

The Vasculum

The Society of Herbarium Curators Newsletter
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FROM THE EDITOR

Greetings to all of my SHC friends and acquaintances! As you will soon see, this issue of our newsletter is filled with a tremendous amount of information that is enjoyable, interesting, and informative. Although there is much in print, I encourage you to click on the numerous website links in each article. It is amazing what additional information is available to us, thanks to our contributing authors. Speaking of contributing, we are featuring our 17th herbarium in this issue. I encourage each of you to consider submitting a piece that celebrates your herbarium. Of the herbaria featured so far, only five are located in states west of the Mississippi (CA, HI, LA, OK, TX). So, I would especially appreciate articles representing other states in this underrepresented area. International submissions are also welcome. You might remember that one of our earlier featured herbaria is located in Ecuador. As a last word, if you're presently surrounded by a frozen, winter wonderland, as am I, here's hoping that this issue will help you temporarily escape to a warmer, greener world. Take heart, just a few months more!

- Conley K. McMullen, James Madison University



Adiantum pedatum L. (Pteridaceae) - © C.K. McMullen

SHC NEWS

A Message from the President

Dear Colleagues,

I hope you've had a wonderful holiday season. As we

begin the New Year, I am pleased to be able to reflect on so many accomplishments over the past twelve months. This year should continue to be a busy one for the Society, as we continue to lay the groundwork for the future. Much of our activity last year was focused on the nitty-gritty of establishing our first grant program and fine-tuning our constitution and by-laws to position us for growth and efficiency. Much of this year's activities will continue along the same lines.

Many thanks are due to Michael Thomas (HAW) for taking on leadership of our web committee. As you may know, our initial web site was set up at the University of Tennessee with the support of the now defunct NBII. I am pleased to report that thanks to Michael, we now have full ownership of our domain name, as well as complete control over our site hosting. A redesign of our web site is in progress, so stay tuned!

Many thanks are also due to Ed Lickey (BDWR) for taking on leadership of our grants committee. Once again, the Society will offer two \$500 grants in support of student research. The deadline for proposal submission is 1 February 2014. Please see herbariumcurators.org for details.

... And, of course, many thanks are due to Conley McMullen (JMUH) for once again producing a fine edition of *The Vasculum*! Conley has been ably putting together this newsletter for us since its inception and deserves all our gratitude.

Finally, I'm pleased to report that SHC is now officially affiliated with the Botanical Society of America and will again hold its national business meeting at the annual Botany conference (26–30 Jul, Boise, Idaho). Check out our logo on the official conference web site: <http://www.botanyconference.org/>! [But, note we are still using our temporary logo until a permanent one can be finalized] Please know that the Southeast Chapter of SHC will continue to meet with the Association of Southeastern Biologists (2–5 Apr, Spartanburg, South Carolina).

I wish you all a wonderful year and hope to see you at the meetings!

- Alexander Krings, North Carolina State University

HERBARIUM NEWS

Featured Herbarium: DUKE - Duke University Herbarium

History of the Duke Herbarium

The Duke herbarium was initiated by Professor Hugo L. Blomquist, who came to Duke (then Trinity College) as a plant morphologist in 1920. His dissertation work involved developmental studies on the fern *Dicksonia*. Blomquist was interested in all groups of plants, and he soon shifted his focus from morphology to taxonomy and plant collecting. In 1931, P. O. Schallert, a physician by profession but an amateur botanist and avid plant collector from Winston-Salem, NC, sold his entire herbarium to Duke. His collection consisted of 16,000 specimens, and was a significant expansion to Duke's then fledgling herbarium. The Schallert collection consisted of 12,000 vascular plants, 3,000 bryophytes, and the remainder was lichens and algae. Thus, the Schallert and Blomquist collections formed the basis of the Duke Herbarium, and today it comprises specimens from five major taxonomic groups (vascular plants, bryophytes, algae, lichens and fungi).

Vascular Plants - In 1932, Professor Henry J. Oosting joined the Department of Biology (then Department of Botany) as a plant ecologist, and began a research program in vegetation analysis. Desperately needing a working herbarium for his vascular plant studies, he volunteered to serve as the curator of the herbarium. Oosting had excellent training in systematics, and it was he who organized and guided the Duke Herbarium into a working facility. Robert L. Wilbur joined the department in 1957 and became the curator of vascular plants. The vascular herbarium had grown steadily by that time, but Wilbur oversaw a near tripling of the number of specimens during his tenure. Upon his retirement in 2007, Michael D. Windham became the current vascular herbarium curator.

Bryophytes - Lewis E. Anderson joined the faculty in 1936 to teach and develop a research program in cytology. He was also interested in mosses, and took a course taught by Blomquist on ferns and bryophytes. Anderson was soon given the responsibility of curating the moss herbarium. His research focus shifted from cytology to bryology and he eventually became an expert in *Sphagnum*. He greatly expanded and developed the herbarium until he retired in 1980, but kept working and collecting throughout his retirement, right up to the time he died in 2007. In 1998, in his honor, the bryophyte herbarium was named The L. E. Anderson Bryophyte Herbarium. Brent Mishler arrived in 1984 and was the curator until 1993 when he moved to the University of California at Berkeley. Jonathan Shaw became the current bryophyte herbarium curator in 1995.

Algae - In 1938, Blomquist began collecting seaweeds in and around Beaufort, NC. He also collected extensively in Puerto Rico in the early 1940s. In addition, James J. Wolfe, a faculty member with an interest in algae and diatoms, collected specimens in Massachusetts and North Carolina. These collections were the beginning of the algal herbarium. Richard B. Searles became its curator in 1965, and although retired, he is still active as the algal herbarium curator.

Lichens - In 1955, William L. Culberson joined the department and became the curator of lichens. He arranged the purchase of most of the herbarium of Julien Harmand (France) in 1957, as well as the residual herbarium of Johan J. Havaas (Norway) in 1965. These collections, along with Culberson's personal herbarium, greatly expanded the holdings of the lichen herbarium at that time. He continued to expand the herbarium throughout his tenure, working with Chicita Culberson, a lichen chemist, until his death in 2003. In their honor, the lichen herbarium was named The Chicita F. and William L. Culberson Lichen Herbarium and Library in 2010. François Lutzoni replaced Culberson as lichen herbarium curator in 2001.

Fungi - When Rytas Vilgalys arrived at Duke in 1986, there was only the rust exsiccata of Solheim and Cummins (*Mycoflora Saximontanensis Exsiccata*) and a small collection of water molds in the mycology lab. Vilgalys became the curator of fungi, and with his collections and those of his graduate students, the fungal herbarium has been growing steadily.

Kathleen Pryer joined the now Department of Biology in 2001, and in 2005 became the Director of the Duke Herbarium. Today, all collections in the herbarium, in addition to being critical to many research studies, are actively involved in several projects aimed at digitization and database development.

The Herbarium and Collections

The Herbarium - The Duke Herbarium began in a small space in a building on the original Trinity College campus, which is now the East Campus of Duke University. The Department of Botany then moved to a building on the main quadrangle of the West Campus in the 1930s. The herbarium was housed on the top floor, and conditions were not ideal, as there was no air conditioning. With the expansion of West Campus in the 1960s, the department moved to the new air-conditioned Biological Sciences building (Fig. 1). Anderson and others were able to guide the design of the herbarium, which allowed for three floors of cabinets (over 265), as well as bench space for curators and students to work. Over time, the collection outgrew that space, and by the early 1980s the collection had overflowed into the hallways and into several other rooms. Beginning in 2009, the vascular herbarium was compactorized and moved into a build-

ing, behind Biological Sciences, that also houses the phytotron and greenhouses (Fig. 2). There is now space for moderate and focused expansion, as well as an adjacent work area. In the meantime, the cryptogamic herbarium moved its overflow into most of the old vascular herbarium space in the Biological Sciences building.

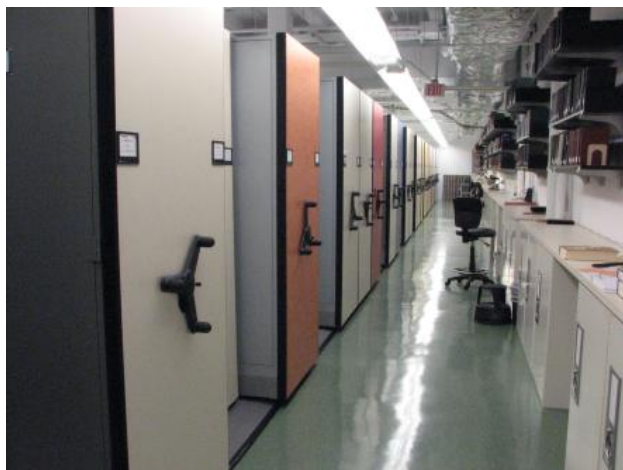


Figure 1 - The new vascular herbarium showing compactors, bench area and library. Photo credit: Carl Rothfels, 2010



Figure 2 - A view inside the cryptogamic herbarium showing cabinets and bench. Photo credit: Jason Elliott, 2014

The Collections - The Duke Herbarium currently contains 400,000 vascular plant specimens (900 types), 238,000 bryophytes (872 types), 162,000 lichens (642 types), 20,500 algae specimens (over 100 types) and 10,400 fungi (35 types) – an estimated 850,000 accessions in total. Original counts for the bryophyte and lichen herbaria are based on estimates, because accession totals were not recorded from the start. Working with Duke Libraries staff, and with generous grant support from the National Science Foundation and the Andrew

W. Mellon Foundation, type specimens for all collections have nearly all been imaged and are starting to become available via JSTOR PLANTS (<http://plants.jstor.org>). Label data for the bryophyte and lichen types is now available in DUKE's Specify databases (see <http://herbarium.duke.edu/databases>). The use of Specify was begun ten years ago with a grant from NSF to database the southeastern United States bryophytes. Data for 169,000 bryophyte specimens and 42,900 lichens has been entered into Specify to date. Label images for the balance of the North American bryophytes (27,000) and lichens (12,700) are in the process of being converted into Symbiota as part of a consortium grant from NSF through the University of Wisconsin-Madison, again with the help of Duke Libraries staff, and all bryophyte and lichen records will appear in both databases. Algal specimen records are also in Specify and are now being imaged as part of an NSF consortium grant through the University of New Hampshire for the MacroAlgal Consortium Portal (<http://macroalgae.org/portal/index.php>). Fungal specimens are being imaged as part of an NSF consortium grant through the New York Botanical Garden (Fig. 3), and are available in MyCoPortal (<http://mycoportal.org/portal/index.php>).

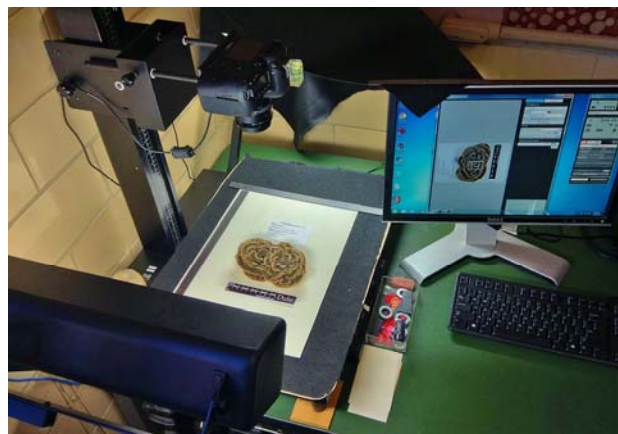


Figure 3 - Imaging a specimen of *Trametes versicolor*. Photo credit: Jason Elliott, 2014

Grants in support of herbarium growth and development, 2004-2016:

Lutzoni, F. and A. J. Shaw. 2011-2015. Digitization TCN: Collaborative Research: North American Lichens and Bryophytes: Sensitive Indicators of Environmental Quality and Change. Consortium led by Corinna Gries and Thomas Nash, University of Wisconsin-Madison. NSF [DGM-1115116](https://www.nsf.gov/awardsearch/showAward?AWDNO=DGM-1115116).

Pryer, K. M. 2011-2014 Proposal from Duke University to digitize types held in North and South Carolina Herbaria. The Andrew W. Mellon Foundation Grant No. 11100624.

Pryer, K. M. 2013-2015. Digitization TCN: The Macroalgal Herbarium Consortium: Accessing 150 Years of Specimen Data to Understand Changes in the Marine/Aquatic Environment. Subaward from the University of North Carolina at Chapel Hill. Consortium led by Christopher Neefus, University of New Hampshire. NSF EF-1304924

Pryer, K. M. and M. D. Windham. 2007-2011. A plan to rehouse and reorganize the vascular plant herbarium and botanical library at Duke University (DUKE). NSF Biological Research Collections Program. DBI-0646452.

Shaw, A. J. 2005-2007. Databasing bryophytes from the Southeastern U.S. in the Duke University Herbarium. NSF DBI-0444586.

Stone, D.E. 2004. Digitizing and Databasing of the La Selva Flora. NSF Award Number: DBI-0346653.

Vilgalys, R. 2013. Digitization TCN: The Macrofungi Collection Consortium: Unlocking a Biodiversity Resource for Understanding Biotic Interactions, Nutrient Cycling and Human Affairs. Consortium led by Barbara Thiers, New York Botanical Garden. NSF 1206197.

Windham, M.D. and K.M. Pryer. 2014-2016. Visualizing Mustards and their Hybrids: The *Boecheira* Digitization Project. The Andrew W. Mellon Foundation Grant.

Vascular Plants - The vascular herbarium is divided into three major groups of vascular plants (angiosperms, gymnosperms and ferns [including lycophytes]). Specimens are filed according to current herbarium organization schemes based on molecular systematic data. In 2009, the flowering plant collection was moved into compactors and reordered following APGII. The fern and conifer collections remain in the original herbarium space in the Biological Sciences building, along with the vascular type specimens.

Besides North Carolina and the southeast, the vascular herbarium contains extensive collections from Mesoamerica, specifically Costa Rica and Panama, including the Office of Tropical Studies' La Selva research site. All of these specimens are now databased in Tropicos (<http://www.tropicos.org/>). Families that are especially well represented include the Juglandaceae, Ericaceae, Rubiaceae, Melastomataceae, Cyperaceae, Juncaceae and Poaceae, due to the research activities of students and faculty over the years. The fern collection is also extensive thanks to an early interest by Blomquist and Wilbur in the group. Currently, the herbarium continues to expand, concentrating on its function as a repository of voucher collections for cytogenetic and molecular systematic studies.

Bryophytes - The bryophyte herbarium is organized by family, according to current molecular systematic data.

Within each family, genera are in alphabetical order and are further subdivided geographically into North Carolina, New World and Old World sections. Types are filed separately, with cross-references posted in the main collection. Also filed separately is a collection of 48 exsiccata sets, which may be accessed at the following site: <http://herbarium.duke.edu/collections/bryophytes/bryo-exsiccatae>). Label data for these specimens will be entered into Specify after the North American bryophytes are finished.

The moss collection is strong in southeastern United States material, as well as in collections by Blomquist, A. J. Grout (a teacher, and well-known amateur bryologist in the early to mid-1900s), W. B. Schofield (former curator at the University of British Columbia; he sent duplicates of his collections to Duke as a repository), and R. M. Schuster (an hepaticologist, who spent three years at Duke in the mid-1950s). Anderson collected extensively around the world, and, in addition, contributed cytological vouchers of mosses and identified many gift specimens. Shaw has deposited his herbarium of Bryaceae (mainly *Pohlia*) at Duke and has followed in Anderson's footsteps by continuing research into *Sphagnum*, greatly expanding that collection. DNA from a large number of *Sphagnum* specimens in the herbarium have been sequenced, supporting work in the bryology lab. He and Blanka Shaw have collected specimens from around the world, notably in China, Japan, Russia, Alaska, Ecuador and Australia .

The hepatics are organized by families, in the same manner as the bryophytes. The original hepatics collection was small, with the specimens of Blomquist and Schuster comprising the majority. Later, the David A. Breil herbarium was donated to Duke by Longwood College, bringing in many specimens from the southeast, mainly Florida. Recently, students and post-docs have contributed specimens to support work on *Bazzania*, *Metzgeria* and *Radula*. B. Shaw has recently collected in Fiji, New Caledonia and Chile. Many of these specimens are vouchers for DNA sequencing studies.

Lichens - The lichen herbarium is organized alphabetically by genus and species, and is further subdivided by geography into North America and Exotic sections (the difference in organization between the bryophyte and lichen collections reflects the philosophy of each of their long-time curators, Anderson and Culberson). Types are filed separately, with cross-references posted in the main collection. There is a separate section for the old exsiccata sets acquired with the Harmand herbarium; current exsiccata specimens are filed within the main collection. Recently, specimens of lichens identified as lichenicolous lichens have been segregated.

The lichen collection is strong in southeastern United States material, as well as in many parts of the world. Chicita and Bill Culberson collected extensively in Japan, western Australia (the largest collection outside

western Australia) and Middle and South America. Their students and visitors collected in the North Carolina mountains, Iceland, and South Korea, as well as in other parts of the United States. As is being revealed by data entry of the collection, the collection is stronger in specimens from Europe and Middle and South America than in the United States and Canada. The collection has been greatly enhanced by the work of C. Culberson, who analyzed over 12,000 specimens chemically, including gifts in exchange for her chemical analyses. Recently, the collection has been expanded with the inclusion of vouchers for three large studies: first, DNA vouchers for the Assembling the Fungal Tree of Life project (Fig. 4), contributed by visitors and graduate students; second, world-wide collections and DNA vouchers of specimens in the Teloschistales; and last, collections, DNA vouchers and gifts of *Peltigera* in support of a worldwide revision currently being done in the lichen lab.

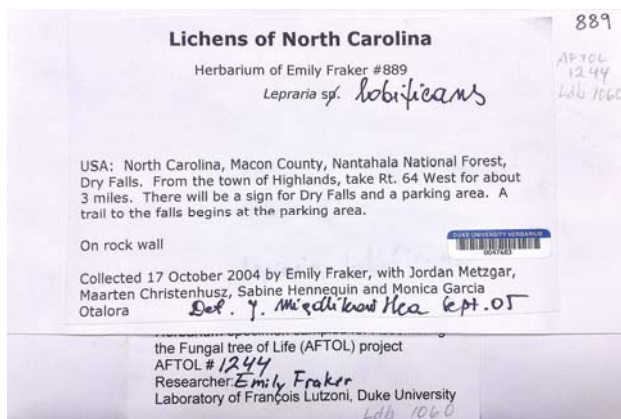


Figure 4 - DNA voucher specimen for the project *Assembling the Fungal Tree of Life*. Photo credit: Jason Elliott, 2014

Algae - The algal herbarium is organized alphabetically by genus and species within the three categories of red, brown and green algae. Nearly all of the label data for these specimens has been entered into the Specify database by the curator. The bulk of the collection is made up of seaweeds from the southeastern United States.

Fungi - The fungal herbarium is organized alphabetically by genus and species. The collection consists mainly of basidiomycetes, with special emphasis on Agaricales. Specimens of *Septobasidium* and vouchers of truffles (*Tuber*) supporting Duke graduate student dissertations, are among the most recent additions.

The Libraries

Duke Libraries graciously permits the herbarium to house books on vascular and cryptogamic plants, as well as bound journal volumes (those that are not yet available online). This has been invaluable for researchers and

students. There is a separate lichen library as well, originally the personal library of W. Culberson, which includes many old volumes and reprints. In addition, there are reprint collections in the bryophyte and vascular herbaria. All of these print resources are still being well-used, even with the advent of online journals.

Herbarium Activity

Within the herbarium, staff, students and visitors have microscopes set up along the benches to study Duke specimens and their own collections. In addition, they borrow collections from other herbaria, and there are cabinets allocated for the storage of this material. Visitors to the systematics labs often refer to Duke specimens when identifying their own collections, and they deposit duplicates and vouchers.

In an average year, Duke sends out 150 loans (8560 specimens), and receives 60 loans (2960 specimens). Access to data from the herbarium database is now resulting in borrowers making more specific loan requests, such as for DNA vouchers or for recent collections. Exchange levels have fallen as grant work has increased and none of the collections has full-time staff.

Some recent publications by Duke curators and graduate students:

Guevara, G., G. Bonito, J. Trapp, E. Cazares, G. Williams, R. A. Healy, C. Schadt and R. Vilgalys. 2013. New North American truffles (*Tuber* spp.) and their ectomycorrhizal associations. *Mycologia* 105(1): 194-209.

Li, F.-W., K. M. Pryer, and M. D. Windham. 2012. *Ga-ga*, a new fern genus segregated from *Cheilanthes* (Pteridaceae). *Systematic Botany* 37: 845-860.

Prieto, M., I. Martinez, G. Aragon, C. Guiedan, and F. Lutzoni. 2012. Molecular phylogeny of *Heteroplacidium*, *Placidium*, and related catapyrenioid genera (Verucariaceae, lichen-forming Ascomycota). *American Journal of Botany* 99: 23-35.

Shaw, A. J., B. Shaw, M. Ricca, and K. I. Flatberg. 2012. A phylogenetic monograph of the *Sphagnum subsecundum* complex (Sphagnaceae) in eastern North America. *Bryologist* 115: 128-152.

Outreach

Unlike museums, the Duke Herbarium does not have a stated outreach mission, however, there are ongoing activities that involve the public and heighten awareness of the herbarium. For example, in 2011, a new website was launched for the Duke Herbarium that contains current news, slide shows, the Duke Herbarium Annual Report,

and much more (<http://herbarium.duke.edu/>). Researchers in the lichen lab host workshops for high school students that include examining herbarium specimens and learning the collection process from field to herbarium. The herbarium staff is occasionally asked to host tours by professors and by outside groups interested in plants and herbaria. In 2012, the world was introduced to *Gaga*, a new fern genus, and the holotype is housed here (Fig. 5). Last year, in collaboration with Duke Libraries, the Director, together with staff and undergraduate students, launched an exhibit in the Perkins Library Gallery titled “Botanical Treasures from Duke’s Hidden Library” (<http://exhibits.library.duke.edu/exhibits/show/herbarium/herbarium/intro>), providing the public and the Duke community with a view of our collections and their importance, as well as with the work involved in maintaining an herbarium. It was well-received, and the library was very happy to have its first science display. And last, archival quality botanical prints and cards based on scanned type images are available at the Terrace Shop at the Sarah P. Duke Gardens on Duke’s west campus (see <http://herbarium.duke.edu/support/merch>).



Figure 5 - Holotype of *Gaga germanotta* with its name-sake. Photo credit: Fay-Wei Li, 2013

Herbarium Support

Currently, the support staff consists of three part-time collections staff, and one full-time. The lichen and bryophyte herbaria each receive three-quarters-time support, the fungi herbarium half-time, and the vascular and algal herbaria none. There had been full-time support for the vascular herbarium, but that position was lost during the recession. A half-time vascular position is supported by soft money, but that may also be lost in the future. The algal collection is maintained by Richard Searles. The collections staff is assisted by undergraduate work-study students who help with processing specimens, as well as by entering data (Fig. 6).



Figure 6 - Anna Torre and Emily Marino, undergraduate work-study students in the cryptogamic herbarium workroom. Photo credit: Jason Elliott, 2014

Acknowledgments

Many thanks to the following for their contributions to this article:

Director of the Duke Herbarium – Kathleen Pryer

Curators - François Lutzoni, Richard Searles and Jonathan Shaw, Rytas Vilgalys and Michael Windham

Herbarium Collections Staff - Layne Huiet and Connie Robertson

Graduate Students - Jason Elliott, Fay-Wei Li, and Carl Rothfels

- Molly McMullen, Cryptogamic Herbarium, Duke Herbarium, mmcm@duke.edu

WTU Revising *Flora of the Pacific Northwest*

The University of Washington Herbarium (WTU) at the Burke Museum has initiated a project to revise the one-volume *Flora of the Pacific Northwest* published in 1973 by C. Leo Hitchcock and Arthur Cronquist. The project Web site is: <http://www.pnwherbaria.org/florapnw.php>.

The original 730-page book was designed by the authors to be a portable plant identification manual for professional and amateur botanists. Even today it remains a singular piece of scholarship and a model for how to produce a regional flora. The new *Flora* will maintain the original volume's title, geographic circumscription, layout, styles, and illustrated keys.

In the 40 years since publication of *Flora of the Pacific Northwest*, significant changes have occurred to the region's flora and to the classification and naming of the taxa covered. We estimate such changes as follows:

- 28% net increase in the number of species and infraspecies;
- 40% of species and infraspecies names will require nomenclatural changes;
- 42% or more of the generic keys must be substantially modified.

Despite the passage of time, *Flora of the Pacific Northwest* remains a vital resource for academic researchers, federal and state agency botanists, land managers, undergraduate and graduate students, and amateur botanists. However, the keys from that volume enable current users to arrive at accepted names for only 47% of the region's taxa. As a result, users must increasingly consult other state/provincial and continental-scale floras for identification purposes.

Our goal is to have the revised *Flora* available in Spring 2017. We have already developed workflows, digitized the entire content from the 1973 *Flora*, and produced updated treatments and keys for approximately 15% of the taxa to be covered. We are also working with illustrators to generate the drawings needed for those taxa not included in the original volume.

- David Giblin, Ben Legler, and Richard Olmstead, olmstead@uw.edu, University of Washington

Five Herbaria in Five Days

Even as I type this title, I can see how ridiculous it is, how far herbarium-mania has taken me. I am a biologist who has fallen in love with herbaria, and also with travel. I recently spent ten days in London, and visited a different herbarium each day, from Monday to Friday. They were varied, all were wonderful, and all my guides were kind, knowledgeable - and extremely patient.

Kew - I began right at the top, taking the Underground to the Royal Botanic Gardens at Kew on Monday. Fortunately, I had met Lourdes (Lulú) Rico, a Neotropical Legume Specialist at Kew, at a conference so I had an "in" there. Kew Herbarium, Art and Archives is so huge, with over 150 on staff, that it was great to know someone to take me around and give me a feel for the place. I have visited Kew, and all the other herbaria discussed here, online but it was still a thrill to actually see the 19th-century, three-story galleried space that is featured in a wonderful [video](#) on Kew Herbarium. Rico then took me through the successively constructed herbarium buildings, a new one being needed about every 40 years to house the ever-expanding collection.

We ended up in the facility completed in 2009, where Rico has an office and she showed me where the Fabaceae are stored. Everything is in Solander boxes: green for specimens, dark blue for art, mandarin for seeds, and burgundy for fruits and other parts. Then she took me back to the oldest building where there are cases that had belonged to George Bentham, and she showed me some of his specimens, as well as those of Nathaniel Wallich, a 19th-century surgeon and botanist who collected in India.

Natural History Museum - Tuesday, I went to another extremely important herbarium - at the Natural History Museum, London. Here, too, I knew someone, Charlie Jarvis, author of the commanding *Order Out of Chaos* (2007), the result of the Linnaean Plant Names Typification Project. He brought me up to the room that houses the 265 volumes of the Hans Sloane herbarium and showed me several of them. The first was an early one with Sloane's own specimens from his stay in Jamaica juxtaposed with the original watercolors of these plants that Everhardus Kickius did for Sloane in 1700 and that were engraved for Sloane's two books on Jamaica. Next, was a volume of James Petiver's specimens, one of a hundred in the collection. Petiver and Sloane were both patrons of Mark Catesby, so many of his specimens are in this collection. Next, I saw a volume of specimens from Leonard Plukenet, another important collector of the time. The difference between the curatorial styles of Petiver and Plukenet was obvious, the former used poorer paper and attachment was more haphazard.

I asked to see examples of Adam Buddle's specimens because I had read in J.E. Dandy's (1958) book on the Sloane collection that they were particularly well done. And they were: good-sized specimens, carefully placed, and most sewn down with white thread. Jarvis also pulled out the volume of John Ray's *Historia Plantarum*, which Sloane used as a catalogue for his herbarium, having written in it the location in his herbarium for specimens described in Ray and adding in new species that hadn't been treated by Ray. This was information science at its best in the 18th century. In the 21st century, Jarvis finds this collection to be valuable as a link between the sciences and the humanities. He is involved in

the [Reconstructing Sloane](#) project jointly sponsored by the Natural History Museum, the British Museum, and the British Library.

Cambridge - On Wednesday, I took the train to Cambridge and went to a brand new facility, the Sainsbury Laboratory, where a great deal of molecular research on plants is done. It is also home to the Cambridge University Herbarium. Christine Bartram, Chief Technician, was more than welcoming (Fig. 1). She had retrieved several treasures to show me, of course including some Darwin specimens, among them the two sheets that had been used in the article “What Henslow Taught Darwin” (Kohn et al., 2005). At the Herbarium, there is a huge collection of illustrations that John Stevens Henslow used in his lectures. They are about the size of herbarium sheets and are filled with images cut and pasted from Henslow’s own drawings as well as from botany books and magazines. The success of such visual aides in his teaching led him to publish large posters in the 1850s, for which the famous botanical artist Walter Hood Fitch did the illustrations.



Figure 1. Christine Bartram and Cambridge specimens.

As with all the herbaria I visited, efforts are being made to digitize material, such as, in the case of Cambridge, all the [specimens](#) Darwin sent back to Henslow from his voyage on the *Beagle*. Many of these sheets were passed to Joseph Dalton Hooker for identification, so they have both his determinations as well as Henslow’s handwriting. But, there are many less well-known treasures waiting for attention. Some wait to be discovered in boxes of

collections, several from the 19th century, and some came to light during the move to the new herbarium. A horde of watercolors of seaweeds done by Mary Philadelphia Merrifield in the 19th century was found in an old shoebox. Bartram had seen the Merrifield name on the box during the move, and when someone inquired about her, having come upon several of her letters, these magical drawings came to light and still wait to be cataloged. I could go on about the treasures Bartram showed me, but I have to chug on to my next herbarium.

Manchester - On Thursday, I traveled north to the Manchester Museum, a long excursion that I undertook because the Manchester Herbarium has a great [blog](#) and I wanted to see the facility for myself. It is housed in the attic of the Museum’s original gothic building from the 1880s. Compact shelving is being installed in one area, so there are Solander boxes piled everywhere awaiting reshelving. The herbarium often does public tours based on the Harry Potter theme and its rooms are perfect for it: looking out over pointed arches and magnificent Victorian roofs, one room with piles of old books including an early edition of Nehemiah Grew’s anatomy of plants, another with early 20th century wax and papier mâché models of plants and plant parts (Fig. 2), still another with dozens of wooden boxes filled with 19th-century microscope slides.



Figure 2. Plant models and Solander boxes at Manchester.

Rachel Webster, Curator of Botany, showed me highlights of the collection, including specimens from Charles Bailey, with a British and European scope, and Cosmo Melville, with a global scope. They were wealthy Manchester patrons of the museum who left their large collections to the herbarium. In a different vein, Leo Grindon’s collection is more horticultural in perspective. Webster described it as having a scrapbook feel because of the number of articles and images found in among the specimens. Finally, the most botanically important specimens are the 16,000 collected by Richard Spruce; these are mostly South American hepatics.

Oxford – Finally, on Friday I headed to Oxford. In one sense, I left the best until last because this is definitely a very old and varied collection. Fortunately, Stephen

THE WIRED HERBARIUM

Zooniverse

Harris, Druce Curator of the Oxford University Herbaria, has done a great job of putting material [online](#). It would be difficult to even list all the material he showed me, but suffice it to say the herbarium is divided into three segments, one originally belonged to the forestry department and is housed separately (because its sheets are bigger), another for the historical collection with some specimens dating back to the 1600s, and then there is the “recent” collection, everything collected after 1796! Within the historical collection of about 70,000 sheets, there are specimens from Mark Catesby, William Dampier, Carl Linnaeus, etc. etc. The most remarkable sheets I saw were those of Johann Dillenius: many moss [specimens](#) on each sheet laid out and labeled beautifully, with the edges fortified by tape made from wallpaper. The 19th-century material amassed by the collector Henry Borron Fielding is probably the most valuable botanical-ly because of the number of types in it.

The Linnean Society - By Friday evening, I have to admit that I was tired, but also pleased with the week - and I still had the following Monday to look forward to - when I went to the Linnean Society where the Librarian, Lynda Brooks, showed me the vault where Linnaeus’s specimens are kept and told me about the [Linnaeus Link](#) project to make his manuscripts accessible online, as his specimens are. Overall, what impressed me the most was how well all these collections are used, not just by botanists but by historians, artists, and others interested in the cultural links of herbaria that go beyond science. Charlie Jarvis and Stephen Harris both publish not only on plant science but on the history of botany; the present project to digitize the manuscripts of Linnaeus will make them much more accessible to historians, the Manchester Herbarium hosts many art students finding their inspiration in various parts of the collection, Kew too hosts artists, and the Cambridge Herbarium’s Henslow drawings are a gold mine for both historians and artists. Though most of these facilities are short-staffed, the message I came away with from all of them is that they are vibrant institutions which will become better known and utilized in the future as more and more of their holdings become accessible on the web.

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The Field Museum, in collaboration with Zooniverse, is developing an interactive web tool that enables anyone with web access to measure liverwort lobules. The underlying goal is to connect students and citizen scientists with the museum’s collection and researchers.

If you click on <http://microplants.zooniverse.org/>, an attractive homepage will appear. Slightly confusingly, the page suggests that the user “step through the tutorial” but there is no link to the tutorial. It turns out that the user should click on the “start classifying” box at the end of this sentence. The pages, designed to be user-friendly for children, display micrographs of *Frulliana* lobules, which are referred to on the pages as leaves. ImageJ software enables the viewer to “click-and-drag” to measure the lobule’s height and (separate measurement) length, then save the data and move to another image.

The photographs are quite compelling, and I began clicking through just to see the next image. I don’t know much about liverworts, and the scanning details reveal an interesting pattern of lobules attached to stems, with obvious variation from individual to individual.

However, the webpage is not just “fun”. Lobule shape and size are critically important in helping distinguish between both between species and groups of species, or subgenera, so the data from the measurements is saved for subsequent use by researchers. Since the summer of 2013, over 20,000 measurements have been generated from thousands of digital images. Dr. Von Konrat estimates that at least two months of researcher effort has been saved due to this data.

I wondered about the quality of the data generated. Can a 12 year old kid really produce useable data? It turns out that the quality of the data is influenced by the quality of the instructions provided, so those instructions have been repeatedly improved during the testing phase of this project. “We are only now beginning to properly evaluate the data generated from the online tool, but preliminary analysis indicates that a majority of the data retrieved appears to be highly accurate.”

I asked Dr. von Konrat what he expected. “What I had originally hoped for has long been surpassed! My underlying ambition has been to help connect museum biological research and collections with education and outreach. A great challenge is the development of a strong network of institutions and volunteer base that will work in an entirely novel approach. We have attempted to achieve this goal of connecting biodiversity collection-based research with the generation of a sizable and useable data set that will aid in our research, without jeopardizing valuable research time in the process. The broader publicity and communication has led to growing partner-

ships with colleges and universities. I had never thought that this concept could be part of a classroom curriculum – which it has through the very early vision of Dr. Thomas Campbell.”

Dr. Campbell has been able to integrate the Microplants project into the basic biology curriculum at Northeastern Illinois. He told me, “Early on, we didn’t have a website and everything was done by hand, but we knew that if we wanted to reach more people we would need to use a web platform. I helped to mentor the first research students who analyzed the data collected in the classrooms. During those early pilots we really learned a lot about how to give instructions. This whole thing has been a learning process. After I had been doing the exercise successfully in my classroom for a while, I was able to convince others to include it in theirs as well. Now, we’ve got the exercise standardized across six sections of 24 students each. We’re putting approximately 288 students through the activity a year here at NEIU and piloting other educational activities related to the project. It’s probably the student’s first exposure to real and meaningful research. Some students will then later apply to continue working with us on the project over the summer at The Field Museum.”

Last month, I used this site as an assignment for my Introduction to Plant Biology students. I had each student spend at least 30 minutes measuring lobules on the website, and asked them to share their experiences. Not surprisingly, my 148 students had widely varying reactions. “I was bored out of my skull - I never realized science was so boring!” “I actually got carried away, and spent about two hours measuring leaves.” “It’s really exciting to be generating real science data!” One thing several students mentioned was a desire to know more. Were their measurements accurate? How would they be used? What have researchers done with the data? How many times does one photograph get measured?

This project is definitely a work in progress. One current project is data analysis, and in particular data cleaning. Each image has been measured at least five times, and statisticians are determining methods to identify and remove outliers. But it clearly has been successful at combining education, outreach to museum viewers, research, and especially giving ordinary citizens a view of science as a process, a process to which they can contribute. It will be interesting to see what happens to this concept. So here’s my challenge to you: how could YOUR research benefit from this kind of approach to data generation?

- Eric Ribbens, Western Illinois University,
E-Ribbens@wiu.edu; Matt von Konrat, Field Museum;
and Thomas Campbell, Northeastern Illinois University

NAME THAT PLANT

Congratulations to Donna Ford-Werntz (WVA) for receiving the highest score on the latest plant “quiz”, which appeared in the July 2013 issue of *The Vasculum*. The species were, in order, *Passiflora foetida* L., *Silene virginica* L., *Pinus pungens* Lambert, and *Tribulus cistoides* L. Oh, Donna also correctly identified the black bear in the fifth photograph!

I’ve included a few more photographs in this issue. If you can identify the *vascular* plant in each photo, feel free to email your answers to me. Additionally, I’d be happy to include any of your photos that you feel may stump our readers. Thanks in advance!

- Conley K. McMullen, James Madison University



Plant #1 - © C.K. McMullen



Plant #2 - © C.K. McMullen



Plant #3 - © C.K. McMullen



Plant #4 - © C.K. McMullen



Plant #5 - © C.K. McMullen

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