Victoria Pinheiro
University of Vermont
NR378
14 April 2014

A Literature Review of Scientific Studies Pertaining to Colchester Bog

Foreword:

The purpose of this document is to collate a brief summary of all known & relevant scientific inquiry into matters regarding Colchester Bog in one place, to facilitate future inquiry and streamline the literature search. The studies contained in this review include peer reviewed research, thesis work and undergraduate research (overseen by experienced and qualified professors). Where it is logical, a summary of their findings is presented. In situations where the studies result in long species lists or other lengthy findings, the reader is referred to the paper at hand. Each study is labeled as available online or not, copies of those not available online can be attained by contacting Rick Paradis of the University of Vermont Natural Areas, who now has a file of digitized copies of the original studies kept in the UVM Natural Areas archives.

The Vertebrate Fauna of Colchester Bog

Milgroom 1977

A survey of vertebrates was performed on Colchester Bog. Data collected was combined with anecdotal observations from locals and with a previous study of vertebrates on the bog performed by Howard and White in 1975. No fish were observed by the researchers, but locals told of large pickerel in the bog and kingfishers were present, possibly indicating fish. Leopard frogs (*Rana pipiens)*, bull

frogs (*R. catesbeiana*) and American toads (*Buto americana*) have all been positively identified in the bog. Eastern painted turtles (chrysemys picta), snapping turtles (Chelydra serpentine) ribban snakes (thamnophis sauritis) and northern watersnakes (Natirx sipedon) are the only documented reptiles to be found. Bird sightings are plentiful, 56 species have been documented in the bog. See the full report for details. White-footed mice (preomyscys leucopus), red squirrels (tamiasciurus hudsonicus), gray squirrels (sciurus carolinensis), raccoons (procyon lotor), short-tailed shrew (Blarina brevicauda), meadow jumping mouse (zapus hudsonus) eastern chipmunks (tamias striatus), eastern cottontail (sylvilagus floridanus) and muskrat (ondatra zibethicus) were also found.

Phytosociological, Hydrological and Other Ecological Features of Colchester Bog, Vermont
Howard and Worley 1976

This paper provides a detailed history and geomorphology of the bog before describing the eight methods landscape analysis used in the Colchester Bog area and how they contribute to the phytosociological analysis the researchers performed. The first method is assessment of the physiognomy, or the general composition of the vegetation of an area as seen while walking through. Remote sensing, in the form of areal photography, was also used. Species distribution studies were undertaken using transects and quadrats to determine dominant species in an area and their percent cover. Interspecific association analysis asked which species, if any, occurred together in a nonrandom manner? Ordination dealt with long lists of plant cover data holding many species and importance values by creating clusters of

similar areas. Species diversity was calculated using the species distribution data. Growth ring analysis gave the researchers an idea of the age of trees present. Successional analysis was performed by comparing photographs of several years. The zones and gradients described by these analyses were then combined. In addition, they did an analysis of environmental factors, conductivity, nutrients, Bakuzis Synecological Factors, peat depth, and hydrology.

Spring Filling of Xylem Vessels in Wild Grapevine
Sperry et al. 1986

This study describes the progression of the contents of the xylem vessels in wild grapevines present in Colchester bog. Xylem vessels contained air overwinter and filled with xylem sap in the spring. The researchers determined the mechanism behind the transition from gas to sap filled vessels.

The Geomorphological Origin of Colchester Bog, Vermont: An Alternate Model
Weeks 1987

Post-deglaciation, sea-water entered the Champlain valley when the ice-plug melted in the St. Lawrence, inundating the area and forming the Champlain Sea. Later, this area experienced glacial rebound, which cut off the Champlain Sea from its salt-water source. Eventually the sea transitioned to a freshwater lake as the salt water was flushed out. But there was a large drop in sea level before the sea transitioned into a lake, leaving deltaic and beach deposits in the present Colchester area. This model states that the pebbly marine-sand that is found beneath the peat of

Colchester bog is not a remnant of an old meander of the Winooski River, but was once one of these deltaic beach deposits. A succession of spits composed of riverine sand brought northward from the Winooski would have curved outward (counterclockwise) until they hit Mills Point Island. In the north the sediment source was sand and gravel derived from the Porter Point formation. Wind and current powered longshore drift would create more migrating spit systems, this time arcing in a clockwise direction towards the Mills Point Island. As these two spits eked out into the open water, they segregated a portion, creating a stagnant, shallow area that allowed for vegetation to take and eventually for the formation of the present day Colchester Bog.

Soils on a Wetland-Upland Transition in Colchester Bog, Colchester, Vermont
Lowstein and Bubier 1988

This study mapped the soil types and drainage classes at the upland-wetland boundary at a fine-scale level in order to assess the potential for land use at this boundary. Entosols and histosols were found in the flat, inundated areas, spodosols were found anywhere wet that experienced slight elevation (slopes, ridges, terraces). Elevations that brought the substrate above the water level into upland areas were sufficient to allow for podsolization. The hydrology of the site was less clearly defined; in this case clearer wetland boundaries will be achieved using soil type as the delineating factor. Drained histosols are traditionally productive for agricultural use, however, the geology of the bog lends itself poorly to drainage, making the bog a poor fit for farmland. Similarly, building residential areas atop

peat is troublesome and labor intensive, as the substrate makes it difficult to use heavy equipment and septic systems are impossible in this area. One runs into similar issues with entisols. Spodosols have more potential for agricultural use, but would still present the issues of flooding and wetness. In conclusion, the Colchester bog would provide the most return to the public in the manner of providing valuable ecosystem services and an area for recreation.

Vegetational Patterns in Relation to PH Levels Is Colchester Bog
Woerner et al. 1995

pH varies greatly across a peat land, this variation leads to different vegetational patterns depending on a plant's optimum pH range. This study sought to correlate plant species assemblages with the pH of the water present. pH, temperature and conductivity were measured every 10m along two 140m transects (for a total of 28 sample sites) to define pH zones. The vegetation in these zones were then described and quantified. In transect B, nutrient samples were taken. Overall, pH was found to decrease and the herbaceous layer was found to increase as the transect progresses into the bog. Low pH and the presence of sphagnum mosses were positively correlated as were high pH and the presence of Spirea and Alnus rugosa. Additionally, a large number of species occurred in areas with both high and low pH's, possibly indicating that these species aren't as sensitive to acidity and could be limited by other factors.

Geographic Variation in Nutrient Availability, Stoichometry and Metal Diversity of Rotifers from Northeastern U.S.A. Bogs with New Species Records for North America and New England
Bledski and Ellison 2003

This study undertook a survey of rotifers in the bogs of Massachusetts, Vermont and Connecticut. A detailed analysis and species list is presented. It was found that species richness increases with bog elevation but has no geographic correlation.

Comparison of Bacterial Communities in New England Sphagnum Bogs Using Terminal Restriction Fragment Length Polymorphism (T-RFLP)
Morales et al. 2006

This study undertakes a survey of bacterial populations at the surface and anoxic sub layer of 24 bogs in Vermont and Massachusetts. They found complex species compositions that seemed to be stratified and similar across the bogs.

Concentrations in Plants and Pore Water of Obrotrophic Bogs in New England, USA
Gotelli et al. 2008

This study looked at geographic patterns in water chemistry and nutrient content of leaf tissue in leather leaf, pitcher plants and peat moss across 24 bogs in Massachusetts and Vermont and assessed how they indicate trends of nutrient limitation and human impacts on an area. Major nutrient and trace heavy metals were low in all three plants. Nutrient ratios indicated that bogs were primarily P limited. Dissolved organic carbon and dissolved organic nitrogen increased with urbanization. Colchester bog was unique among the 24 bogs sampled and was found

to have the highest pH and highest DOC, DON, P, Al, Cu, K, Mg, Na, and Zn.

References

Bledski, Leszek A., and Aaron M. Ellison. "Diversity of Rotifers from Northeastern U.S.A. Bogs with New Species Records for North America and New England." *Hydrobiologia* 497.53-62 (2003)

Gotelli, Nicholas J., Paula J. Mouser, Stephen P. Hudman, Sergio E. Morales, Donald S. Ross, and Aaron M. Ellison. "Geographic Variation in Nutrient Availability, Stoichometry and Metal Concentrations in Plants and Pore Water of Obrotrophic Bogs in New England, USA." *Society of Wetland Scientists* 23.3 (2008)

Howard, Lauren D., and Ian A. Worely. "Phytosociological, Hyrdological and Other Ecological Features of Cholchester Bog, Vermont." *Proceedings of the Lake Champlain Environmental Conference* (1976): 52-116.

Lowstein, Frank, and Jillian Bubier. "Soils on a Wetland-Upland Transition in Colchester Bog, Colchester, Vermont." *University of Vermont* (1988)

Milgroom, Michael. "The Vertebrate Fauna of Colchester Bog." *Univeristy of Vermont* (1977):

Morales, Sergio E., Paula J. Mouser, Naomi Ward, Stephen P. Hudman, Nicholas J. Gotelli, Donald S. Ross, and Thomas A. Lewis. "Comparison of Bacterial Communities in New England Sphagnum Bogs Using Terminal Restriction Fragment Length Polymorphism (T-RFLP)." *Microbial Ecology* 52.1 (2006): 34-44.

Sperry, J. S., N. M. Holbrook, M. H. Zimmermann, and M. T. Tyree. "Spring Filling of Xylem Vessels in Wild Grapevine." *Plant Physiology* 83.2 (1987): 414-17.

Weeks, Charlotte. "The Geomorphological Origin of Colchester Bog, Vermont: An Alternate Model." *University of Vermont* (1987):

Woerner, Joseph, Christopher Wulff, and Melody Krause. "Vegetational Patterns in Relation to PH Levels Is Colchester Bog." *University of Vermont* (1995)