to the abundant limestone found in the bedrock almost throughout Woodstock.

RARE, THREATENED, ENDANGERED, AND UNCOMMON PLANTS

Twenty rare, threatened, endangered, and uncommon plants listed by the Vermont Fish & Wildlife Department's Nongame & Natural Heritage Program were observed during the course of the inventory (Table 2). Some of these species are known occurrences found in the Nongame & Natural Heritage Program's database, while others are new element occurrences. Almost all of these species, including the rivershore species, are calciphiles, or lime-loving plants. This is directly related to the abundant limestone layers found in the bedrock in Woodstock.

Table 2. Rare, threatened, endangered, and uncommon species observed in Woodstock during 2007 natural community inventory.

COMMON NAME	SCIENTIFIC NAME	STATUS	S_RANK	# Points	# EOs
Garber's Sedge	Carex garberi	Threatened	S1	4	1
Few-flowered Spikerush	Eleocharis pauciflora	Threatened	S1	2	1
Schreber's Muhly	Muhlenbergia schreberi		S1	1	1
Sticky False-Asphodel	Tofieldia glutinosa	Threatened	S1	3	1
Hay Sedge	Carex argyrantha		S2	2	1
Male Fern	Dryopteris filix-mas	Threatened	S2	9	4
Obedience	Physosteigia virginiana	Threatened	S2	6	1
Loose Sedge	Carex laxiculmis		S2S3	1	1
American Ginseng	Panax quinquefolius		S2S3	5	4
Minnesota Sedge	Carex albursina		S3	22	12
Back's Sedge	Carex backii		S3	27	12
Hitchcock's Sedge	Carex hitchcockiana		S3	16	11
Greenish Sedge	Carex viridula		S3	1	1
Purple Clematis	Clematis occidentalis		S3	1	1
Glade Fern	Diplazium pycnocarpon		S3	4	3
Wiegand's wild-rye	Elymus wiegandii		S3	1	1
Fringed Gentian	Gentianopsis crinita		S3	1	1
Tall Millet-grass	Milium effusum		S3	5	4
Shining Ladies' Tresses	Spiranthes lucida		S3	3	1
Blunt-leaved Woodsia	Woodsia obtusa		S3	1	1

SITES OF SIGNIFICANCE FOR BIODIVERSITY

One main reason for conducting this natural community inventory was to assess which areas in town are important for conserving the biodiversity in Woodstock based. Based natural community mapping and location of rare, threatened, or endangered plants found during the inventory, 31 sites are recommended as areas of significance for biodiversity. These are general areas that encompass clusters of state or locally significant natural communities, as ranked by this inventory, along with areas with rare plants and/or exceptional populations of uncommon plants. They are broken down into three levels of significance: State Significant Sites, Local/State Significant Sites, and Local Significant Sites. The State Significant Sites contain occurrences of State significant examples of natural communities, and in some cases, state rare, threatened, or endangered plants. Local/State Significant Sites are locally significant because of natural community occurrences, but contains an occurrence of a state rare species. Local Significant Sites contain several locally significant occurrences of natural communities, the best example of a particular natural community in town, and in some cases good populations of uncommon plants. The significant sites are shown in Figure 2. They are listed below broken down by significance level. Features which led to their significant designation are bulleted after each site. Numbers following site names in the list refer to polygon ID numbers on Figure 2 map. Names are from USGS topographic map or new inventions.

The polygons of the sites chosen as significant for biodiversity are rough boundaries for the extent of features of note at each site, plus forested buffer. They are not precisely drawn, and should not be construed as precise boundaries depicting the occurrences of significant features at a site.

State Significant Sites

Ottauquechee 1 (3)

- River Cobble Shore (S2, L2) – one State significant example
- Seep (S4, L4) – locally significant example (unusual riverbank location)
- River Sand or Gravel Shore (S3, L3) - locally significant example
- Sugar Maple-Ostrich Fern Floodplain Forest (S2, L1) – though degraded, locally significant example (the best remnant in town)
- Threatened Species – 1 plant (S2)

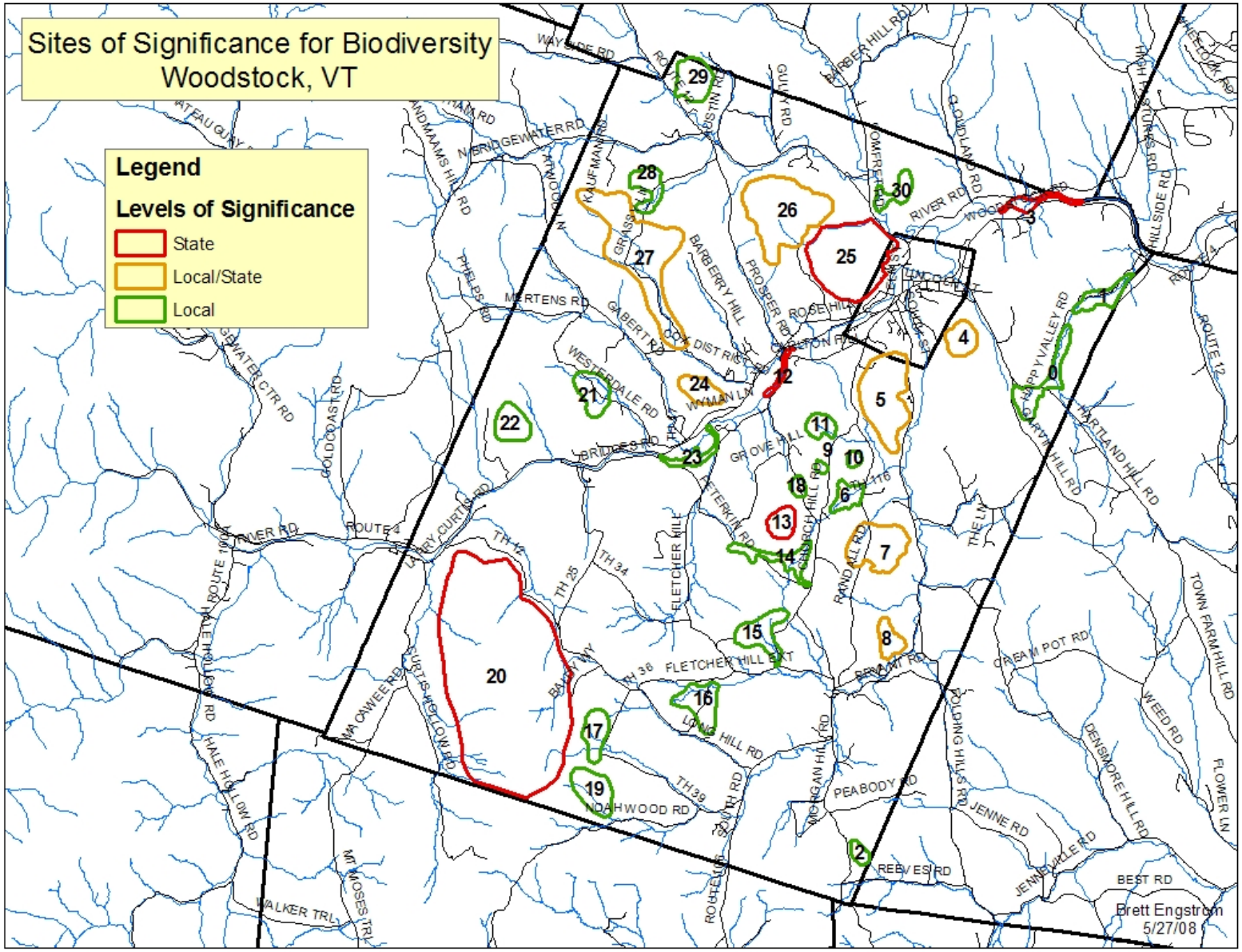
West Woodstock Bridge (12)

- Calcareous Riverside Seep (S1, L1)
- River Cobble Shore (S2, L2)
- River Sand-Gravel-Cobble Shore (S3, L3)
- RTE & U Species – three threatened (S1) plants, 2 uncommon (S3) plants

Carlton Hill Basin*(13)

- Rich Fen (S2, L1) – State significant example
- Seep (S4, L4) – at least locally significant example
- *This site might likely include all of Carlton Hill, which has potentially significant hardwood forest and other elements. However, the uplands were not surveyed during inventory.

Figure 2. Sites of significance for biodiversity in Woodstock, Vermont. Numbers on map refer to site ID numbers found in list.



Old Baldy-Long Hill North (20)

- Rich Northern Hardwood Forest (S4, L4) – two quite large, quite high elevation, examples probably of State significance
- Northern Hardwood Forest, including Semi-rich variant (S5, L5) – the most extensive, contiguous example in town, including some very mature and undisturbed examples. This directly connected to a very large, unbroken forest block dominated by northern hardwoods extending for several thousand acres into adjacent Reading and Plymouth. Truly a matrix forest. Entire forest block likely of State significance.
- Northern Hardwood Talus Woodland (S3, L1) – Locally significant example
- Red Spruce-Hardwood Swamp (S3, L1) – one, possibly two, at least locally significant examples
- Seep (S4, L4) – Series of locally, and likely State, significant examples
- northern hardwood seepage forest (L2?) – locally significant example; un-ranked natural community type
- seepage marsh (L1) – one locally significant example
- RTE & U Species – 1 threatened plant (S2), 2 uncommon plants (S3)

Mount Tom (25)

- Dry Oak Forest (S3, L1) – State significant example; only example in town
- Rich Northern Hardwood Forest (S4, L4) – several locally significant examples
- Mesic Red Oak-Northern Hardwood Forest (S4, L2) – one locally significant example
- dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – locally significant example
- Hemlock Forest (S4, L3?) – at least 2 locally significant examples
- Hemlock-Northern Hardwood Forest (S4, L4) – one large, at least locally significant example
- Seep (S4, L4) – several locally significant examples
- Vernal Pool (S3, L3) – several locally significant (perhaps State) examples
- RTE & U Species – three rare (S2) and several uncommon (S3) plants, including some A-ranked populations of uncommon plants. Historical records of other rare plants.

Local/State Significant Sites

Mount Peg (4)

- Vernal Pool (S3, L3) – cluster of four documented pools, likely State Significant.

Rock City Slope-High Vee (5)

- Rich Northern Hardwood Forest (S4, L4) – locally significant examples
- dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – locally, perhaps State, significant example
- Seep (S4, L4) – at least one locally significant example
- Vernal Pool (S3, L3) – one State significant example, plus one other

Indian Tree Hill (7)

- Rich Fen (S2, L2) – one locally, and perhaps State, significant example
- Rich Northern Hardwood Forest (S4, L4) – several locally significant examples
- Seep (S4, L4) – one locally significant example
- Sedge Meadow (S4, L2?) – only mapped example in town, though others undoubtedly exist
- unclassified fen-related wetland – one example in old pasture
- RTE & U Species – one rare (S2S3) and several uncommon (S3) plants

Driveby Slope/Horseshoe Hill (8)

- Rich Northern Hardwood Forest (S4, L4) – locally significant example

- Hemlock-White Pine-Northern Hardwood Forest (S4, L1?) – locally significant example
- RTE & Uncommon Species – one rare (S2S3) and three uncommon (S3) plants

Shaw Cemetery Hill (24)

- Dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – one locally significant example
- Rich Northern Hardwood Forest (S4, L4) – one locally significant example
- Hemlock Forest (S4, L4) – example of undetermined significance
- RTE & U Species – one rare (S2S3) and four uncommon (S3) plants, including very large populations of some of the uncommon species

Pogue Hills (26)

- Rich Northern Hardwood Forest (S4, L4) – several locally significant examples
- dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – locally significant example
- Hemlock-Hardwood Swamp (S2, L1) – cluster of locally significant swamps
- Vernal Pool (S3, L3) – three at least locally significant examples
- mixed sloping seepage forest (L2?) – one locally significant example
- RTE & U Species – one rare (S2S3) and several uncommon (S3) plants

Vondell Valley (27)

- Semi-rich Northern Hardwood Forest (S5, L4) – one locally significant example
- Rich Northern Hardwood Forest (S4, L4) – several locally significant examples
- Seep (S4, L4) – locally, perhaps State, significant examples
- Vernal Pool (S3, L3) – several locally, and perhaps State, significant examples
- Alder Swamp (S5, L4) – one locally significant example
- sloping seepage forest (L2?) – several large examples that need more inventory work
- RTE & Uncommon Species – one threatened (S2) plant (state significant), several uncommon (S3) plants

Local Significant Sites

Gar-Hart-Hap Wetland (0)

- Alder Swamp (S4, L4) – one large and one small example significant locally
- Alluvial Shrub Swamp (S4, L3) – one large, locally significant example
- Shallow Emergent Marsh (S4, L3) – small example in complex with shrub swamp

Happy Valley (1)

- northern hardwood seepage forest (L2?) – locally significant example. Un-ranked natural community type
- Mesic Red Oak-Northern Hardwood Forest (S4, L1) – locally significant example
- Hemlock-Northern Hardwood Forest (S4, L4) – locally significant example

South Corner Wetland (2)

- Beaver Meadow/Pond (S4, L3) – the largest open wetland in town. Needs survey

Goosefoot Basin Wetland (6)

- Beaver Meadow/Pond (S4, L3) – one of the largest marshes in town, forest buffered

1196 Hill (10)

- Rich Northern Hardwood Forest (S4, L4) – locally significant example
- Uncommon (S3) Species – two plants at Old VINS

- Rich Fen (S2, L1) – locally significant example
- Uncommon (S3) Species – one plant

Peterkin Road Wetlands (14)

- Red Maple-Black Ash Swamp (S4, L2) – two locally significant examples
- Seepage marsh (L1) – one locally significant example
- Unclassified fen-related wetland (L2?) – one locally significant example
- Shallow Emergent Marsh (S4, L3) – one of potential local significance
- Sloping seepage forest (L2?) – one example needing survey

Meetinghouse Hill (15)

- seepage marsh (L1) – locally significant example
- unclassified fenny wetland (L2?) – locally significant example
- Hemlock-Hardwood Swamp (S2, L2) – locally significant example
- Alder Swamp (S5, L5) – large example
- Rich Northern Hardwood Forest (S4, L4) – one locally significant example
- Vernal Pool (S3, L3) – one needing confirmation
- Uncommon (S3) Species – at least four plants, 3 upland and one wetland

Bendedict Road Wetlands (16)

- Red Maple-Black Ash Swamp (S3, L2) – locally significant example, one of largest in town
- Seep (S4, L4) – un-ranked example, in natural setting
- Intermediate Fen (S2, L1) – poor example, but locally significant because only one in town
- Shallow Emergent Marsh (S4, L3)– small example, part of larger wetland complex
- Alder Swamp (S5, L4) – locally significant example

Keeling Road Wetlands (17)

- Vernal Pool (S3, L3) – 2 at least locally significant examples
- Rich Fen (S2, L1) – remnant, part of larger wetland, of local significance
- Shallow Emergent Marsh (S4, L3) – two small examples
- Alder Swamp (S5, L4) – one example, part of beaver wetland complex

Carlton Hill Road Swamp (18)

- Hemlock-Hardwood Swamp (S2, L1) – locally significant example
- Vernal Pool (S3, L3) – locally significant example

Noah Wood Valley (19)

- Seep (S4, L4) – at least 3 locally significant examples
- Vernal Pool (S3, L3) – at least 2 examples
- seepage marsh (L1) - one good example of unclassified natural community type
- Red Spruce-Northern Hardwood Forest (S4, L2) – degraded example of a locally rare forest type.

Westerdale Road Wetlands (21)

- Alder Swamp (S5, L4) – several wetlands forming one locally significant example
- Vernal Pool (S3, L3) – one or two potential in area; another perched on hill to west

West Throne Arm (22)

- Dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – one locally significant example
- RTE & U Species – four uncommon (S3) species

- Rich Northern Hardwood Forest (S4, L4) – one example of unclear extent

Lincoln Bridge Floodplain (23)

- Sugar Maple-Ostrich Fern Floodplain Forest (S2, L1) – one locally significant examples
- River Sand-Gravel-Cobble Shore (S3, L3) – several examples needing inventory
- Shallow Emergent Marsh (S4, L3) – one small, oxbow type
- Alder Swamp (S5, L4) – sizeable wetland that needs confirmation

Grassy Lane North Wetlands (28)

- Vernal Pool (S3, L3) – several documented examples of local, and perhaps State, significance
- Rich Fen? – potential sizeable fen needing confirmation
- Red Maple-Black Ash Swamp?– one or two needing confirmation. Possible site for Calcareous Red Maple-Tamarack Swamp (not documented for town)
- Alder Swamp (S5, L5) – one needing confirmation

Dana Hill South (29)

- Mesic Red Oak-Northern Hardwood Forest (S4, L2) – one locally significant example
- Dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – one locally significant example
- Rich Northern Hardwood Forest (S4, L4) – two locally significant example
- Hemlock-Northern Hardwood Forest (S4, L4) – example of local significance
- RTE & U Species – two rare (S1 & S2S3) and three uncommon (S3) plants, including large populations of some of the uncommon species.

Barnard Brook East Hill & Terrace (30)

- Dry-mesic sugar maple-hop hornbeam-red oak forest (L2) – one locally significant example
- White Pine-Northern Hardwood Forest (S?, L1) – one of the few forested examples, of local significance.
- Sugar Maple-Ostrich Fern Floodplain Forest (S2, L1) – one locally significant example

LIMITATIONS OF THE INVENTORY

Encompassing an area over 44 square-miles, the town of Woodstock is a significant extent of piedmont landscape to undertake such a mapping project. Given the large project area and the limited amount of field time budgeted, the natural community map should be viewed as a work-in-progress. In addition to this inventory's work, the map includes many different spatial data sources. All together they form a total of 780 of natural community features. Yet, this only part of the complexity out there in the landscape. Many more seeps, vernal pools, and rich northern hardwood forests are not mapped purely because of lack of field time to discover them. These features are often not detectable from remote sources, such as aerial photos, hence they get missed. Another limitation to the map is the polygon lines. Most of these lines are inferred from remote sources, especially topographic and soil maps, and aerial photos. They must be viewed as approximate, not hard and fast lines. Wetland boundaries are often discernable from remote sources, but upland natural community boundaries are often gradational and much more difficult to accurately map from remote sources.

REFERENCES

Arrowwood. 2004. Woodstock Wetlands Inventory, Assessment, & Mapping Project. Unpublished report prepared for the Woodstock Conservation Commission.

Engstrom, Brett. 2005. Natural Communities of Indian Tree Hill, Patricia & Paul Highberg Property, Woodstock, Vermont. Unpublished report, including natural community map, to the landowners.

Engstrom, Brett and DeLeo, John. 2007. A Natural Community Inventory of the City of Montpelier, Vermont. Unpublished report prepared for the Montpelier Conservation Commission. Posted online at http://www.montpelier-vt.org/mcc/Montpelier_NC_Inventory_2007.pdf

NatureServe. 2005. Vegetation map of Marsh-Billings-Rockefeller National Historical Park, Woodstock, Vermont. NatureServe contracted to do work for the National Park Service. Brett Engstrom subcontracted with NatureServe to do the mapping.

Thompson Elizabeth and Sorenson, Eric. 2000. *Wetland, Woodland, and Wildland*: *A Guide to the Natural Communities of Vermont*. The Nature Conservancy and the Vermont Department of Fish and Wildlife.

Woodstock Conservation Commission. 2002. Woodstock Vernal Pool Identification and Mapping Project. Final report to the Silvio O. Conte National Wildlife Refuge. Cooperative Technical Assistance by the Vermont Institute of Natural Science.

USDA Natural Resources Conservation Service. 2005. The Soils of Vermont and their associated Natural Communities, version 1.1, December 2005. Unpublished report by NRCS, Colchester, Vermont.