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NEBC MEETING NEWS

April 2021

New England Botanical Club President Jesse Bellemare welcomed participants to the 1151st meeting on Saturday, April 3, 2021. He introduced the 2021 NEBC Distinguished Speaker, Dr. Robert I. Bertin, Professor of Biology, Emeritus, College of the Holy Cross, Worcester, Massachusetts. Dr. Bertin is currently studying the effects of recent climate change on flowering phenology and changes in the floristic composition of New England over time. He coauthored the *Flora of Worcester County* and more recently, the *Flora of Franklin County*, and has made major contributions to the understanding of floristic change in our region.

Dr. Bertin's presentation was titled "Regional Floras and the Assessment of Regional Change." Published floras and herbarium collections are vital sources of historic data on plant distributions. Most herbarium specimens held at New England institutions can be viewed in digital form on the Consortium of Northeastern Herbaria website. The NEBC Herbarium has the most extensive collection of New England specimens, going back 200 years. MassWildlife's Natural Heritage and Endangered Species Program (NHESP) is another valuable source, providing town occurrences of rare (state-listed) species.

Dr. Bertin worked on the Franklin County Flora Project with Dr. Karen Searcy, Matt Hickler, Glenn Motzkin, and Pete Grima, with contributions from other botanists. They logged 46,000 field records, collected 4300 specimens, and examined 16,000 herbarium specimens and thousands of literature records. The resulting *Flora of Franklin County* includes 1205 native species and 635 nonnative species, with 67 historic species not found and 50 species documented that had not been reported historically. The highest diversity was found in the towns of the Connecticut River Valley.

Dr. Bertin briefly described three collaborative floristic projects in which he is currently involved: 1) analysis of changes in the flora of Franklin County, 2) analysis of changes in rare species in Massachusetts that have northern affinities, and 3) changes in abundance of orchids.

Dr. Bertin and collaborators examined changes in Franklin County species using an index based on the number of towns in which a species was recorded recently (since 2010) and historically (pre-2010). The median change index was modestly positive (0.18) for native species, presumably reflecting the greater intensity of recent than historical sampling, but much higher (0.52) for nonnative species, reflecting their increasing frequency. This increase in nonnative taxa could cause problems for insect herbivores—such as moths and butterflies—since other studies have shown lower diversity and abundance of these insects on nonnative plants. Dr. Bertin and collaborators looked at changes in native species in different habitat types. A large apparent increase in species of aquatic habitats was probably an artifact of the more thorough sampling of these

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habitats in the recent period rather than any real changes in frequency. Ledge habitat showed a low change index, probably reflecting relatively thorough coverage of these habitats in both the historical and recent periods. Ruderal habitats had a highly positive change index, likely due to increased ruderal habitat and increased species with an affinity for that habitat. Dr. Bertin commented that aerial photos show an increase in ruderal habitat in Worcester County, and a similar trend is likely in Franklin County.

Dr. Bertin examined changes in mycoheterotrophs as a group, including plants such as *Corallorhiza maculata* and *Hypopitys monotropa*, which rely on fungi for at least some of their carbon. The change index for the 70 species of mycoheterotrophs indicates that they are not doing as well as the rest of the plant species. A comparison of plant families showed that the Boraginaceae, Woodsiaceae, and Orchidaceae have the greatest proportion of species below the median change index.

Dr. Bertin and collaborators looked for changes in species with northern affinities. They used *The Atlas of the Flora of New England* to create a latitudinal index identifying northern species, which are those near the southern limit of their range in Franklin County. Statistical analyses indicate that approximately 60% of northern species are declining in abundance and the greatest losses are occurring at lower elevations. They compared historical records with recent observations for 25 state-listed species in Connecticut and Massachusetts. Northern state-listed species appear to be declining at the southern edge of their ranges, and on average, the southern New England occurrences of these species have moved about two degrees north.

Dr. Bertin and Dr. Searcy are investigating changes in the abundance of orchids in southern New England. Orchids are well represented in historic herbarium collections and recent records were obtained from the NHESP and the floras of Franklin and Worcester counties. Southern New England has about 50 orchid species. Of the 22 orchid species with the greatest apparent declines in Massachusetts, most but not all are state listed and Dr. Bertin believes that some orchids are candidates for reassignment. For instance, *Malaxis unifolia* and *Platanthera hookeri* are both just watch listed but were not recently found in Franklin or Worcester counties. He noted that *Platanthera macrophylla* occurs in five towns in Franklin County, but only eight or nine plants are known. *Spiranthes lacera* is not state listed in Massachusetts but only 10% as many recent records were found as historic. Dr. Bertin compared modes of pollination with the decline in abundance and found that orchid species that are pollinated by moths or flies had the highest (75%) mean loss.

Dr. Bertin and his collaborators continue analyzing the data collected for the *Flora of Franklin County* to study patterns of floristic change in Franklin County and the region.

May 2021

President Jesse Bellemare welcomed participants to the 1152nd meeting on Saturday, May 1, 2021, and introduced the speaker, Dr. Eric T. Doucette, Assistant Professor, Biology Department, Massachusetts College of Liberal Arts in North Adams, Massachusetts. Dr. Doucette gave a presentation titled "A New Approach in Shadbush Species Delimitation." He is particularly interested in taxonomically challenging genera

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with high degrees of hybridization. *Amelanchier* is a member of the apple subfamily of the rose family, which has edible pome-type fruits. It is taxonomically difficult because it contains not only diploids (2x), but also tetraploids (4x) having four sets of chromosomes, and triploids (3x) with three sets of chromosomes. Tetraploids are facultatively asexual (apomictic), allowing genes to acquire new functions through mutation (neofunctionalization), leading to niche partitioning and speciation. A small percentage (1–3%) of tetraploid plants can reproduce sexually and backcross with diploids and create novel morphologies. Triploids may occur where two diploid species or a diploid and a tetraploid species overlap geographically.

Dr. Doucette and collaborators studied *Amelanchier* diversity in the continental United States, beginning with diploids, and found a new diploid species in northern California. As a result of their research, two northern taxa (*A. alnifolia* and *A. humilis*) are to be combined into one widely ranging species, *A. alnifolia*. He noted that *Amelanchier* also occurs in the Old World, but the highest diversity is in North America. Tetraploids are pseudogamous, meaning that the seed is produced asexually but pollen is required to produce the endosperm. Tetraploids have high levels of functional pollen, sometimes hybridizing with diploids, producing triploids that may persist in the landscape.

Dr. Doucette noted that species concepts and classification are human constructs. He used *Amelanchier utahensis* as an example of the difficulty of applying species concepts to this group. He found that while this taxon is widespread, diploids with the species' characteristics were limited to several locations and the remainder of the range had triploids, tetraploids, and plants of unknown ploidy level not corresponding to diploid morphology. The Grand Canyon has especially high diversity, possibly due to the large microhabitat differences allowing different species to bloom at the same time that would be phenologically separated at other sites.

Amelanchier also has numerous microspecies (hundreds to thousands) that are narrowly distributed and are often allotetraploid apomicts. He used "*Amelanchier rubra*" to illustrate this phenomenon. It is morphologically distinct but is narrowly distributed and is an allotetraploid apomict that appears to be a hybrid between *A. alnifolia*, *A. canadensis*, and possibly *A. laevis*. The microspecies "*A. rubra*" has persisted at some sites but disappeared from others after a few decades. Microspecies may not have the longevity of a species, and their temporal trajectory is uncertain. Many of these occurrences appear to be ephemeral on the landscape.

In New England, their research group recognizes four diploid species: *Amelanchier alnifolia*, *A. arborea*, *A. bartramiana*, and *A. canadensis*. In addition, there are four polyploid taxa, *A.* ×*neglecta*, *A. nantucketensis*, *A. lucida*, and *A. laevis*. They are not naming the microspecies at this time but believe these need to be considered on a case-by-case basis. The Maine taxon known as "*A. oligoflora*" is tree-like and has hairy leaves, so it keys out to *A. arborea* but is otherwise dissimilar. To include "*A. oligoflora*" with *A. arborea* would greatly widen the circumscription of that species.

Dr. Doucette and his colleagues have considered various ways to separate species and species complexes, by using cytotype data and traditional morphology. The preferred approach is to recognize species complexes that include diploids and other ploidy

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levels that conform to the morphology and ecology of those diploids. This will allow field botanists to key plants to their level of confidence, assigning a plant to a species complex and not having to give a species name if they do not have sufficient information. He hopes this will decrease misidentifications. There will likely be some intercomplex hybrids that do not key even to a complex. That is a function of the biology of the plants.

The key based on this species complex approach to *Amelanchier* will have nested levels of identification accuracy and will include a key to species complex using five characters as well as a key section for diploid species. Dr. Doucette is interested in feedback on this approach to *Amelanchier* and the usefulness of a key using species complexes and providing nested levels of identification accuracy.

—Karen Hirschberg, *Recording Secretary*

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