

**Minutes of 2013 annual meeting of the Consortium of Northeastern Herbaria**

The 2013 meeting of the Consortium of Northeastern Herbaria was held July 17-19 at the University of Vermont in Burlington, Vermont, hosted by Dorothy Allard and David and David Barrington of the Pringle Herbarium.

Arthur Gilman, of the New Flora of Vermont, led a field trip to Mount Mansfield on July 17, pointing out alpine plants near the summit of Vermont's highest mountain.

The formal meeting began July 18 with an invited talk by Charles Davis, co-director of the Harvard University Herbaria, who spoke about the value of herbarium collections and written historical records in analyzing changes in New England climate. Davis said the mean temperature in the Boston area has risen 2.4° C since about 1850. Photographs, herbarium specimens and Henry David Thoreau's journals show that plant phenology has changed as well, with plants flowering an average of 8 degrees earlier now than they did a century ago. However, some clades are more affected than others, and non-native species seem to be particularly responsive. The failure of some species to respond to changing environmental conditions may make them especially vulnerable to extinction, he said. In general, plants that now are becoming less common appear to be more closely related than expected by chance, he said. Species that are not adjusting their phenology to the warming climate are declining more than species that are more responsive, and, as would be expected, many northern species are declining. The mechanistic basis for declines is not clear and needs to be investigated, Davis said. The continuing research in which Davis is involved also shows that invasive plants are particularly responsive to climate change, shifting their phenology more than other non-native species and more than native plants. Invasive species in the Boston area are flowering about 11 days earlier now than in the past.

Lena Struwe of the Chrysler Herbarium at Rutgers spoke about her experience working with students to make an online campus flora. Students were required to document species on the campus either with herbarium specimens or photographs. They compiled a list of 273 species in 100 plant families (Asteraceae was the family with most species and *Polygonum* was the genus with most). Through the exercise, students learned to identify common plants, but they also came to see their campus as a place that had much to teach them – a place that can serve as a living laboratory. Developing the campus flora has led to additional projects, such as an inventory of parking lot weeds.

Paul Harwood spoke about several projects in which the Brooklyn Botanic Garden is involved. The Metropolitan Flora project has been going on for 23 years and is continuing, compiling observational and literature records for the metropolitan area in New York, New

Jersey and Connecticut. The data can be used to track changes in the flora such as the declines in more than 100 species and the addition of more than 20 species to the region since the early 1980s. Because of work done on the project, potentially invasive species can be identified, such as *Arthraxon hispidus* (small carpgrass), which is moving north from the southern United States and has been described as “the new *Microstegium*.” Harwood said that 34% of the metropolitan flora is non-native, compared with only 14% from the Catskills.

Luc Brouillet spoke about Herbarium Marie-Victorin’s using its relocation as an opportunity to change the way specimens are organized taxonomically in the herbarium and in the MT database. The herbarium moved to the Biodiversity Centre on the site of the Montreal Botanical Garden in 2011 and at that time began reorganizing specimens according to APG3. For small families, genera are simply being arranged alphabetically; for large families, genera are being organized by tribes or subfamilies. Within species, specimens are organized geographically, by province within Canada and by larger regions outside Canada. The reorganization is being carried out by volunteers, who check the database to determine whether the species names on specimens are still recognized as correct and, if not, where those specimens should be filed. However, Brouillet said it sometimes is difficult to establish what is an accepted name, since all names are not listed by the standard authorities and because different sources sometimes provide conflicting information. Resolving questions about the status of a particular name can be time-consuming, he said. Brouillet provided suggestions on additional sources of taxonomic information that he has discovered.

Brouillet also spoke about new tools and services that have been made available through Canadensys. The Canadian national database now has 1.25 million occurrence records available online. Much of the work of entering the data is done by volunteers, and he said it is difficult to guarantee the quality of the data-entry work. This has become increasingly important as more and more herbaria are entering specimen information in online databases, raising questions about whether individual herbaria or whether aggregators like GBIF, Canadensys or the CNH are responsible for quality control. In addressing this problem, Canadensys has developed new tools to help it standardize the names of countries and to help with other data-entry processes. Another tool changes the way dates are entered so they all conform to the same format. Additional tools are needed to parse scientific names. Canadensys also has a tool that converts latitude and longitude from degree-minutes-seconds format into decimal-degree format, and the tool can accept entire lists of coordinates for conversion. He hopes to develop new tools that will be able to identify data records that have incorrect coordinates, which results in Canadian specimens’ being mapped to Kazakhstan or the middle of the ocean.

In the final talk of the morning session, Barbara Thiers of the New York Botanical Garden provided an update on the Global Plants Initiative, a project through which information on almost 2 million type specimens has been made available online. The project, funded by the Andrew W. Mellon Foundation, began about 10 years ago and has involved more than 350 herbaria all around the world. Through the project, high-resolution images of type specimens have been created and information on the specimens, along with the images, have been made available online. In addition to about 1.8 million specimen records, the project has created 145,000 records of monographs, drawings, photographs, fieldbooks, correspondence and other records. All of the data now is being made available through JSTOR as part of the next phase of the project, which will be run without funding from the Mellon Foundation. Thiers said the project will have to be self-sustaining and this will require that member institutions pay an annual fee to access the images. The fee will be determined by the size of an institution. African countries will be able to access the information without charge, and other developing nations will have access at discounted rates.

Patrick Sweeney spoke during the afternoon about the NSF-funded project “Mobilizing New England Vascular Plant Specimen Data to Track Environmental Changes.” Through the project, 1.3 million records of New England plant specimens will be digitized. The data on these plants, which are held in 15 herbaria, will be used to study the consequences of changes in climate and land use during the past 200 years. The past year has been spent preparing for the actual digitization, which will start in August, Sweeney said. In addition, participants have been developing a conveyor belt system that will increase the rate at which specimen images can be captured and saved, and one of these systems will be installed at Harvard in August. During a second phase of the project, workers will use the images to capture phenology and habitat data from specimen labels, entering that information into the database. All of the information captured as part of the project will be made available online through the consortium’s web site.

James Macklin spoke about a new project that will generate new genomics data and develop new tools to monitor potentially damaging invasive plants in Canada. The project, which is a collaborative effort involving several governmental agencies, will lead to development of a genomics reference library that can be used quickly and easily in the field to identify invasive species. The project involves a number of initiatives, including one developing new extraction techniques. In addition to target species themselves, the project will compile sequences of close relatives so they can be included in the reference library as well. Specimens from throughout each species’ geographic range will be sampled so genetic variation within the species also will be represented in the archive.

During the annual CNH business meeting, Sweeney reported that the consortium now has 61 member institutions and that information on more than 440,000 herbarium specimens is served on the web portal. There was discussion about the location for the next annual meeting, and Luc Brouillet offered to investigate the possibility of arranging the meeting in conjunction with the 50<sup>th</sup> anniversary meeting of the Canadian Botanical Association in Montreal next summer. Sweeney asked if there were particular projects that consortium members would be interested in working on, and this led to discussion of the possibility of facilitating crowdsourcing for herbaria databasing efforts. Barbara Thiers mentioned that Symbiota will soon release an add-on that will make it possible for volunteers to enter data on specimens gathered as part of particular projects – a lichen collecting expedition to Alaska, for instance. Sweeney said he will investigate what is needed to set up the Symbiota interface.

The final event of the afternoon was a tour of the Pringle Herbarium, led by Dorothy Allard, with assistance from two student workers. Allard showed off some of the historically important items in the collection as well as the new equipment that will be used to create specimen images as part of the regional Environmental Change databasing project.

A workshop on the Filtered Push program was conducted Friday morning, led by Paul Morris, David Lowery, Maureen Kelly and Robert Morris of Harvard. They are in the third year of a 4-year NSF-funded project to develop the Filtered Push tools, which are intended to improve the quality of online specimen data by allowing experts to comment on and make corrections to the data. Experts will be able to comment on the name assigned to specimens or on the georeferencing of the specimen, and that information then will be sent to the curator of the individual collection that holds a specimen, where changes in the database can be made. The Filtered Push tools will be used with the CNH database beginning in August as a way to test the tools and demonstrate their usefulness. The software has been written to work with Specify databases, but tools are being developed to make Filtered Push work with other platforms as well. The tool may be particularly useful for data aggregators, ensuring consistency in spelling, identifying errors in georeferencing and enforcing a standard taxonomy to eliminate conflicts that may exist involving the accepted name for particular taxa.

Dorothy Allard led an afternoon workshop on georeferencing tools, focusing on the Georeferencing Calculator, a tool that allows users to determine the latitude and longitude of a location, with a precise estimate of the uncertainty around those values. After providing a brief background on georeferencing and defining the terms needed to discuss the process, Allard had participants work in pairs while using topographic maps to determine the coordinates and error estimates for several locations. Allard also suggested a number of online tools that can be used to find coordinates for particular locations, with error estimates.

