New England Botanical Club - Minutes of the 989th Meeting

June 6, 2003 Dr. Karen Searcy, Acting Recording Secretary

The 762nd meeting of the New England Botanical Club, being the 989th since its original organization, met on Friday, June 6, 2003, at Split Rock Camp, Ashburnham, MA. The evening speaker was Dr. Matthew G. Hickler of the University of Massachusetts -- Amherst. Matt spoke on the topic "Vegetation Patterns and Species Diversity: Floodplain Ponds of the Nashua River."

The floodplain of the Nashua River at Fort Devens, Worcester County, Massachusetts has numerous ponds that were formed when meanders were cut off and became isolated. Matt Hickler assisted by the "hippo-squad" studied fifteen of the floodplain ponds ranging in size from 0.25 to 2.5 hectares. This is a dynamic ecosystem. Spring floods can scour ponds or deposit sediment providing new habitat and altering old habitats. Although not dated, individual ponds last decades to a few hundred years. Hickler suspected that equilibrium models such as hydrarch succession would not be useful in understanding this ecosystem.

As a first step in understanding vegetation patterns and species diversity, the vegetation of each pond was sampled and species lists compiled. The ponds showed a marked zonation. Ponds typically had a central zone of open water characterized by *Spirodela polyrrhiza, Lemna minor, Wolffia brasiliensis*, and *Ceratophyllum echinatum*, or *C. demersum* but not both. Additional common species included *Potamogeton natans* and *Nuphar variegata*. A deep marsh zone frequently followed the open water zone in the floodplain ponds. Common species in this zone included *Pontederia cordata*, and *Sparganium americanum*. *Sparganium natans*, an endangered species in Massachusetts was found on one pond in this zone. In 10 of the 15 ponds there was a zone of *Cephalanthus occidentalis* that formed a dense band along the shore. *Bidens discoidea*, a Massachusetts watchlist species was observed as an epiphyte on the stems of this plant. Finally 7 of the 15 ponds included a wet meadow. This zone was periodically flooded and was the most diverse, with a point diversity as high as 25-30 species/m^2. Species composition was highly variable but typically included an assortment of grasses and sedges mixed with a variety of herbaceous species including many annuals. *Scirpus cyperinus, S. tabernaemontani, Carex lacustris*, and *Typha latifolia* also contributed to diversity of this zone in some ponds.

Hickler found the floodplain ponds to be unexpectedly diverse relative to the surrounding area. Approximately 20% of the flora of former Fort Devens was found in the floodplain ponds even though they made up a fraction of 1% of the total fort area. One component of floodplain pond diversity was the difference in species composition between ponds, or beta-diversity. Of the 151 species recorded, 65 were found in only one or two ponds while only two species were found in all ponds. Using Jaccard's coefficient of similarity, basically the percent of shared species, there was about a 34% similarity between any two

ponds, so that the floras of the ponds tended to be unique. However, the diversity pattern was more complex since diversity was not evenly distributed among ponds. Twelve of the ponds were relatively species poor with about 45 species per pond while 3 ponds were species rich with about 90-100 species per pond. In addition, the three richest ponds had about 25% of species that occurred only once or twice, while species poor ponds had about 10% of their species in this group.

Hickler concluded that, indeed, diversity patterns in the ponds did not fit equilibrium models of biodiversity. For example, the model of island biogeography predicts that large ponds should be species rich, while smaller ponds should be species poor. Instead, for the Fort Devens floodplain ponds there was no significant relationship between pond size and species number. Instead, a major factor in determining species richness appeared to be whether the pond was connected to the river. All species rich ponds were connected to the Nashua River while none of the species poor ponds were. The connected ponds followed the water level of the river. High water in the spring was followed by a rapid decline as the season progressed. The occasional heavy summer rain filled the connected ponds but these drained quickly and within a few days they regained their lower water summer level. In contrast, for the ponds that were not connected, water levels dropped more slowly in the spring and perhaps more importantly following heavy summer rain low diversity pond remained flooded for some time.

Hickler concluded that the best way to understand the Fort Devens floodplain ponds was to view them as non-equilibrium systems. With sufficient disturbance species could not establish competitive dominance so diversity was high irrespective of pond size. In addition, differences between richness levels could probably be attributed to the effect of summer floods, a disturbance that reduced diversity in isolated but not connected ponds.