New England Botanical Club – Minutes of the 1020th Meeting
6 October 2006
Karen Lombard, Recording Secretary

The 793rd meeting of the New England Botanical Club, being the 1020th since its original organization, was held on Friday, October 6, 2006 in the Lecture Room of the Fairchild Biochemistry Building, Divinity Avenue, Cambridge, MA. There were 27 members and guests in attendance. Paul and Lois Somers mentioned an upcoming auction fundraiser with food, wine, and music to support the land conservation activities of the Ashburnham Conservation Trust on November 19th. Pat Swain announced the availability of a public GIS datalayer on occurrences of mostly uncommon natural community types from the Massachusetts Natural Heritage and Endangered Species Program database. It can be accessed at http://www.mass.gov/mgis/natcomm.htm.

Vice-President Robert Bertin welcomed the night's speaker, Dr. Jill Bubier from the Environmental Studies Program at Mount Holyoke College. Dr. Bubier has researched wetland ecology for many years in North American peatland communities including bogs in Canada, Alaska, and New England. Dr. Bubier spoke on the topic: "Effects of nutrient addition on carbon cycling in a boreal peatland." Peatlands contain one-third of the global pool of soil carbon, and bogs comprise most of the peatlands in North America. They have been long-term sinks of carbon since deglaciation because of their cold, water-logged soils with slow decomposition, but with a warmer and perhaps drier climate, bogs could become weaker carbon sinks or even carbon sources. Dr. Bubier and her colleagues are examining how changes in climate and nitrogen deposition will affect the carbon sink potential of peatlands. She has collaborated with Dr. Tim Moore of McGill University for several years on a fertilization experiment at a long-term research site at Mer Bleue Bog in Ottawa, Ontario, Canada.

Mer Bleue is a large raised bog at the southern end of a belt of peatlands that extends south and east from Hudson Bay in Canada. Mer Bleue bog is dominated by ericaceous shrubs; the dominant moss is *Sphagnum capillifolium*. It is a relatively dry peatland, with the water table 30-40 cm below the surface. Peat cores have shown that the site was originally a fen that changed rapidly to a bog as peat accumulation isolated the wetland from groundwater. Dr. Bubier's study area is a 28 km^2 area within this huge peatland system.

Dr. Bubier began her presentation by comparing rates of atmospheric nitrogen input in North America and Europe. European rates of nitrogen deposition are very high (up to 5 g N m^{-2} y^{-1}) compared to the highest portions of eastern North America (downwind of Midwestern power plants). Mer Bleue rates are 0.8-1.2 g N m^{-2} y^{-1}. Long term eddy covariance tower data at the site have shown that in the spring the bog takes carbon dioxide (CO_2) from the atmosphere; then by late summer and early fall rates of accumulation level off depending on drought conditions. By the fall, the peatland becomes a source of carbon as decomposition exceeds plant production. In most years the bog is an overall carbon sink, but in some years the bog becomes an overall source of carbon to the atmosphere. Although six years of measurement show average peat accumulations of 20 g C m^{-2} y^{-1}, interannual variability is high.

In Jill's experiments, nitrogen was added in various levels to 3 $\times$ 3 meter plots, both alone and in combination other limiting nutrients, phosphorous and potassium. Treatments were applied every three weeks during the growing season, and plant biomass and species composition were measured along with net ecosystem exchange of CO_2 (NEE). The initial hypothesis for the fertilization experiment was that high nutrient levels would cause the bog to become a stronger carbon sink due to more plant growth. However after five years, the plots with the highest nutrient addition (20 $\times$ ambient levels of N deposition with P and K) showed lower NEE at maximum light than all other treatments. Surprisingly, lower rates of gross photosynthesis, not respiration, were discovered to be responsible for the differences in NEE. Although shrubs increased in biomass and leaf area in the high-nutrient plots, moss biomass decreased. After three years of fertilization, *Polytrichum* was dominant over *Sphagnum*, and by five years, all moss had died off. Similar results have been observed in European bogs that receive high nitrogen deposition from the atmosphere. Further investigation of various hypotheses for the moss decline have shown that it is primarily from increased shrub growth and litter inputs, which block light to the moss layer. There also may be possible toxic effects of nutrient addition contributing to the decline of first *Sphagnum*, then *Polytrichum*, as this has been documented by other researchers.

Dr. Bubier concluded her talk by outlining several future scenarios for peatland impacts from increased nitrogen fertilization. At low nitrogen deposition (< 1 g N m-2 y-1) carbon accumulation may increase. At high nitrogen deposition (>1 g N m-2 y-1) carbon accumulation will probably decrease owing to plant species shifts and loss of moss photosynthesis. Decomposition will likely increase in the future as recalcitrant *Sphagnum* tissues are replaced by more easily decomposable vascular plant leaf litter. Overall, with high nitrogen inputs, peatlands will likely shift from being important carbon sinks to sources, which could exacerbate climate change.