

New England Botanical Club – Minutes of the 942nd Meeting

6 November 1998 Prepared by Dr. Paul Somers, Recording Secretary

The 715th meeting of the New England Botanical Club, Inc., being the 932nd since the original organization, met on Friday, Nov. 6, 1998 in the main lecture hall of the Biological Laboratories, Harvard University, with 63 members and guests present, including members visiting from Tennessee, Mississippi, and Nebraska.

Two new members were introduced to the Club. There was no new or old business, but lots of gossip concerning the availability of a number of floras (Concord, MA, and Maine) and publications from the Massachusetts Division of Fisheries and Wildlife ("Our Irreplaceable Heritage" and "Invasive Plants").

President Dave Conant then introduced the evening's speaker, Dr. Bruce Lindwall, a recent graduate of the University of Massachusetts, who spoke on the topic "The Effects of Habitat Fragmentation on Plants." Dr. Lindwall first thanked the New England Botanical Club for awarding him (in 1996) a Graduate Student Research Award to support his dissertation research. He then launched into a fascinating presentation of his dissertation research findings about genetic diversity in populations of three alpine tundra species, comparing fragmented populations from nine peaks in the Adirondack Mountains of New York with nine sample sites within a continuous, unfragmented habitat of the Presidential Range in the White Mountains of New Hampshire. Other previous studies on the effects of fragmentation on loss of genetic diversity, he said, have involved habitats with a relatively recent history of fragmentation (i.e., less than a few hundred years) and only one taxon. He thought by examining high peak populations presumably separated for thousands of years that the effects of time on genetic drift and genetic diversity might be more apparent. By examining three species, he hoped to reduce the possibility of any erroneous conclusions made by assuming that what is true for one is true for all. Lindwall identified the three key questions he wanted to answer in the study as: 1) Do plant populations in the fragmented Adirondack peaks have less diversity than the continuous population in the White Mountains? 2) Is there more gene flow in the Presidential Range than among the fragmented populations in the Adirondacks? 3) What effect does greater habitat area have on diversity in the White Mountains versus the smaller area for each of the isolated Adirondack sites?

A fortuitous coincidence of Lindwall's site design, he added, was that the overall land area and distances between sites for the two study areas were approximately the same. Something he could not control in the study was the wind, which blew at a record 164 mph the day before one of his many summit climbs. To quantify the relative abundance and frequency of each species, a total of 6000 square-meter plots were examined. Finding that the mountaintop winds would often carry his meter tape 30 meters downwind, he soon learned that pacing yielded straighter lines. The genetic diversity was assessed using allozyme analysis. The three species studied were *Minuartia groenlandica*, which appears to be exploiting disturbed trail edge habitat, *Carex bigelovii*, which forms large patches in the White Mountains, and *Diapensia lapponica*, a monotypic genus found in tundra. A total of 3000 tissue samples were taken and analyzed during the study. Each was stored in dry ice to keep the proteins at minus 80 C, which necessitated

carrying 50-pound blocks of dry ice to backcountry locations near each summit when taking samples.

What were the findings? For each of Lindwall's three questions, the answers were "yes", "no", and "maybe". Did the Adirondacks have less genetic diversity? For *Diapensia lapponica*, the answer was a statistically significant "yes", but for *Minuartia groenlandica*, he found higher diversity at all Adirondack peak sites than at the Presidential Range subsites. The results for *Carex bigelovii* were not as easy to interpret. The overall genetic variability was greater in the White Mountains, but because *C. bigelovii* is less abundant in the Adirondacks than the Presidential Range, the sample size was small and only one of four indices was higher statistically. Thus, we have a "maybe". What about gene flow? Lindwall created dendrograms to illustrate degrees of similarity (or difference) in both genetics and geographic distances among the populations. Comparing Nei's index of genetic identity for each of the three species relative to the Adirondacks and Presidentials, the answers were again mixed. For *Carex bigelovii*, there was a close relationship among all sites in the New Hampshire but not so among the New York sites. *Minuartia groenlandica*, on the other hand, showed no particular pattern with generally good gene flow across the board. However, the most genetically distant population in the Adirondacks was from the most distantly isolated peak, the Gothics. The story with *Diapensia lapponica*, also seemed to relate to distance between sites. In both areas, there appeared to be good gene flow with near neighbors, such as among the four McIntyre Ridge peaks in the Adirondacks, but less so when distance was greater between sites. What role does habitat area play? With *C. bigelovii*, there was a clear relationship; bigger places had more variability. Just the opposite was true for *Minuartia*: the smaller sites in the Adirondacks had statistically higher variability than the continuous population in the Presidentials. For *Diapensia*, size appeared to have no effect, and thus we have a "maybe" answer.

There was one general conclusion that fit all three species, Lindwall said in summary: that the greatest amount of genetic diversity occurs where each species is the most abundant. He also concluded that we should neither assume that species will behave the same despite similar histories, nor for conservation planning purposes assume that the largest habitat area will support the most diverse population of a given species.

Following an enthusiastic discussion about the unexpected results for *Minuartia* on the area size question, the group adjourned for refreshments and socializing.