Floristic Survey of the Vascular Flora of the North Springfield Bog, North Springfield, Vermont

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Abstract

A botanical field survey of the vascular flora in the North Springfield Bog, Springfield, VT was performed on 22 July 2006. The bog is located on a high terrace above the Black River in a glacially deposited sandy to gravelly soil terrain. The bog itself is situated at the bottom of a small watershed that slopes towards the bog on three sides. The surrounding forested slopes are a regenerating Maple/Hemlock forest. The bog is comprised of a floating peat mats and frequent occurrences of moats surrounding the edge of the mat. The bog is dominated by tall shrubs, lacks occurrences of characteristic peat hummocks, and has a limited occurrence of bog species. A total of 65 species were observed in the surrounding upland forest and 50 wetland species within the bog. Based on species occurrences and physical features, the bog was determined to be classified as being a poor to intermediate fen.

Introduction

Bogs are one of many forms of wetlands. They are dominated by decomposed plant material, or peat, and can be common landscape features within glaciated and northern boreal forests worldwide (Haslam 2003, Johnson 1985). Peatlands do exist in warmer climates where high accumulation of peat develops in standing water areas restricting the decomposition of dead graminoid (grasses, sedges and rushes) plant material. Generally, in warmer climates the soil microbes and warmer temperatures create conditions for an accelerated consumption of organic matter (Crum 1988) and eliminate the conditions that are necessary for peatland development. In the temperate glaciated northeastern United States, including upper Michigan, and northward into more boreal areas, where it is cooler and with lower evapotransporation rates, extensive peatlands are common and roll along parts of the landscape. The extensive peatlands of the boreal north can be continuous across both wetland and upland areas and are referred to as blanket bogs. Closer to the terminus of geologic glaciated boundaries, as here in Vermont, peatlands are scattered depressional landscape positions that frequently contain isolated bogs.

Bogs are typically located in areas with favorable topographic features such as depressions and suitable climatic conditions. These depressions may have formed as blocks of ice were deposited by glaciers that upon melting left a depression on the landscape. These melted ice block depressional areas are referred to as kettle bogs. In addition to depressional landscapes, excess water must be available to create an anaerobic condition that slows the decomposition of plant material. Also, many northern bogs are located in “cold pockets” and receive cool down-drafting night air even in the summer months which adds to the slow decomposition of organic material. When the source of water for the bog is strictly from precipitation the bog is referred to as being ombrotrophic. These types of bogs typically have water with a pH less than 7. Bog systems with an influx of surface and ground water, rich in mineral content, and a pH value greater than 7 are classified as fens.

The combination of pH and source of water influences the plant species composition of bogs and fens. Bogs with a lower pH are also low in mineral and nitrogen content. Many of the acidic bog species have the physiological ability to fix or obtain nitrogen by other means. Generally in acidic bogs, *Sphagnum* moss is the supplier of peat materials. Fens in contrast are dominated by sedges and other trees and shrubs with a higher diversity typical of bogs, and other mosses dominate rather than *Sphagnum*.

In July 2006, I made a site visit to do a floristic survey of the North Springfield Bog, in Springfield, VT. This bog is perched above the Black River on an old terrace. There are a series of active and abandoned gravel pits surrounding the small watershed of the bog. The bog is situated at the bottom of a small watershed that slopes toward the bog. As part of the floristic survey, I noticed different features that were atypical for a bog and felt that some effort should be made to classify it as one of the several bogs or fens. Also, I thought it would be helpful to discuss the influences of various physical features on the composition of species and plant community arrangements.

Study Area

North Springfield bog is located in Windsor County, in Springfield, VT. The bog is located just west of the Black River at geographical coordinates 72° 30" 52.0' W, 43° 19" 28.6' N and at an elevation of 518.37 feet above sea level. The bog is approximately 0.1075 acres (Gotelli and Ellison 2002) in size and is immediately surrounded by a Maple/Hemlock forest The bog is located on property owned by the Town of Springfield, VT and the land stewards are the Ascutney Mountain Audubon Society. The Audubon Society has maintained paths leading up to and around the bog as well as a floating boardwalk that reaches the center of the bog with several branches allowing additional access to view the bog habitat.

Methods

The site visit was made to the North Springfield Bog on 22 July 2006. A vascular plant floristic survey was made in two different habitat types. The survey was done by walking and searching for all species present at the time of the visit. First, the bog was surveyed by recording all species observed within the bog by use of the floating walkway. The bog edges were then surveyed at several points by penetrating the bog using fallen trees and logs lying along the edge or by wading in on foot. Second, the upland area surrounding the bog was walked and species were also recorded. No inventory of bryophyte (mosses) species was done during this survey. However, a few common and dominate species of mosses were noted.

All species observed were identified using field morphological features. A few technical and unknown species were identified in the field using the Flora of the Northeast (Magee and Ahles 1996). Nomenclature (Appendix 1 & 2) follows that of Gleason and Cronquist (1991).

Data Analysis

I used published lists of representative species for various bog and fen types to assess their relationship to the Springfield bog (Thompson and Sorenson 2005, Crum 1988) to partially determine the classification of the bog (Appendix 1). Comments about species distributions within the bog were made based on inferred pH values associated with various bog types, species occurrences on peat mats or along moats (laggs), and relationship of physical features to surrounding topography

Results

A total of 50 species were observed within the bog based on a one day survey. Another 65 species were observed in the immediate surrounding upland landscape. The various aspects of the bog and surrounding upland are discussed below.

Species Occurrences in the Surrounding Upland Forest

A Maple/Hemlock forest surrounds the immediate of the bog. The forested slopes have inclusions of other species representative of other forest habitat habitats, such as Red Oak (*Quercus rubra L.*) and Basswood (*Tilia americana L.*). The presence of these species may simply represent available micro dry or mesic habitats available within the forest, or are remnants of former successional plant communities associated with prior logging activities. A White Pine (Pinus strobus L.) stand is located to one side of the east side of the bog. Weedy species were not common on the slopes except near the eastern edge of the bog, at what once appeared to be an outlet, there were patches of weedy species. These are no doubt indicators of some former human soil surface disturbance. The surrounding forest itself is a typical regenerating hardwood stand with mostly native species in the shrub and herb understory.

Species Distribution Patterns in the Bog

The bog has several dominant growth forms and physical patterns. The majority of the peat bed is located in the middle of the bog and is connected to the shoreline towards the eastward edge near what appears to be an old outlet. The peat bed is more uniform and contiguous along the edges of the bog where there is level topography in the adjacent upland. Those edges of the bog abutting sloped upland terrain tend to have an open water moat (lagg) along the edge.

Species distribution patterns within the bog are influenced by the location of the the peat mat mixed with an open water lagg along many edges. Of the 50 species observed within the bog, only 7 species are typical of a more “classic” peat bog (Appendix 1). In contrast, 13 species more typical of open water lagg edges and marshes were observed near the open water edges. The remaining 30 species are wetland species that are not habitat specialist (Reed 1988). Undoubtedly the mineral content and pH of the water itself is a common theme for occurrence between these wetland species present.

The classification series of different bogs through fens in part represents a range of pH and mineral content in water conditions. For example, the 7 signature bog species observed are species that are known to have an occurrence range from peaty dwarf/spruce bogs through poor fens (Crum 1988, Thompson and Sorenson 2005). These differences in bog types throughout the northeast United States represents adaptive abilities or genetic plasticity, to live in anaerobic conditions and pH ranges from acidic to basic. The 7 representative bog specific species were limited to occurring on the peat mat.

Other Physical Features of the Bog

Several other physical features of the bog undoubtedly influence the presence or absence of certain bog species. Two features noted at the Springfield bog that most likely influence species occurrences are the lack of hummocks and hollows on the peat mat and the overall wet condition of the floating peat. There are some shallow hummocks on the surface of the peat mat but they lack any substantial height to provide additional habitat for other bog species that typically occur on the tops, sides, and bottoms of hummocks. Likewise, with excess free water on the peat mat, these wetter conditions limit the presence of many other bog species. But the open water lagg and wetter marsh like conditions along the edges allows for occurrence of many species more typical of fens.

Along the edge of the bog there is an active water mark indicating periodic fluctuations of water levels. This rise and fall of surface water may be caused by several hydrologic conditions such as surface input during spring run off, extreme precipitation events, or combined recharge with groundwater inputs. At the time of the survey, there was no active outlet to the bog or any rills or small channels feeding surface water input into the bog.

Sphagnum Lawn

Intermingled between tall shrub zones on the peat mat are shallow rolling mounds or hummocks of *Sphagnum* lawns. These distinct groups of bog mosses are common inhabitants of bogs with lower pH values. The two dominant Sphagna species observed on the peat mat were *S. magellanicum* Brid. and *S. girgensohnii* Russ. Another peatland moss that was common was *Pleurozium schreberi* (Brid.) Mitt. In some locations on the floating mat these species created a closed moss canopy on a rolling hummocky surface.

Rare Species

No vascular plant species listed as rare or endangered in the state of Vermont were observed. Similarly, no Federal species of concern were observed.

Discussion

The growth form aspect and appearance of vegetation at the North Springfield bog appears to be the results of topography, hydrologic input, and seasonal fluctuation of

the water level of the bog. As pointed out by Crum (1988), typically bogs and fens that have a lagg component are usually associated with sloping adjacent topography. This is holds true at the Springfield bog, the laggs are located along the edges of the bog where there is sloped terrain right up to the edge of the bog. The combination of hydrologic inputs from surface water, and most likely groundwater, no doubt play a large role in the mosaic vegetated patterns of the peat bed and laggs.

Species distribution patterns within the bog itself also appear to be sorting along various hydrologic gradients and other internal physical features. Within the peat mat itself, where there is a noticeable lack of peat hummocks and hollows, the moss beds are interwoven with shrub communities. The 7 bog shrubs and herbs are limited in occurrence to just the peat mat. The peat mat is dominated by tall shrub species that are 6-10 feet in high. The taller shrubs on the mat are High Bush Blueberry (*Vaccinium corymbosus* L.), Mountain Holly (*Nemopanthus mucronatus* (L.) Loes.), and Black Chokeberry (*Aronia melanocarpa (*Michx.) Ell.) (Fig. 1).

Figure 1. North Springfield Bog looking South. The bog in many locations is dominated by tall shrub species

The edge of the floating sedge mat and open water is rich in lagg species. These lagg species are reported to frequently be found in fens (Crum 1988). The higher pH values and mineral rich hydrologic conditions are in contrast to the lower pH conditions associated with the peat mat. This contrast in hydrologic conditions sets up stark differences in micro habitats within the bog. But, neither the peat mat nor the lagg is

extensively developed enough to allow for a larger component of species associated with either of the bog types. This limited development of the peat mat and the lagg edges restricts or limits the overall species diversity at the bog.

The flux in elevation of the surface water caused by one or both sources, surface and groundwater, may be another limiting factor restricting species occurrences. The surface water flux appears to be influencing the growth habit of Pitcher Plant (*Sarracenia purpurea* L.) at the bog. At the Springfield bog this species has a "stretched" growth form appearance with elongated trumpet shaped leaves, which is an atypical growth form pattern. This unusually elongated appearance may be a local adaptation to the seasonal flux in surface water levels. It would be interesting to study the added elongated measurements of the leaves in comparison to the elevation flux of the surface water.

Conclusion

The landscape setting and hydrologic inputs to the bog have created a mosaic pattern of bog and fen features. By combining all the features (peat bed, open water lagg, and species occurrences) the North Springfield Bog is best described as a bog that fits somewhere between a poor to intermediate fen in natural community classification systems. A poor fen is a peatland type that has taller hummocks, less tall shrubs, and more extensive peat deposits. Whereas an intermediate fen lacks hummocks, has tall shrubs, and the peat is derived from leafy graminoid materials instead of *Sphagnum*. Neither of these two fen conditions exists solely at the bog, but the combination of some parts of each type does occur. Without knowing the long term history of the site, it is possible that this may be a previously human disturbed bog which might explain the remaining occurrence of peat and bog species. Or the bog may be a remnant old pond with a marsh like setting going through succession and paludification (the expansion and accumulation of peat over time laterally). Whatever the history of the site may be, the current hydrologic conditions are limiting the development of a bog or fen flora and restricting the overall species diversity at the site. These limiting factors and their results do make Springfield bog unique in that it is distinctly different from classic kettle bogs.

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Appendix 1: Representative Species for Various Bog and Fen Types in Relationship to the Springfield Bog

Species	Common Name	Dwarf	Spruce Bog	Pine Bog	Poor Fen	Intem Fen	Rich Fen	Laggs	Marsh
Abies balsamea (L.) P. Mill.	balsam fir		X	X					
Acer rubrum L.	red maple			X	X				
Andromeda glaucophylla Link	bog rosemary	X	X	X	X, Y	X			
Aralia nudicaulis L.	wild sarsaparilla								
Arctium vulgare (Hill) Evans	woodland burdock								
Aronia melanocarpa (Michx.) Ell.	black chokeberry	X			X				
Athyrium filix-femina (L.) Roth	common ladyfern								
Betula papyrifera Marsh.	paper birch								
Botrychium multifidum (Gmel.) Trev.	leathery grapefern								
Calamagrostis canadensis (Michx.) Beauv.	bluejoint					Y	Y	Y	
Caltha palustris L.	yellow marsh marigold							Y	
Carex canescens L.	silvery sedge								
Carex comosa Boott	longhair sedge								
Carex rostrata Stokes	beaked sedge								Y
Carex trisperma Dewey	threeseeded sedge	X							
Carex viridula Michx.	little green sedge								Y
Chamaedaphne calyculata (L.) Moench	leatherleaf	Y			X	Y			
Drosera rotundifolia L.	roundleaf sundew	X	X		X				
Dryopteris thelypteris (L.) Sw.	eastern marsh fern								
Dryopteris cristata (L.) Gray	crested woodfern								
Dulichium arundinaceum (L.) Britt.	threeway sedge								Y
Galium trifidum L.	threepetal bedstraw								
Geum canadense Jacq.	white avens								
Glyceria canadensis (Michx.) Trin.	rattlesnake mannagrass							Y	

Glyceria striata (Lam.) A.S. Hitchc.	fowl mannagrass							Y	
Hypericum virginicum L.	Virginia marsh St. Johnswort								
Iris versicolor L.	harlequin blueflag								Y
Juncus effusus L.	common rush								
Lemna minor L.	common duckweed								
Lycopus americanus Muhl. ex W. Bart.	American water horehound								
Nemopanthus mucronatus (L.) Loes.	catberry			X				Y	
Thelypteris palustris Schott	eastern marsh fern							Y	
Onoclea sensibilis L.	sensitive fern	X	X		X			Y	
Picea mariana (P. Mill.) B.S.P.	black spruce								
Pinus strobus L.	white pine								
Pteridium aquilinum (L.) Kuhn	western brackenfern								
Salix candida Flueggé ex Willd.	sageleaf willow					X	X, Y		
Salix nigra Marsh.	black willow								
Sambucus canadensis L.	common elderberry								
Sarracenia purpurea L.	purple pitcherplant	X	X		X				
Scirpus atrocinctus Fern.	blackgirdle bulrush								
Scirpus caespitosus L.	tufted bulrush							Y	
Scirpus cyperinus (L.) Knuth	woolgrass							Y	
Scirpus tabernaemontani Gmel.	softstem bulrush								
Spiraea alba Du Roi	white meadowsweet						Y		
Spiraea tomentosa L.	steeplebush								
Vaccinium corymbosum L.	highbush blueberry		X					Y	
Vaccinium oxycoccos L.	small cranberry	X	X	X	Y	X			
Vicia cracca L.	bird vetch								
Total		8	7	5	8	4	1	10	3

X = Thompson, E. and E. Sorenson. 2005
Y = Crum 1988

Appendix 2: Upland Species Observed

Species	Common Name
Acer rubrum L.	red maple
Acer saccharum Marsh	sugar maple
Actaea rubra (Ait.) Willd.	red baneberry
Agropyron trachycaulum (Link) Malte ex H.F. Lewis	slender wheatgarss
Agrostis stolonifera L.	creeping bentgrass
Alliaria petiolata (Bieb.) Cavara & Grande	garlic mustard
Aralia nudicaulis L.	wild sarsaparilla
Aronia melanocarpa (Michx.) Ell.	black chokeberry
Aster lateriflorus (L.) Britt.	calico aster
Berberis vulgaris L.	common barberry
Betula papyrifera Marsh.	paper birch
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.	bearded shorthusk
Carex arctata Boott ex Hook.	drooping woodland sedge
Carex debilis Michx.	white edge sedge
Carex deweyana Schwein.	dewey sedge
Carex foenea Willd.	bronze- headed oval sedge
Carex pensylvanica Lam.	Pennsylvania sedge
Circaea alpina L.	small enchanter's nightshade
Cornus foemina P. Mill.	stiff dogwood
Cornus sericea L.	redosier dogwood
Cystopteris fragilis (L.) Bernh. ssp. dickieana (Sim) Hyl.	brittle bladderfern
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	poverty oatgrass
Dennstaedtia punctilobula (Michx.) T. Moore	eastern hayscented fern
Dryopteris cristata (L.) Gray	crested woodfern
Euphorbia esula L.	leafy spurge
Fagus grandifolia Ehrh.	American beech
Fraxinus americana L.	green ash
Galium boreale L.	northern bedstraw
Hieracium aurantiacum L.	orange hawkweed
Impatiens capensis Meerb.	jewelweed
Juncus tenuis Willd.	poverty rush
Lonicera tatarica L.	Tatarian honeysuckle
Lycopodium complanatum L.	groundcedar
Lysimachia nummularia L.	creeping jenny
Maianthemum canadense Desf.	Canada mayflower
Mitchella repens L.	partridgeberry
Onoclea struthiopteris (L.) Hoffmann	ostrich fern
Osmorhiza chilensis Hook. & Arn.	sweetcicely
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper
Picea abies (L.) Karst.	Norway spruce
Picea rubens Sarg.	red spruce
Pinus strobus L.	white pine
Plantago major L.	common plantain
Poa pratensis L.	Kentucky bluegrass
Polystichum acrostichoides (Michx.) Schott	Christmas fern
Populus tremuloides Michx.	quaking aspen
Prunella vulgaris L.	common selfheal
Prunus pensylvanica L.	pin cherry
Prunus serotina Ehrh.	black cherry
Pteridium aquilinum (L.) Kuhn	western brackenfern
Quercus rubra L.	red Oak
Rubus allegheniensis Porter	Allegheny blackberry
Rubus idaeus L. ssp. idaeus	American red raspberry
Solidago canadensis L.	Canada goldenrod
Solidago rugosa P. Mill.	wrinkleleaf goldenrod
Sonchus arvensis L.	field sowthistle
Thelypteris noveboracensis (L.) Nieuwl.	New York fern
Tilia americana L.	American basswood
Trientalis borealis Raf.	starflower
Tsuga canadensis (L.) Carr.	easter hemlock

Vaccinium corymbosum L.	highbush blueberry
Vaccinium myrtilloides Michx.	velvetleaf huckleberry
Viola canadensis L.	Canadian white violet
Vitis aestivalis Michx.	summer grape