New England Botanical Club – Minutes of the 953rd Meeting

3 Dec 1999 Prepared by Dr. Paul Somers, Recording Secretary

The 726th meeting of the New England Botanical Club, being the 953rd since its original organization, met on Friday, December 3, 1999 at the Biological Laboratories of Harvard University in Cambridge, Massachusetts with 53 members and guests present.

Vice President Lisa Standley introduced the names of two new members and invited items of business and announcements. George Newman announced that copies of the itinerary for the July 2000 NEBC field trip to the Gaspé Peninsula were available. Pat Swain reminded everyone that it was time for students to prepare Graduate Research Award proposals due by March 1, 2000 for the Club's annual award(s). Karen Lombard stated that the keying group met at 5:00 PM in the Harvard University Herbaria. Gossip featured Les Mehrhoff talking about erroneous reports of *Microstegium vimineum* and asking for information or observations of birds dispersing *Rosa rugosa*. He floated the hypothesis that its hips are transported by water along the eastern seaboard. Dr. Standley then introduced the evening speaker.

Dr. Leila Shultz, Research Associate Professor at Utah State University, presented a lecture entitled, "Breaking new ground in floristics: Using geographic information systems to predict species distributions in western North America." For the neophytes on Utah geography and flora, she started by describing 4-6 floristic provinces of Utah, the exact number depending on one's interpretation. The Colorado Plateaus define the southeastern portion of the state while the southwestern corner is considered an eastern extension of the Mojave Desert floristic province. A western fifth of the state consists of the Great Basin (formerly occupied by the Pleistocene Lake Bonneville) and 35 associated mountain ranges including the calcareous Wasatch Mountains that form the Basin's eastern border. The northwestern corner of the state has mountains of igneous origin and a flora influenced by migrations from the Pacific Northwest. This leaves one or more provinces in the east that include the Uinta Mountains with floristic affinities to the Rocky Mountains, the Uinta Basin, considered by some to be part of the Colorado Plateaus, and the La Sal Mountains along the border with Colorado. The Utah flora includes 2602 native and 682 introduced species, and these numbers are increasing due to new discoveries and introductions. Between 1974 and 1994, 88 new species were described from Utah, a number of them described by Shultz herself. Also, newly naturalized introductions have contributed about 100 new taxa to the flora since 1987, she said. Utah is a state where 10-15% of the flora is considered endemic and about 250 species have been proposed for federal listing.

Dr. Shultz described the collaborative efforts between herself, Martha Aiken, and other researchers at Utah State University to develop and test a geographic information system (GIS) for floristic data that would have the capability of predicting new locations for the state's rare plants. A first step toward this end was to create a rare species specimen database from which geographic coordinates could be extracted. A rare species appendix to the Atlas of Vascular Plants of Utah published in 1988 by Albee, Shultz, and Goodrich helped with this effort. Herbarium specimens that could be mapped at a 10 x 10 km scale or finer were selected and digitized, so that each mapped species represented a data layer in the GIS. The predictive modeling research was largely that of Aiken who completed a Master's thesis entitled "Predictive

modeling of rare plant habitat in the eastern Great Basin," a project funded by the Bureau of Land Management and the Hill Air Force Base. A field key was developed from environmental attributes and associated species data collected at 467 site plots. Approximately 20% were presence plots for rare species. Four rare plant species were selected for their representation of different kinds of habitats: *Sphaeralcea caespitosa* (valley & foothill sites), *Penstemon concinnus* (pinyon-juniper woodland), *Primula domensis* (faces of dolomite cliffs), and *Jamesia tetrapetala* (granite canyons). New data layers with site-specific data were then added to the baseline information provided by the coarse grid-distributions provided by the Atlas. Additional data for the GIS models came from four existing geographic databases: one elevational, both state and national soil databases, and a surficial geology database. Probability of occurrence maps were then developed from the GIS data containing 13 environmental variables encompassing slope, elevation, aspect, soil, and geologic data.

The predictive model used a tree-classification system to sort data using binary recursive partitioning. The attribute data for each variable was examined sequentially to identify the optimal partition resulting in the most homogeneity within classes and the most heterogeneity between classes. The procedure was repeated for each branch of the key. The result was a dichotomous key that was then incorporated into a computer program for extrapolation of the classification over large areas. The dichotomous key produced in S-Plus was written as a series of conditional statements for GRID, such that each variable in the model was represented by a unique grid coverage. GRID is a cell-based geo-processing software that is integrated with ARC/INFO. As GRID reads the conditional statement, each grid cell is analyzed and simultaneously a new grid is generated in which each cell reflects the predictions of the terminal leaves of the conditional statement. The new grid is then converted to polygon coverage and the predictions are mapped using ARCPLOT.

Models were evaluated for total percentage of correct predictions and analyzed using two statistical tests for utility and bias. Both field-based and GIS-based models performed well for all four species of plants tested. For the GIS, based on 12 different models, mean accuracy was 97% for all predictions; for the Field Key, based on 16 models, the mean for correct predictions exceeded 95%. The models with the highest utility and lowest bias used elevation and aspect in predicting distributions. Overprediction occurred for all species but was considered less of a problem than underprediction.

The presentation included habitat pictures for a number of rare species from the vast remote areas of Utah. Most of the species shown were discovered and described in the 1970-80's. Although the rate of new discoveries has declined, a respectable number of new finds occurred in the 1990's, demonstrating a need for continued botanical exploration in remote areas of the intermountain west. Shultz emphasized the importance of using separate fields for spatially explicit data (e.g., latitude and longitude) in herbarium databases, thus providing a means for transporting floristic data to geographic information systems. She encouraged the employment of different spatial scales depending on the data source, i.e., 10 km grids for the generalized localities provided by most herbarium collections and 1 km grids for records with latitude and longitude given in seconds. Databases developed from site-intensive studies such as those used in the Utah predictive model can serve the dual role of providing floristic information for

herbarium vouchers and ecological data for mathematical models that investigate the relationship of plant distributions to climate and ecology.