New England Botanical Club – Minutes of the 1014th Meeting
3 February 2006
Karen Lombard, Recording Secretary

The 787th meeting of the New England Botanical Club, being the 1014th since its original organization, was held on Friday, February 3, 2006 in the Lecture Room of the Fairchild Biochemistry Building, Divinity Avenue, Cambridge, MA. There were 44 members and guests in attendance. Announcements and gossip began the evening. One new member was announced, Shane Shaw of Orleans, Vermont. Janet Sullivan was congratulated on producing 10 volumes of *Rhodora* in 9 years! Council member, Julie Richburg, and her husband Mike celebrated the arrival of Isabelle Cate Perusse on January 28th. Pat Swain announced that the Massachusetts Heritage Program is co-sponsoring a half day symposium with Manomet Observatory on natural communities in Easton on April 1st. The joint field meeting with the Southern Appalachian Botanical Society will be June 4-7 and the registration will go out with the March mailing. Graduate student award applications are due March 1st.

Vice President Karen Searcy announced the evening's speaker, doctoral student David Ellum of Yale University School of Forestry and Environmental Studies. His talk was titled: "Plasticity vs. Acclimation: Response Pathways of Forest Understory Herbs to Seasonal Increases in Light Environments and the Implications for Plant Conservation in Managed Forests of Southern New England." Ellum was the recipient of an NEBC 2005 graduate student award. He is studying the related effects of forest canopy structure and silvicultural practices on landscape-level, groundstory floristic patterns in New England forests. He is investigating how the life history traits of woodland herbs contribute to the functional and structural diversity of naturally regenerated, mixed-species forests in southern New England. Ellum began his talk by summarizing the role of woodland herbs in forests. These species are the main source of forest floristic diversity, are important in nutrient cycling, provide wildlife forage and cover, provide vertical diversity, and compete with forest tree seedlings. Economically, some species provide non-timber forest products and are used medicinally. Canopy removal in forests may negatively affect these species in several ways, including physical damage during harvest operations, reduced populations due to low fecundity and limited dispersal capabilities, increased competition from r-selected species, and physiological stress in the post-disturbance environment. As one aspect of his research, Ellum is focused on measuring the physiological stress of plants when the forest canopy is removed in either the winter dormant period or summer growing season.

Plants adapt to changes in their environment via either plasticity or acclimation. Ellum defined plasticity using the example of adaptations fixed during the development of a plant, such as leaf thickness or number of stomates. Acclimation is defined as reversible changes that occur once the plant has matured and is adapting to environmental changes. The theory is that shade-adapted species are not as plastic as shade-intolerant pioneer species. The species he used in his research included *Maianthemum canadense* (Canada mayflower), *Arisaema triphyllum* (Jack-in-the-pulpit), and *Aralia nudicaulis* (false sarsaparilla). Ellum chose these species because they are summer green perennials, shade plants adapted to photosynthesis at low levels, produce one set of leaves per year, and could be ecological surrogates for rare plants in the same environment. He grew the species in pots a common garden under a forest canopy and looked at the results of five treatments: 1 & 2, movement of plants during winter to open and edge light environments (simulating winter canopy harvest); 3, movement of plants during summer to open or edge light environments (summer canopy harvest); and 5, control plants that remained under the forest canopy. For the edge treatments he used just a western edge (shaded in the afternoon) because most plants slow down their photosynthesis in the afternoon. This would provide shade during the time of day when heat and light stress would be high while carbon gain would be limited. Ellum then measured changes in leaf morphology, anatomy, and physiology under the different treatments.

Results showed that the three woodland herbs demonstrate a high level of plasticity when exposed to full sun prior to leaf development, however, mature plants demonstrated limited short-term acclimation potential after being exposed to full sun. Plasticity is shown in morphological, anatomical, and physiological traits, and leads to improved fitness in high-light environments. Changes in leaf morphology from exposure to full sun prior to development included smaller, thicker leaves held at angles that reduced the amount of direct light hitting the leaf surface. Leaf anatomical adaptations to high light during development included a significantly more developed palisade layer in *Aralia*, more tightly packed spongy mesophyll in *Maianthemum*, and greater stomatal densities and very large intercellular spaces in *Arisaema*. Mature plants exposed to full sun showed photooxidation and physical damage to leaf cell structure. These negative impacts of high light on mature leaves were mediated by the edge treatment.

To measure physiological adaptation, Ellum looked at chlorophyll fluorescence and photosynthetic responses across treatments. Chlorophyll fluorescence indicated that mature plants showed significant stress after being moved to full sun, while plants that developed in the full sun showed no significant differences from the control group. Photosynthetic light response curves indicated higher net carbon gains for winter canopy harvest simulation than controls, and greatly reduced photosynthetic rates for summer canopy harvest simulation.

Overall, the research demonstrated that winter canopy removal may be preferred in order to improve the survival of forest understory species in open-light environments. Ellum hopes his research will contribute to the development of practical and sustainable forestry standards, help in developing guidelines for working forest easements, and refine strategies for the management of non-timber forest products and rare plants.