

# The Vasculum

The Society of Herbarium Curators Newsletter  
Volume 18, Number 1: January 2023

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# Message from the President



Dear Members,

Happy New Year to all our herbarium colleagues across the globe! A lot is happening and there is a lot to do in the coming year for the Society of Herbarium Curators (SHC).

I've been learning about our Society and all the great committees and activities. I have to thank Erin Manzitto-Tripp for showing me the ropes and sharing great resources. We will be looking for a new President Elect in 2023, so be thinking of who could help lead the Society in the coming years. Thank you to our excellent SHC officers who regularly weigh in on society issues. Diana Jolles keeps us running as Secretary and Maribeth Latvis has done an excellent job keeping our finances on track as Treasurer. Michael Thomas (Webmaster) has been keeping our website up-to-date and helping us develop a fundraising plan. We also have three Members-at-Large, thank you to Alina Freire-Fierro, Socorro Gonzalez-Elizondo and Gilberto Ocampo.

I want to extend a special thank you to Tilottama Roy, our Newsletter Editor. Tilo has taken on the task of putting together our twice-yearly *The Vasculum*. This is a big task and she keeps *The Vasculum* publishing articles that help and inform our herbarium curator community. Let's keep those articles and ideas coming in for our Newsletter. We have several quite active committees that will be looking for new members. Please consider nominating yourself, a colleague or an emerging professional to serve. Here are some of our open positions:

- We need liaisons to SHC for the Botanical Society of America, American Society of Plant Taxonomists, and the Society for the Preservation of Natural History Collections. Liaisons serve on the Affiliate Organizations Liaison Committee. Liaisons will help keep the executive board up to date on happenings in their respective societies. If you are active in these societies, and want to serve SHC, you can play a critical role in keeping SHC informed and connected to on-going initiatives.
- We need a new member to join the Membership Committee. This is an important committee that can help the society to reach new members, build a social media profile and grow the community. Please consider joining this committee and helping build the society.
- We need to find several members willing to serve on our Student Awards Committee. This committee administers the student research awards program. This is a fun committee and helps support the research of our students. It would be great to build the committee.

Looking to our summer conference, the SHC will be meeting with the Botany conference in Boise, Idaho, U.S.A. in July 2023. This will be a hybrid meeting. The SHC will sponsor a symposium this year that is planned during the main conference (Mon-Wed). This special session is tentatively titled, SISRIS: Supporting Inclusive and Susta-

inable (collections-based) Research Infrastructure for Systematics. The symposium is coordinated on behalf of SHC by Erin Manzitto-Tripp and is the brainchild of SHC-SE members Shawn Krosnick and Andrea Weeks. Shaun and Andrea have a pending NSF proposal that supports their work, the Botany symposium, and an ASB Symposium. This sounds like a great special session for Botany 2023.

Recently, the SHC had an opportunity to sign on to a letter that provides input on the discussion draft of the One Health Security Act, a forthcoming legislation led by Senator Kirsten Gillibrand (D-NY). The sign-on letter urges that the bill be expanded to include biodiversity infrastructure, including natural history collections, herbaria, and associated data and expertise. The bill prominently features plants and agricultural pathogens. The letter and proposed edits have been sent to Senator Gillibrand and if anyone is interested, they are available on the AIBS website.

My best to the Society in 2023.

Anna K. Monfils  
Professor, Biology,  
Director, CMC Herbarium  
Central Michigan University  
President, Society of Herbarium Curators (2022-2024)

The Society of Herbarium Curators (SHC) unites the world's herbarium professionals in discussion, training, action, and support for the benefit of herbaria, science, and society. SHC envisions a network of innovative, well-trained herbarium professionals, empowered to recognize and address local and global stakeholder needs with organizationally sustainable strategies that advance the well-being of herbaria, science, and society. For more information, please join us online:

— [www.herbariumcurators.org](http://www.herbariumcurators.org) —



# From the Editor's Desk

Happy New Year to all of my fellow SHC members and herbarium lovers! Hope the year 2023 has started on a wonderful note for everyone. Our current issue of *The Vasculum* contains the latest news from the Society of Herbarium Curators, as well as herbaria across the globe, including collections and curatorial practices and new innovations, in an effort to bring together an international community of herbarium professionals and enthusiasts. With this issue, my journey as the Editor-in-Chief of *The Vasculum* continues, and I hope to continue serving our readership and SHC members through this ongoing endeavor, showcasing the latest news, views, and developments from around the world.

This issue features the Kansas State University Herbarium (KSC), established in 1877. Carolyn J. Ferguson (Professor and Curator) gives us a tour of KSC with its more than 180,000 specimens. David S. Barrington, Professor and Curator of the Pringle Herbarium (VT) at the University of Vermont, provides our Early Career Advice and describes his experiences in herbarium curation. The SHC Worldwide section features an interview with Dr. Enrique César Crivelli, Curator of XAL herbarium in Xalapa, Mexico, which is a part of the National Institute of Ecology (INECOL). This is the first issue of *The Vasculum* to feature a section on the SHC Endowment. In this section, Maribeth Latvis, SHC treasurer, provides us with an update on the financial aspects of our society. This issue also contains a short piece by Katelin Pearson about how the SHC Early Career Section participated in SPNHC's Wiki Edit-a-Thon, which was held in November of 2022, as well as an announcement by Laura Eckland on the upcoming SPNHC 38th Annual Meeting. Our current issue also goes in depth into the history of the flora and herbaria of Sudan, the third largest country in Africa, contributed by Maha S. Kordofani. We also get an update on the Costa Rica donation made to the Missouri Botanical Garden (MO) courtesy of Katharine B. Gregg. Other highlights include articles by Searrah Bierker and colleagues and Katherine Matthews on describing a new method on herbarium collection, as well as on the development of educational modules for school children using leaf specimens, respectively, as well as an interview of Linda W. Curtis by Eric Ribbens, and an opinion piece by Stephen Saupe.

As with every work that gets published, *The Vasculum* is also built on teamwork. I've been helped, supported, and guided by so many people while I compiled this issue. Many thanks to all our contributors, and I hope our readers will greatly appreciate the variety and diversity of these articles, and the enriching experience thereof. Special thanks to the current SHC President, Anna Monfils, for her awesome support at every step of this process. My heartfelt thanks to our fantastic editorial board members, Abigail Moore and Harlan Svoboda, whose help is deeply appreciated.

As always, we invite your article ideas and contributions. Our contributors build the fabric of this newsletter. So, a gentle reminder to everyone: please keep sending me your contributions as well as any feedback you may have. Happy reading!





Figure 1: Voucher specimen of *Verbena canadensis* (L.) Britt, from the Leo A. Galloway Herbarium at Missouri Western State University (Photo credit: Tilottama Roy)- A section of this image is also featured on the cover of this issue

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Tilottama Roy  
Editor, *The Vasculum*  
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Missouri Western State University

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# News from the Society

## SHC Endowment

Initiated in 2018, the purpose of the SHC Endowment is to establish long term financial stability for the Society, enabling us to expand student research awards, herbarium assistance, training opportunities, outreach, DEI initiatives, and other activities that build towards our Mission and Vision. Through the approval of the SHC Investment Policy and amendments to the Bylaws to create an Investment Committee, the Endowment entered its fundraising phase in 2020. Over the past two years, we have raised \$5,700 through generous contributions from our membership. With this promising start, the Investment Committee met in April 2022 to review options that prioritize growth, agreeing that the WellsTrade brokerage account provided the most flexible service at this point. Securing formal financial advising to help us manage our investment portfolio remains a top priority. Our next goal is to reach \$10,000 through targeted fundraising efforts and increased visibility, which would make the SHC Endowment eligible for team advising through Wells Fargo. The Endowment is in the early stages of growth, and we will not use any portion of it until it reaches \$30,000. After that point, any spending will be limited by the investment return and only that portion will be used to further SHC goals. Looking into the future, the SHC would qualify for one-on-one financial advising once \$100,000 is reached. Building this solid financial bedrock will take time, but the SHC is on an exciting path forward. Looking into 2023, we humbly encourage our membership to keep the SHC Endowment in mind as they plan their charitable giving and to help us amplify upcoming fundraising initiatives if they are able. As always, we welcome your input and questions!

To make a donation, please visit [herbariumcurators.org/donate](https://herbariumcurators.org/donate) or contact SHC Treasurer (Maribeth Latvis, [secretary@herbariumcurators.org](mailto:secretary@herbariumcurators.org)).

With best wishes for a prosperous New Year,  
Maribeth Latvis  
Assistant Professor and SDC Herbarium Director  
Society of Herbarium Curators Treasurer  
South Dakota State University

## New location for the Marion Ownbey Herbarium (WS)

The Marion Ownbey Herbarium will be moving to a new physical location on the Washington State University Pullman campus over the course of the first half of 2023! For this reason, normal operations will be stopped from January 16th to August 1st, 2023. Access to the collections for research, teaching, and outreach will be difficult to impossible for most of this time as we will be boxing the collection for the move. For questions about access and when collections might be available, contact Director Eric Roalson ([eric\\_roalson@wsu.edu](mailto:eric_roalson@wsu.edu)) and/or Collections Manager Walter Fertig ([walter.fertig@wsu.edu](mailto:walter.fertig@wsu.edu)).

# **SPNHC 38th Annual Meeting**

## **Where**

San Francisco, California, and online

## **When:**

May 28 - June 2, 2023

## **Host**

California Academy of Sciences

## **Theme**

Taking the Long View

## **Website**

<https://www.calacademy.org/SPNHC-2023>

## **Contact Us**

[SPNHC2023questions@calacademy.org](mailto:SPNHC2023questions@calacademy.org)

Join us in San Francisco, California, U.S.A. for the 38th annual meeting of the Society for the Preservation of Natural History Collections. The conference theme “Taking the Long View” encourages all of us to envision the future of our field, our collections, and ourselves. What lessons can we take from the past to better shape our future? What are our goals as a society and as individual organizations? Hosted by the California Academy of Sciences and held at the Hilton Union Square in downtown San Francisco, SPNHC 2023 is sure to provide plenty of insight, inspiration and fun!

## **Program**

The program for SPNHC 2023 is still in development but will include workshops on Monday, May 29, and the plenary session and committee meetings Tuesday, May 30. Symposia, talks, and posters on a variety of collections-related topics will be presented Wednesday and Thursday, May 31-June 1, and the annual business meeting will be Friday morning, June 2. Abstract submissions for talks and posters are now open. Check our website for instructions and deadlines.

## **Field Trips**

Field trips for SPNHC 2023 are in the active planning stages. In the works are: a visit to the iconic Monterey Bay Aquarium, a winery tour and tasting in Sonoma, a student-run wildlife museum, the famed Marine Mammal Center,



Figure 1: SPNHC logo (Credit: Rachel Diaz-Bastin, California Academy of Sciences)



Figure 2: Golden Gate Bridge in San Francisco (Credit: J. Karachewski © 2022 )



walking tours of San Francisco, a geology tour of the City, and maybe even a whale watching boat tour! Field trips details will be available when registration opens. Watch your email or check our website for registration information.

## Events

SPNHC events are always a highlight! 2023 includes a Monday evening Ice Breaker at the California Academy of Sciences in Golden Gate Park, Tuesday Trivia Night, dinner and dancing at the annual banquet on Thursday, and the always anticipated collections tours of the host institution – the California Academy of Sciences – on Friday. There will also be bonus tours of the nearby collections of the Berkeley Natural History Museums at the University of California, Berkeley, U.S.A.. Be sure to sign up for these fun and inspiring events during registration.

## Venue

SPNHC 2023 will be held at the Hilton Union Square, in downtown San Francisco within easy walking distance of restaurants, theaters, museums, shopping, public transportation, and the world-famous cable car. We've reserved a block of rooms for SPNHC attendees at a special discounted rate. Explore San Francisco for a few days before or after the conference for the same great room rate.

## Host

The California Academy of Sciences was established in 1853, and has grown to include an aquarium, planetarium, rainforest, and natural history museum all under one living roof. The Academy's Institute for Biodiversity Science and Sustainability houses the research collections and programs and is at the forefront of efforts to understand two of the most important topics of our time: the nature and future of life on Earth. With nearly 46 million scientific specimen spanning eight disciplines, these collections provide one of the best records of life on Earth, both now and in the past.



Figure 3: HiltonSkyBar (Credit: Hilton Hotels & Resorts)



Figure 4: CAS Entrance (Credit: California Academy of Sciences)

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Laura Eklund  
Senior Collection Manager, Anthropology  
Chair of Science Collections  
Co-Chair, SPNHC 2023 Local Organizing Committee  
California Academy of Sciences

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# Practical Synergies: SHC Early Career Section Contributing to SPNHC Best Practices Wiki

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In its first few years, the Society of Herbarium Curators' Early Career Section (ECS) identified a need for accessible, comprehensive documentation about herbarium practices. Many great resources exist, but few central clearinghouses for this information had been assembled. The ECS worked hard to assemble these herbarium- and botany-related resources, but were then faced with an important question: where could this information be made publicly available?

This year, great strides have been made toward solving this dilemma by taking advantage of the hard work of a related professional society, the Society for the Preservation of Natural History Collections (SPNHC, affectionately pronounced “spinach”). One of the main activities of the SPNHC Best Practices Committee is to populate and curate the SPNHC Best Practices Wiki ([https://spnhc.biowikifarm.net/wiki/Main\\_Page](https://spnhc.biowikifarm.net/wiki/Main_Page)), a website that aims to make natural history collection curation practices available for its membership and beyond. The site is steadily becoming a rich resource of knowledge and expertise (see committee co-chair Genevieve Tocci's article in the last issue of *The Vasculum*), though its documentation regarding botanical collections has historically been somewhat limited. Enter the SHC Early Career Section, armed with loads of resources assembled over the years that its membership has found helpful for learning the ropes of herbarium curation. After some discussion and training from the SPNHC Best Practices Committee, the ECS was ready to help populate the Wiki.

The majority of progress has been made this year, thanks to the SPNHC Best Practices Committee leading a Wiki Edit-a-Thon. This virtual event on November 10th, 2022 served as dedicated work time for the SPNHC community—including the SHC ECS—to review the content on the SPNHC Best Practices Wiki and edit or add content. The event kicked off with a quick refresher on how to edit the Wiki and a discussion of which pages needed edits, and the participants launched into editing the topics of their choice. The SHC ECS dug into the herbarium- and digitization-related pages given their expertise, drawing from their pool of assembled resources.

This SPNHC Wiki Edit-a-thon was a successful step in galvanizing the community to contribute to this growing resource, and the SHC ECS was excited to play a part. Interested in contributing or at least learning more? Stay tuned for future Edit-a-Thon opportunities on the horizon or contact the SHC Early Career Section ([earlycareer@herbariumcurators.org](mailto:earlycareer@herbariumcurators.org)) for more info.

SHC Early Career Section officers for the term 2022-2024 are as follows:

Anthony Baniaga - President, UCLA; Daniel Konemann - Member at Large, Howard University; Erin Berkowitz - Professional Development Officer, University of New Mexico; Maryam Sedaghatpour - Secretary, UC Berkeley; Nina House- President Elect, California Botanic Garden

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Katelin D. Pearson  
Project & Data Manager  
Symbiota Support Hub, iDigBio  
Arizona State University

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# Archiving Population Variation: A New Collection Method for Herbaria

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## Abstract

The uses of herbarium specimens have greatly diversified but collection methods themselves have been slow to change. Here, we describe a pilot project that tests a modified approach to collecting herbarium specimens to more comprehensively document phenological, morphological, and life history variation in populations. We combine traditional collections with population sampling and iNaturalist (<https://inaturalist.org/>). We use the *Reynoutria* Houtt. hybrid complex (Polygonaceae) at a site in southwestern Pennsylvania, U.S.A. as a test case. Taking logistical space constraints and collectors' time into consideration, we plan to further expand and standardize this method to other species and sites and incorporate other data to embody the "extended specimen" concept.

## Introduction: The need for extended collection methods

With few exceptions, the way we collect herbarium specimens have changed little over the centuries. Herbarium specimens powerfully document the who, what, where, and when of plant biodiversity, to enable a long history of studies in taxonomy and systematics and floristics, aid in species identification, importantly serve as scientific vouchers, and inspire old and new botanists alike as educational tools (Heberling and Isaac 2017, Heberling 2022). However, herbarium specimens are imperfect. They cannot capture every aspect of an individual, population, or species. The uses of herbarium specimens have drastically expanded to provide valuable information about not only how plants have evolved, but also how the surrounding environment and plant interactions are changing (Heberling and Isaac 2017). This new appreciation for herbaria is incredible, but new uses are limited to the information available on specimens collected for a different purpose. Collection methods must also evolve to fit the new research atmosphere surrounding herbarium specimens.

In a project supported through The Society of Herbarium Curator's 2022 Undergraduate Research Award, we co-



Figure 1: . Mason Heberling (left) and Searrah Bierker (right) collecting *Reynoutria* specimens at Barking Slopes Conservation Area, Plum Borough (Allegheny County), Pennsylvania, USA (Credit: Mason Heberling)

mbined traditional collection techniques with more recent collection approaches to create a collection method that explicitly considers more than the individual plant itself at one point in time. We were inspired by and built upon previous collection methods. First, “mass collections” (also called population samples), most famously developed by Anderson (1941) and Fassett (1941), are an approach to field collecting that captures population-level variation within a species by collecting multiple plants or portions of the plant from different individuals in a standardized approach. This collection method will allow one to have a view of an entire population, instead of a single individual, within a specimen, allowing one to see the frequency of variation, the discontinuity of variations, and connections made around why these variations in populations exist (Anderson 1947, Heberling 2022). Similarly, life history vouchers, proposed by Utech et al. (1984), were introduced as another method to archive intraspecific variation across life stages from seedlings to reproductively mature plants. This methodology specifically can help investigate changes in phenology and traits over the plant’s life cycle, as well as provide exemplar specimens for natural history studies and education (Heberling 2022). The digital documentation of specimens collected is also important to provide context of what the specimens themselves looked like in the field and to give a better sense of what the surrounding area of where it was collected looked like and what the plant experienced. This goal can be accomplished through using iNaturalist to document the collected specimens and including a QR code to the observation on the labels of mounted specimens (Heberling and Isaac 2018).

### **Methods: A test of an integrated collection approach**

We implemented a new collection method for specimens, which we (tentatively) simply call “integrated vouchers” that connects these three underused methods of specimen collection (e.g., mass collections, life history vouchers, iNaturalist) to better archive variation in herbaria. To pilot this approach, we conducted a field-based project collecting specimens at Barking Slopes Conservation Area in Allegheny County, southwestern Pennsylvania, U.S.A. To test this method, we focused on the *Reynoutria* Houtt. (Fig. 1) hybrid species complex (Polygonaceae), a group of taxa introduced from Asia to Europe and North America which is known to be taxonomically difficult and morphologically diverse (Zika and Jacobson 2003). We sampled three species of *Reynoutria* that are abundant at Barking Slopes and display differences in their leaf morphology within a population: *Reynoutria japonica* Houtt., *Reynoutria sachalinensis* (F.Schmidt) Nakai, and their hybrid *Reynoutria ×bohemica* (Chrtek & Chrtková) J.P.Bailey.

We collected specimens by establishing transects running north to south within a population of each species. The transect length of each *Reynoutria* patch was divided into ten equal intervals to sample ten plants within the patch. At each interval, the stem closest to the transect was marked with a numbered tag, and a leaf was collected from the individual and labeled with the corresponding plant number for the mass collection. An iNaturalist observation was also taken for each sampled individual. Once all the individuals were sampled, we collected a voucher specimen from an untagged ramet within the same plot. We looked for young plants as well to implement the life history collection aspect, but since *Reynoutria* species are clonal, it was difficult to find these individuals. Future *Reynoutria* collections at other sites will include seedlings. This collection method was repeated for each taxon.

After the initial visit in early June 2022, we returned in mid-August when the plants were flowering and in mid-October when the plants were in fruit to document *Reynoutria* species’ reproductive stages. At the two following visits, voucher specimens were collected from the same *R. japonica*, *R. sachalinensis*, and *R. ×bohemica* individuals previously collected. iNaturalist observations were made for all previously tagged individuals. At the first and last visit, iNaturalist observations were also made for the overstory and understory species found within each plot. All the observations were compiled into an iNaturalist project (<https://www.inaturalist.org/projects/knotweed-sampling>).

Once all the specimens were collected and dried, specimen labels were created that include collection method details, standard label data, as well as links to iNaturalist observations of the individual, population, and associated



species. For each species, three “standard” voucher specimens were mounted on their own herbarium sheet representing phenological stages), and the mass collection leaves were placed in a large envelope mounted on a single specimen sheet. The voucher specimens have a QR code on their labels that link to their associated iNaturalist observation while the leaves have ten QR codes, one for each individual’s iNaturalist observation that include images of the leaves, entire plant, and community context. All four herbarium sheets for each species were placed in a palm folder together with a description of the project and the QR code to the iNaturalist project on the front (Fig. 2). Though each set of specimens is stored together in a palm folder, each individual specimen was given its own unique catalog number and collector number. All specimens were deposited at Carnegie Museum of Natural History Herbarium (CM). They were digitized and will be available online at [midatlanticherbaria.org](http://midatlanticherbaria.org) (collector numbers: Bierker 1 through Bierker 14).

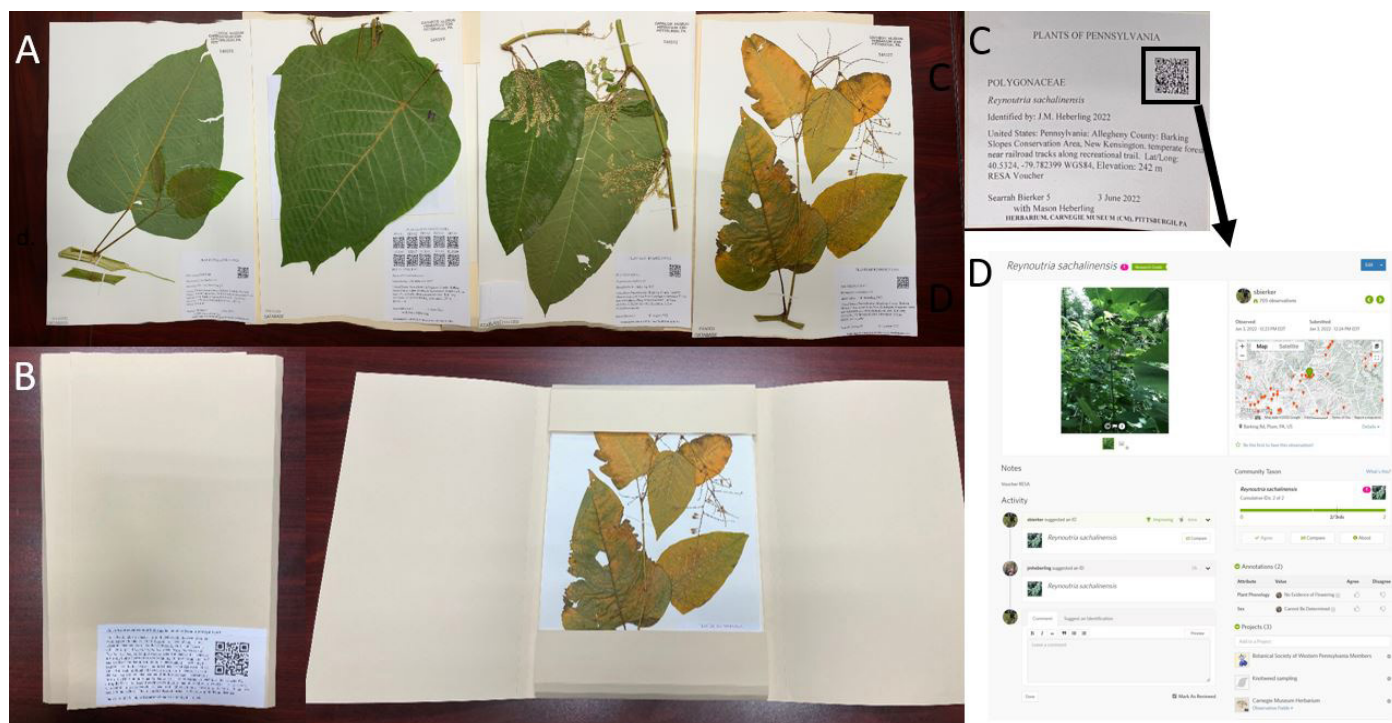


Figure 2: Example *Reynoutria sachalinensis* integrated specimen. (a) Each set of specimens is contained within a palm folder; in this example, including: a vegetative voucher specimen (Bierker 5), ten leaves collected systematically along a transect through the population (Bierker 4), a flowering voucher (Bierker 10), and a fruiting voucher (Bierker 13). (b) All specimens associated with the same collection are housed in a palm folder with a label on the front that includes a description of the project and QR code to the iNaturalist project. (c) An up-close of the label of the first integrated specimen for *Reynoutria sachalinensis* showing a QR code that links back to the iNaturalist observation with field images. (d) Screenshot of associated iNaturalist observation for a specimen (<https://www.inaturalist.org/observations/120028525>) (Credit: Mason Heberling).

## Conclusion and future directions

Herbarium specimens have continued to be collected in traditional ways while their use in research has expanded beyond these methods. By looking at different ways to collect a wider range of information with each herbarium sheet, it allows us to better use specimens in the future for new avenues of research and implements the Extended Specimen concept (Lendemer et al. 2020). We hope that this pilot study could be expanded to other species that display wide variations in morphology and provide documentation of these differences in the future. We plan to expand this pilot study and explore new ways to more explicitly and comprehensively archive phenological, functional trait, and life history variation in herbarium specimens. Integrated approaches to specimen collecting are needed for research uses in the future, both known and unknown.



## Acknowledgements

We thank The Society of Herbarium Curators for funding this project through the undergraduate research grant, and the Carnegie Museum of Natural History's Section of Botany for curatorial supplies and long-term preservation of these specimens. We also thank the Allegheny Land Trust for giving permission to collect specimens and supporting our research at our field site.

We would like to acknowledge that the specimens in this study were collected on land that is the traditional territory of the Monongahela people (autonym unknown) and the Osage Nation (Wahzhazhe). The Carnegie Museum of Natural History (CMNH) in Pittsburgh, PA is located on lands once occupied by the Monongahela people, the Seneca (O-non-dowa-gah) people-one of the Six Nations of the Haudenosaunee (hoe-den-ah-show-nee) and the Lenape (Lenni-Lenape or Delaware) people, the Wyandot (Wandat) people, the Shawnee (Shaawanwaki) people and the Osage Nation. We honor with gratitude the land and these peoples. One can learn more using the Native Land Digital map, which seeks to map the Indigenous territories, treaties and languages from around the world.

## Literature Cited

- Anderson, E. 1941. The technique and use of mass collections in plant taxonomy. *Annals of the Missouri Botanical Garden*, 28(3): 287.
- Fassett, N.C. 1941. Mass Collections: *Rubus Odoratus* and *R. Parviflorus*. *Annals of the Missouri Botanical Garden* 28(3): 299–374.
- Heberling, J.M. 2022. Herbaria as big data sources of plant traits. *International Journal of Plant Sciences*, 183(2): 87–118.
- Heberling, J.M., and B.L. Isaac. 2018. iNaturalist as a tool to expand the research value of museum specimens. *Applications in Plant Sciences*, 6(11): e01193.
- Lendemer, J., B. Thiers, A.K. Monfils, J. Zaspel, E.R. Ellwood, A. Bentley, K. LeVan, J. Bates, D. Jennings, D. Contreras, L. Lagomarsino, P. Mabey, L.S. Ford, R. Guralnick, R.E. Gropp, M. Revelez, N. Cobb, K. Seltsmann, and M.C. Aime. 2020. The extended specimen network: A strategy to enhance us biodiversity collections, promote research and education. *BioScience*, 70(1): 23–30.
- Utech, F. H., S. Kawano, M. and Ohara. 1984. Voucher specimens from life history studies - Its significance and necessity of conservation. *Journal of Phytogeography and Taxonomy*, 32:14.
- Zika, P.F., and A.L. Jacobson. 2003. An overlooked hybrid Japanese Knotweed (*Polygonum cuspidatum x sachalinense*; Polygonaceae). *Rhodora* 105(922):143–52.

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# Learning from Leaves: Teaching Kids Science from Herbarium Specimens

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## Introduction

At Western Carolina University (Cullowhee, North Carolina, U.S.A.), prior to the pandemic, members of the Biology Department regularly got requests from area schoolteachers and other youth educators to offer outreach experiences for their students to enhance science education and increase student awareness of college opportunities. The western NC rural Appalachian region is home to groups underrepresented at 4-year colleges, including members of the Eastern Band of Cherokee Indians and low-income students. As part of a 3-year NSF CSBR award entitled, “Development of the Catamount Biological Collections to Enhance Biodiversity Research and Education in the Southern Appalachians” (NSF Award #2001683), an undergraduate student and I developed three science modules for different grade levels using leaf specimens from the WCU Herbarium (WCUH) teaching collections.

In June 2022, Caroline Witherspoon, a WCU undergrad who was hired from grant funds as an herbarium assistant, and I worked to design and create the kits that would meet North Carolina state science curriculum standards related to plants. We consulted educators at the Science House in Asheville, North Carolina, U.S.A., a satellite office of NC State University that promotes STEM education and hosts an equipment loan program, to identify grade levels where curricular standards cover plant science and topics that are not already covered in existing modules, as well as how to create engaging activities for young students. By the end of the fall 2022 semester, we created three boxed kits that are kept at the Science House and can be checked out by teachers for classroom use. Each kit contains materials for 10 students/groups and teacher instructions. We hope to hold demo workshop for teachers in the future. Caroline presented a poster on the kits and results of classroom testing at the 2022 SURF (SoCon Undergraduate Research Forum) conference at Wofford College. Through this outreach effort, she gained skills in science education methods and communication.

The Stomata Kit (see below) was tested in the 6th grade class of the Catamount School, a middle grade “lab” school of WCU, and was modified based on student and teacher feedback. Most of the modifications involved reorganization of the order of activities to improve the flow and reduce wait time. But we did receive some unexpected responses, such as a comment from the teacher: “Don’t include rubber bands. Never give middle school students rubber bands.” The rubber bands had been used to hold together items in the module and were subsequently removed. One unexpected student comment, which involves viewing stomata through a microscope, was to make the kit accessible to seeing-impaired students. We added enlarged photographs of the microscope images to the kit to assist anyone who is somewhat seeing-impaired or has trouble using the microscope, but we have not created touch-based material for blind students (anyone with such experience, please contact me!).

## Kit descriptions

The Stomata Kit (Fig. 1) can be modified to suit grades 6, 7, and 9. The kit contains leaves from *Rhododendron maximum* L. and *Vaccinium stamineum* L. (both local Ericaceae species), clear nail polish, tape, and microscope slides, and instructions for making a lower epidermis peel. Students are then instructed to view the peels under the microscope to observe stomata from the two leaves to compare their size and density. They answer questions to learn about cell structures and functions, draw conclusions on how the environment impacts plants, and think about evolutionary relationships and possible adaptations that have helped these plants survive in different environments.

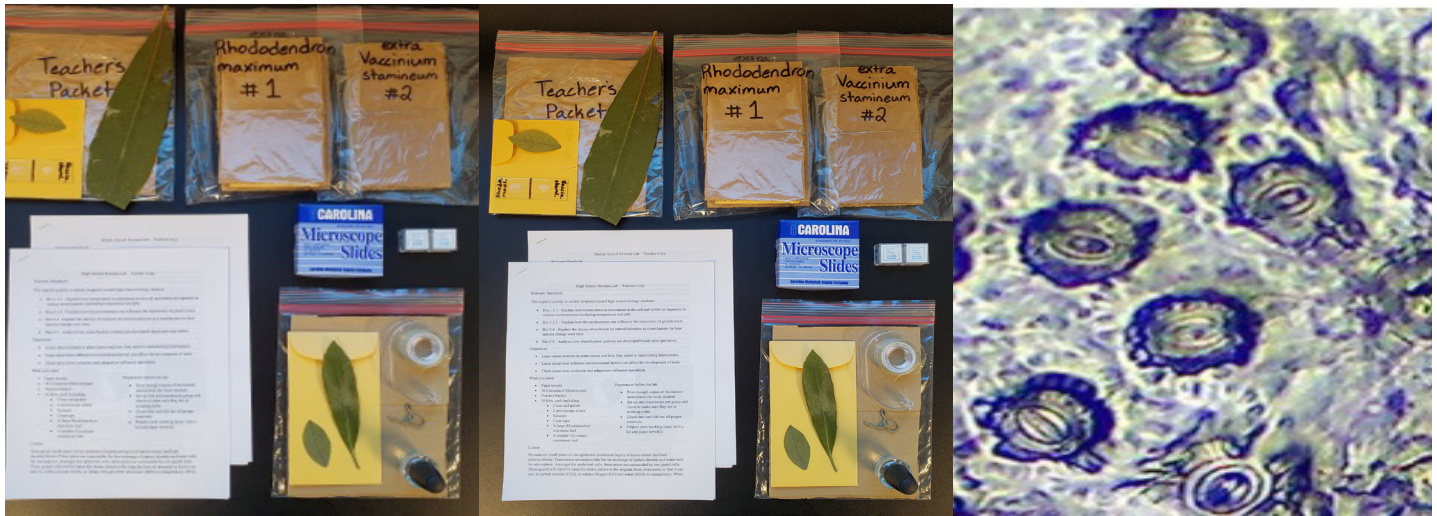


Figure 1 (from left to right): The Stomata Kit contents; Packets of dried, pressed leaves of *Rhododendron maximum* and *Vaccinium stamineum* respectively, supplies to make and observe epidermal peels, and instructions for teachers and students; A photographs of stomata viewed under the compound microscope at 400x of *R. maximum* (Credit: Katherine Matthews)

The Kindergarten kits (Fig. 2) are meant to be played as games: The Leaf Kit contains laminated cards with four differently-shaped leaves (*Cercis canadensis* L, *Acer rubrum* L., *Cornus florida* L., *Quercus alba* L.) for students to use to practice describing descriptive characteristics characteristics of each leaf and to compare and contrast them. The Tree Matching Kit contains laminated cards of four different trees (*Quercus alba*, *Acer saccharum* Marshall, *Pinus strobus* L., and *Cercis canadensis*), with pictures of the whole tree, a closeup of the leaves, and a closeup of the fruit. The students are instructed to match the pictures with actual leaf specimens (glued to cards and laminated) and with dried fruit samples in plastic bags. Then they observe and describe how each type of fruit moves through the air when dropped.

Finally, we created a study guide for the Science Olympiad (a national STEM competition program) Forestry tree identification event for middle school students. This consists of a ring binder containing leaf and twig specimens of trees on the official list from the WCUH teaching collections and a QR code link to a checklist of the trees created on SERNEC.

### Conclusion

We received positive feedback on the experience of a middle school class using the Stomata Kit, and we hope that these kits will help expand botany education in public schools. The WCUH teaching collection was developed from student collections from my Flora of the Southern Appalachians class and from specimens found to be unsuitable for the research collection (mainly unlabeled specimens), and was originally kept in a haphazard condition. Caroline fully organized the collection in 2021, and it is now well-suited for creating outreach modules since it contains many duplicate specimens of common woody plant species. The curator of the insect collection, Luiz Silveira, and his graduate assistant are in the process of developing similar, animal-based science education modules for schools. These mobile science kits are not only effective educational tools, but they also teach people about biological collections, what and where they are, and how they enhance scientific knowledge and education.



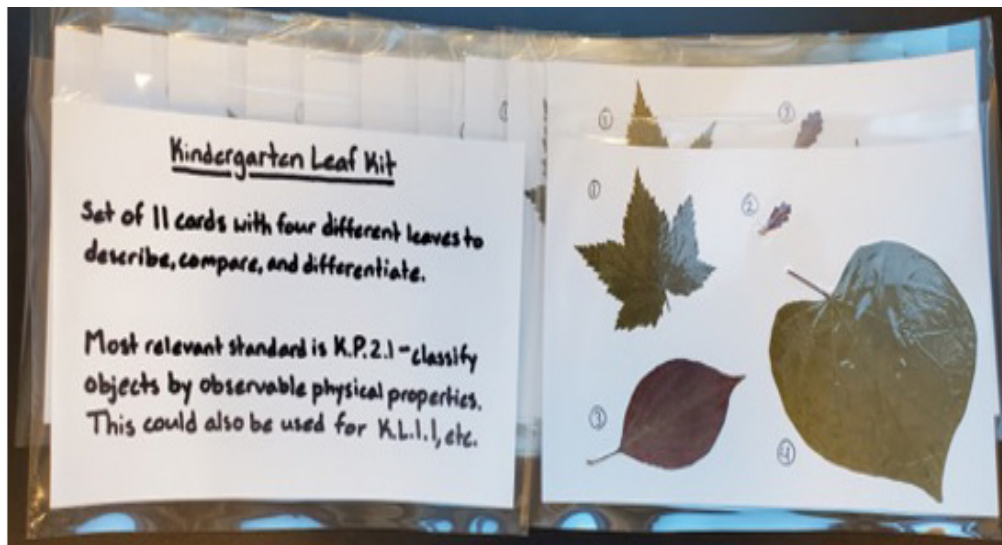


Figure 2: Kindergarten kit contents. Top: Leaf Kit cards; Bottom: Tree Matching Kit cards (Credit: Katherine Mathews)




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Katherine Mathews,  
Professor, Director of WCU  
Herbarium (WCUH),  
Western Carolina University

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# History of the Flora and Herbaria in Sudan

Sudan covers a vast area of tropical northeast Africa, ranging from desert in the north to savannah woodland in the south, and contains a diverse flora. It is considered to be one of the richest African countries in flora. Over 4000 plant specimens are deposited in different herbaria in Sudan. Plant collections in Sudan began by the 19th century. Early collections were made in Northern Sudan and along the Red Sea coast, with southern Sudan visited in 1860–63. By the 20th century, collections were made by foresters and agriculturists. In 1906, Broun produced the Catalogue of Sudan Flowering Plants. The documentation of plants in Sudan started with some reports: Broun's (1906) Sudan Notes and Records and the publication Broun & Massey (1929). Crowfoot (1929) produced a short book on Plants of Northern and Central Sudan. The most recent country-wide account of the Sudan region's plant diversity is the Flowering Plants of the (Anglo-Egyptian) Sudan by Andrews (1950–56). Andrews' work provides a very useful starting point for a modern checklist, although the content is both incomplete and outdated. Updates to Andrews' work exist, notably by Wickens (1968) and Drar (1970). More recently, there have been excellent botanical accounts published. The woody flora has also received some further attention, e.g., El Amin's (1990) guide to the trees and shrubs of Sudan.



Figure 1: Professor Maha and her herbarium team (Credit: Maha Kordofani)

However, large areas of the two countries (Sudan and South Sudan) and large parts of the flora remain uncovered by any modern treatment. An updated, accurate, and comprehensive checklist was produced by Darbyshire et al. (2015) to provide a baseline reference for future botanical and conservation work in the Sudan region and to fill the gap in our regional knowledge.

The flora of the Sudan represents part of our wealth and heritage; it is a source of pride that should be documented, managed, and conserved for future generations. It has always been important for people as a source for live-stock grazing, fodder, construction material, firewood, food, and traditional medicine. Furthermore, it has vast environmental value in sustaining and determining ecosystems and biodiversity. Medicinal and aromatic plants have been identified and used throughout human history and presented in an atlas. Many medicinal plants grow in Sudan, including *Adansonia digitata* L. (tabaldi), *Tamarindus indica* L. (tamarind), *Grewia tenax* (Forssk.) Fiori (goddaim) (HCENR, 2003). It is important to recognize such plants, as this leads to their conservation and propagation.

Harrison and Jackson (1958) classified the vegetation of the Sudan on the basis of rainfall and soil types into five major ecological zones, with each zone having its own typical and specific vegetation. There are some topographic features that deserve mentioning: the Nile and its tributaries and the isolated mountains in the east, west, and south. These unique features have created special ecosystems.

## Plant collectors in Sudan

Early plant collection in Sudan was closely related to the political history of exploration and colonialism. The earliest Sudanese specimens held in the Herbarium of the Royal Botanic Gardens, Kew (K) date from the 1830s, when a small number of explorers and traders roamed the country. Some collectors were involved in government

efforts or military expeditions to suppress slavery, while others operated with, or under the protection of, Arab slave and ivory traders. When the Nile route was closed to them, slave traders began to use a route north through Darfur to Egypt, where slavery was still legal. Two of the three main collectors during the mid-19th Century, Georg Schweinfurth and Johannes Pfund, were associated with either slave traders or the attempt to suppress them, while Theodor Kotschy was part of a European-led scientific expedition employed by the Egyptian government. British collectors at this time were principally involved in the search for the source of the Nile.

### History of Herbaria in Sudan

In 1906, an herbarium was established at Shambat and moved to Wad Medani after 1918. Another was established in the Range and Pasture Administration at Khartoum and El Obeid. The University of Khartoum Herbarium (KHU) was established in the 1950s in the Botany Department, Faculty of Science, by Macklay the then Dean and Head of the Botany Department. The Forestry Research Center Herbarium at Soba (KHF) began in 1962, after transferring some woody specimens from the Wadi Medani Herbarium to Soba (WM; now specialized in woody plants of the Sudan). Later a specialized medicinal and aromatic plants herbarium was established in 1972 in Medicinal & Aromatic Plant Research Institute, National Centre for Research in Khartoum. The Botany Department Herbarium (KHU) in the Faculty of Science, University of Khartoum, is the largest and serves as a reference herbarium. It includes more than 4000 species belonging to 400 families. Many of these plants are rare, type, or voucher specimens used for teaching under- and post-graduates. It contains rich records for local plant species, though older herbarium specimens are very rare. Currently, the herbarium occupies an area of 200 m<sup>2</sup> and it houses approximately 25,000 plant specimens collected from all over Sudan and South Sudan. It also renders services to MSc and Ph.D. students and researchers from different universities, governmental and non-governmental institutions, and the general public. It includes fine collections of vascular plants and Pteridophytes and provides a representation of plant communities that have existed throughout modern history each year. These specimens are deposited into proper cabinets to protect the specimens against insect damage. A list of specimens of a particular genus or species can be prepared upon request; these specimens can then be loaned to professionals for their study under certain regulations. Cooperation with Kew herbarium staff gave much appreciated help in presenting the checklist of the flora of Sudan and South Sudan. Digitization and imaging were completed two years ago under the Biodiversity Management Programme (IGAD) to ensure accessibility by the public and researchers from different national institutions. A plan for a seed bank is under consideration for the future.

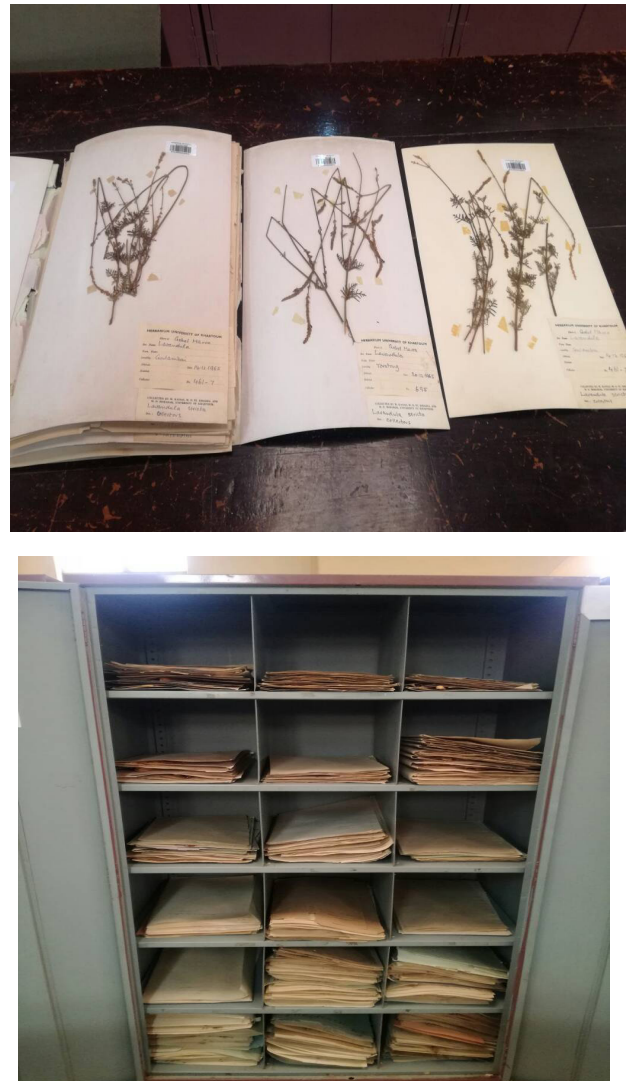


Figure 2: Herbarium KHU; Top: Voucher specimens; Bottom: Herbarium Cabinets (Credit: Maha Kordofani)

## Literature Cited

- Andrews, F.W. 1950. The flowering plants of the Anglo-Egyptian Sudan. Vol. I (Cycadaceae-Tiliaceae). T. Buncle & Co. Ltd., Arbroath, Scotland.
- Andrews, F.W. 1952. The flowering plants of the Anglo-Egyptian Sudan. Vol. II (Sterculiaceae-Dipsacaceae). T. Buncle & Co. Ltd., Arbroath, Scotland.
- Andrews, F.W. 1956. The flowering plants of the Sudan. Vol. III (Compositae-Gramineae). T. Buncle & Co. Ltd., Arbroath, Scotland.
- Broun, A.F. 1906. Catalogue of Sudan flowering plants. El-Sudan Printing Press, Khartoum.
- Broun, A.F. & Massey, R.E. 1929. Flora of the Sudan. The Controller, Sudan Government Office. London.
- Crowfoot, G.M. 1928. Flowering plants of the northern and central Sudan. Orphan's Printing Press Ltd., Leominster.
- Darbyshire I, Kordofani M, Farag I, Candiga R, Pickering H. The plant of Sudan and South Sudan an annotated checklist. Kew: Royal Botanical Garden; 2014. ISBN: 978-1-84246-473-1.14.
- El Amin, H.M. 1990. Trees and shrubs of the Sudan. Ithaca Press. Exeter.
- Harrison, M.N. & Jackson, J.K. 1958. Ecological classification of the vegetation of the Sudan. Forests Bull. No. 2 (New Ser.). Sudan Forests Dept., Ministry of Agriculture, Khartoum.
- HCENR, (Higher Council for Environment and Natural Resources). 2003. Assessment of National Capacity Building in Biodiversity Monitoring Including Taxonomy. Ministry of Environment & Physical Development, Khartoum.

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# George B. Rossbach 1961 Costa Rica collection donated to Missouri Botanical Garden

A collection of over 800 Costa Rican specimens was recently donated to the herbarium of the Missouri Botanical Garden (MO), St. Louis, Missouri, U.S.A. by Dr. Katharine B. Gregg, Curator of the George B. Rossbach Herbarium (WVW; Fig. 1a). The specimens were collected over the summer of 1961 by the late Dr. George Rossbach (1910–2002), who taught biology at West Virginia Wesleyan College, Buckhannon, West Virginia, U.S.A. from 1949 through 1976 and established the herbarium there upon his arrival. Earning a B. S. from Harvard in 1933, Rossbach completed both a master's in 1940 and a Ph.D. in 1941 from Stanford University. Prior to his appointment at West Virginia Wesleyan, he taught marine biology at the College of William and Mary during the academic year 1948–1949.

Plants were collected from all seven provinces of Costa Rica, from sea level to high elevations, over the period July 3 through August 20. Since their collection in 1961, the specimens had been stored, relatively untouched and in bundles tied up with cotton string (Fig. 1b). Upon opening the folders in 2021, the collection proved to consist primarily of vascular plants (Fig. 2), but with small numbers of macroalgae, lichens, and fungi. Many of the ferns had been identified and annotated in 1964 by Edith Scamman, an expert on Costa Rican ferns working at Harvard's Gray Herbarium (GH) in the 1960s. As many of the specimens are unidentified, it is hoped that being housed at MO will encourage their identification and enhance their usefulness. Label data and images of all the donated specimens have been uploaded to Tropicos and may be accessed there at any time. Both jpegs and raw image files are available from Katharine (Kathy) Gregg. Annotations are welcome and should be addressed to [herbarium@mobot.org](mailto:herbarium@mobot.org).



Figure 1: Shipment of George B. Rossbach collection from WVW to MO. Top: Original folders, as tied up by George Rossbach in 1961. Bottom: Cartload of over 800 specimens shipped in 11 boxes.



Figure 2. Specimens collected by George Rossbach in Costa Rica in 1961. From left to right: *Columnea microcalyx* Hanst., Province Cartago; *Drimys winteri* Forst., Province Alajuela; *Polybotrya villosula* Christ, Province Limón.

Katharine B. Gregg,  
Professor Emerita and  
Curator,  
George B. Rossbach  
Herbarium (WVW)  
West Virginia Wesleyan  
College



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# The Wired Herbarium #15 - An interview of Linda W. Curtis by Eric Ribbens (rewritten from 2013)

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Linda Curtis published an article in the Illinois Native Plant Society Journal *Erigenia* titled “*Carex* of the Zion Beach-Ridge Plain” (*Erigenia* 26: 15-25. 2013). In it she described the *Carex* L. sedges that grow in Dunesland along the southwest Lake Michigan coast. As part of her research, she collected herbarium specimen data from websites and email contacts with curators as they were difficult to identify. Linda Curtis aka Lindaeus, writes *Carex Corner* for Illinois Native Plant Society’s Harbinger

## **Q. How important was the virtual herbarium data to your work?**

A. It was essential. All the curators’ responses were different as were their websites. At first it was confusing, and the delay of download time was long on some sites. Twelve of the Midwest herbaria I contacted had some specimens from the Dunesland, which extends from Kenosha, Wisconsin, U.S.A. south to the Waukegan, Illinois, U.S.A. Harbor. A non-Midwest herbarium, Harvard University Herbaria, Cambridge, Massachusetts also responded with a specimen. I then realized I should track collectors and their affiliated colleges rather than only *Carex* itself, and even found specimens from the Dunesland *Carex* in other countries.

## **Q. How was the specimen information collected that you obtained?**

A. At that time, many curators did not have scanned images and made the search in the stacks and scanned them personally for me, rather than send them as mailed loans. Some herbaria had student workers or assistants who began scanning specimens. One remarked the *Carex* were so difficult to identify, their *Carex* specimens languished unidentified in cabinets.

## **Q. How important were the scanned images to you?**

A. Again, essential. I had bought every book and manual with *Carex*, and the descriptions in each varied. Eventually, the shared information between herbaria included websites that allowed enlargements of parts of the scans. Then *Carex* began to emerge from under-reported field data to collected and vouchered specimens in an herbarium. I began sending macro-images of *Carex* to the University of Wisconsin-Madison and the University of Florida-Tampa’s Florida Atlas. The images show the diagnostic traits of small parts so necessary for ID.



## **Q. What should herbaria do to improve?**

A. They have evolved so much with their imaging and photo galleries that botanists like myself use the Internet more now than the old manuals. Some herbarium website glossaries have included images and not just descriptions.

Figure 1: Close up of *Carex haydenii* Dewey (Credit: Linda Curtis)

## **Q. Has your work on *Carex* enabled herbaria to catalog the many specimens sent that were not prioritized for identification?**

A. Absolutely. On the Herbaria website I offered my *Carex* books free to any herbarium that had an in-house library for research. Many responded and reported excellent usage of the books by graduate students as well as the curators. Although Bog-fen *Carex* of the Upper Midwest and Woodland *Carex* of the Upper Midwest are sold out, they will soon be available as ebooks, along with my newest book *Carex* of Central Florida.

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# My Bucket List

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I am the curator of the Bailey Herbarium, which serves the joint Biology Department of the College of St. Benedict and Saint John's University (CSB|SJU), Collegeville, Minnesota, U.S.A. (<https://www.csbsju.edu/herbarium>). We have more than 32,000 specimens of vascular and non-vascular plants and fungi, which makes us the largest private college herbarium in the state. We have several historically-important collections including those of Z.L. Chandonnet and the Flora Austro-Hungarica. We primarily use our specimens in teaching and undergraduate research projects.

Since becoming the Curator in 1994, I implemented many changes including merging the collections from our separate institutions and organizing the specimens phylogenetically. However, one major project that I never finished was to make our specimens available online. This has been on my academic "bucket list" for years.

I started the process multiple times. For one reason or another, each time it faltered and I needed to begin again. As retirement approached, I worried that I would retire before finishing the job. That is, until I was contacted by George Weiblen, University of Minnesota Professor of Plant & Microbial Biology and Science Director of the Bell Museum. George was recruiting outstate herbaria to team up with the Bell Museum to digitize their collections to be included in the Bell Museum Biodiversity Atlas (<https://bellatlas.umn.edu/>). George received funding for this project from the Legislative-Citizen Commission on Minnesota Resources (LCCMR) program.

Although COVID-19 set us back over a year, the project finally got started in June 2021 when I boxed up our specimens and George and Tim Whitfeld (Bell Museum Herbarium Collections Manager) arrived at our doorstep in their rented truck. We loaded up more than 100 boxes of specimens (Fig. 1) and they hauled them to the University of Minnesota where for their ace team, comprised of University of Minnesota undergraduates, to bar-coded and photographed each one. A little more than a year later (August 2022), Tim redelivered our specimens, and I have since returned them to their respective cabinets.

What remains is to examine each image and then enter the information (specimen name, collector, collection date, etc.) from the label into a database that is Web-accessible. Much of this work is being done by volunteers through the Zooniverse website (check out the Mapping Change project at <https://www.zooniverse.org/projects>). One of my undergraduate herbarium assistants, Katie Barclay, and I have entered lots of data, too. Though I formally retired in May, I am busy continue to codeing the remaining specimens and will keep at it until the project is complete.

Tim, George, and Katie Noreen (Curatorial Assistant at the Bell Museum Herbarium), deserve much credit for setting everything up and providing necessary training to all of the volunteers involved in data coding. You can monitor the progress by searching the Bailey Herbarium collections at the Bell Museum Biodiversity Atlas website.

I am so very grateful to George, Tim, Katie, the Zooniverse volunteers, and undergraduate assistants, for helping me tick off the final item on my academic bucket list. Now that I am retired, I will have heaps of time to devise a suitable way to thank these amazing individuals for their scientific expertise, hard work, and making my bucket list a reality.



Figure 1. George Weiblen (left) & Tim Whitfeld after loading 32,000 specimens from the CSB|SJU Bailey Herbarium on a truck to transport them to the University of Minnesota (St. Paul) for digitizing (Credit: Stephen Saupe).

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Stephen G. Saupe, Curator  
Bailey Herbarium  
College of St. Benedict/St. John's  
University

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# Early Career Advice

**David S. Barrington** (Fig. 1) is a Professor and the Curator of the Pringle Herbarium (VT) at the University of Vermont

## **How have herbaria enriched your research?**

I have somewhere around 3000 herbarium sheets of ferns in the genus *Polystichum* Roth from the Andes in my study collection, both from our own collection here at the Pringle Herbarium (VT) and from other herbaria received on loan. They are absolutely critical to the continuing improvement of my understanding of the morphological distinctions between the species and hybrids in my study group. They have also proved to be great sources for our next-gen sequencing work on these plants, because a small sample taken with permission of the lending herbarium leads to me having both morphological and genetic data for the same frond of the same plant. Yet a third database, on spore shape and size, comes from the herbarium sheets; these data give me working hypotheses for ploidy level and for species vs. hybrid status.

## **How have herbaria enriched your teaching?**

One of my favorite answers to this question is that I bring in totally unlabeled, unmounted herbarium-ready collections of two species and their hybrid into the classroom and spread them out randomly. I ask the students to distinguish how many groups of plants there are, then I say that we are looking at a hybrid and its parents and ask them to decide which is which. Finally, I ask them to actually spell out what characters they are using to decide. This exercise really gets their understanding of hybridization underway.

## **What types of outreach activities do you do for the general public?**

We regularly have people eager to visit the herbarium. Adults come who are interested in the local flora and have heard that the herbarium has samples of the flora. An hour-long tour often completely transforms their understanding of an herbarium, its connections to other herbaria, and its utility. Often, folks are interested in the complex history of collecting, gifts, and exchange that yield the collection as it now stands. We also have school groups come, even preschoolers. I have a special cabinet full of cool fruits and seeds for them to play with, and I show as much about the regular collection as will make sense for the age group.

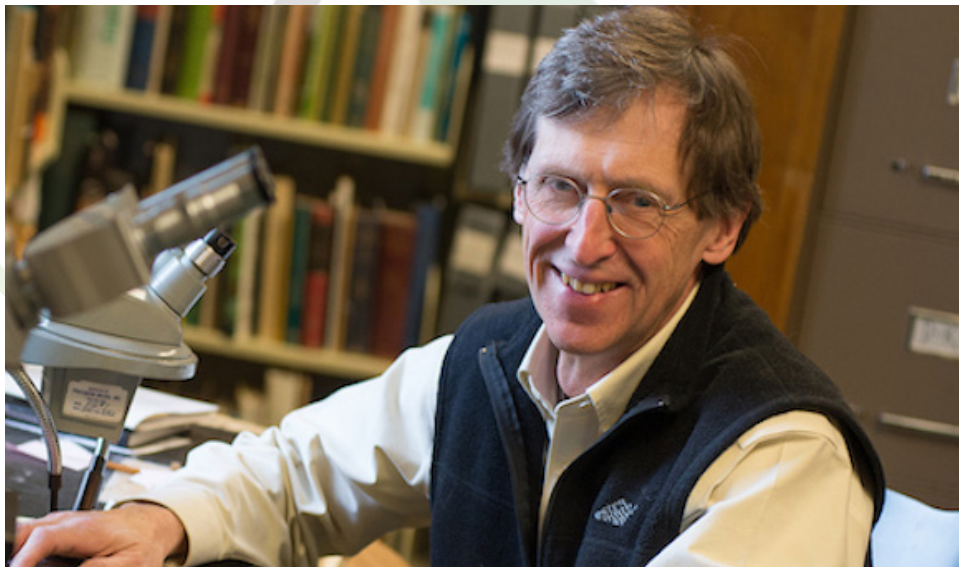


Figure 1: David S. Barrington

There was a small herbarium (maybe 15,000 sheets) at my undergraduate institution (Bates College, Lewiston, Maine, U.S.A.), and my taxonomy professor showed it to me. I was totally fascinated, so he asked if I would like to help with the collection. To start, I simply put specimens away that hadn't been filed. Later, I added my own collections of the local flora to the herbarium. The Bates Herbarium (BCL) is now incorporated into the Pringle Herbarium, so all of my earliest collections came along and are here with me now.

### **What was your first herbarium-related job?**

The work at Bates College was all as a volunteer. The first time I was paid to work in an herbarium was between my junior and senior year at Bates, when Rolla Tryon hired me to work in the fern collection at the Harvard University Herbaria. There, I got a sense of how the really big herbaria operate, and I learned about herbarium-related research from Dr. Tryon and his graduate students. It was an incredible experience and completely convinced me that I had found my life's work. I went on to get my doctorate with Dr. Tryon.

### **What was the species of your first herbarium collection and where did you collect it?**

My first collection was of the field horsetail, *Equisetum arvense* L., and I collected it by the mailbox in front of my folks' house in Bath, Maine. I guess most of us collect the really weedy, common things first...

### **What are some herbarium-specific challenges you have faced during your career and how were you able to overcome them?**

It's fairly well known that we had a fire in the Pringle Herbarium in 2017. The problems caused by the fire have been the biggest challenges of my life with herbaria—but not because of damage from fire—rather from damage from the water used by the firemen to put out the fire. Though we had virtually no loss of specimens in the fire because of the good work of the firemen and our newly purchased metal cabinets, the building was condemned, and we had to move the whole collection to another building. We are still in temporary quarters awaiting renovation of our space for the herbarium's specific needs five years later.



### **What challenges do you see early career curators and collection managers facing and how do you think they could be met?**

The biggest challenge early-career curators will have is convincing administrators that there is value to these collections. There are cogent arguments to be made based on the need for work on biodiversity and climate change, among others, but it takes repeated sales pitches to keep administrators convinced. It's important to secure a clear commitment of one's work time to simple curation and development of the herbarium—separate from research time—and it's equally important to pursue outside funding aggressively so that you have an external certification that the herbarium has value.

### **What was the best herbarium/career advice that you received?**

Figure 2: New NSF-funded cabinets arriving at the Pringle Herbarium

This is probably not going to be what you expect, but when I left Harvard to take my job as curator of the Pringle Herbarium, then Gray Herbarium director Reed C. Rollins said to me, “David, accumulate as much power as possible as soon as possible.” He was absolutely correct; you need a position of respect across the university or the larger museum to accomplish your goals.

**What advice could you give for early career members to be successful?**

Attract students and volunteers to help. Sell the value of the collection to administrators. Apply for grants. Keep applying. Choose a focus group for your own work and set aside real research time when no one can interrupt you to develop publications. Involve at least some students in your work, not just any old project. Welcome the public.

**How is being an early career curator/collections manager nowadays better than when you began your career?**

Herbaria are better understood now, since the integration of molecular biology with systematics and evolution as well as collections becoming understood as key resources. Academics are much more likely to understand the value of systematics with our science becoming based on testable hypotheses. Funding is better than it used to be, with collections-specific grant programs at several federal agencies.

**How is being an early career curator/collections manager nowadays more challenging than when you began your career?**

I don't think it is. For instance, I think there are about the same number of jobs as always, especially now that there is so much more emphasis on rare and endangered species and plant communities.

**How can early career members better leverage herbarium sciences into the future?**

I think I've covered a lot of the territory in this question already, but to summarize-make your herbarium a happening place that is full of students and volunteers working with the collection, both curating and researching. Open the doors to the community and sell the utility of the collections for biodiversity and conservation research to administrators.

**What are the important ways herbarium staff can promote and advocate for their collections?**

One thing I haven't mentioned is that I get the state conservation community directly involved in the herbarium, offering space for meetings of rare and endangered species committees and offering conservation professionals label-printing and mounting services for their collections. This group always means well, but often don't get their collections to us for accession-offering the exact tasks that students will enjoy, as a bait does help.

**What are some future challenges you see early career members facing, and how can they rise to meet those challenges?**

There is more and more focus at higher education institutions on career preparation and on programs that lead to jobs. Training in herbarium-related work does lead to jobs, lots of them with only an undergraduate degree, but you need to keep track of the ones your students get and showcase them.

**What is the best thing about managing a herbarium collection?**

The challenge of naming a plant that stumps everyone else.

**What is the one most important thing that a herbarium does?**

Highly biased answer here: document and preserve type specimens-the key materials at the foundation of the naming of living things. However, providing the basis for insights into changes in distribution over time, into phenological changes over time, and countless other projects that can be undertaken with the collections, are realistically just as important to the herbarium's continuing relevance.



### **What is the future of herbarium science?**

There is a place in the sciences for maintaining real samples of real plants, not just images or DNA sequences. To argue otherwise is to pretend that we have learned all that we can from the physical collections.

### **Do you have any closing advice for early career members?**

It's about the plants. Nurture your passion for them. Everything else is less exciting, less interesting.



Figure 3: The 2015 gathering at the Pringle Herbarium to celebrate the publication of Art Gilman's *New Flora of Vermont*

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Early Career Advice is a regular feature of *The Vasculum*. If you have questions you would like to ask or if there is someone you would like to see interviewed, please contact us ([earlycareer@herbariumcurators.org](mailto:earlycareer@herbariumcurators.org); current president: Anthony Baniaga- email: [abaniaga@g.ucla.edu](mailto:abaniaga@g.ucla.edu)) for more info.

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# Featured Herbarium

## Overview and administration

The Kansas State University Herbarium (KSC) was established ca. 1877 and became a key part of the early research foundation of the then Kansas State Agricultural College. Today, KSC holdings number over 180,000 specimens of plants from around the world, including vascular plants and bryophytes, with a focus on the Great Plains of North America. The Herbarium is located on the top floor of historic Bushnell Hall on the University's main campus, in Manhattan, Kansas, U.S.A. Our website is: [www.ksu.edu/herbarium](http://www.ksu.edu/herbarium).

Kansas State University ("K-State") is an R1 land-grant university with student enrollment of ca. 20,000. The Herbarium is housed within the Division of Biology in the College of Arts and Sciences. It is directed by a tenured faculty Curator in Biology (Carolyn Ferguson, with support from the Kansas Agricultural Experiment Station). Staffing additionally includes a part-time Associate Curator who is involved with plant diagnostics (Mark Mayfield, with support from K-State Research and Extension, College of Agriculture). K-State Research and Extension supports diagnostic services to provide expert plant identification data to extension workers and citizens in general (which much activity via the Plant Diagnostic Information System [PDIS] program of the Great Plains Diagnostic Network [GPDN], administered through the Department of Plant Pathology, College of Agriculture). Undergraduate student workers are regularly involved in specimen mounting, repairs, filing, imaging, and data entry (Fig. 1).



Figure 1: A student completing repair work on herbarium specimens (Credit: Kansas State University Herbarium)



## History

The history of the KSC Herbarium is documented by Barnard (2003), who demonstrates that the then-Kansas State Agricultural College housed an herbarium as early as 1872. However, some early collections were lost, and the founding of the modern Herbarium appears to date to ca. 1877, shortly after the campus was moved to its current location from its original grounds about a mile to the west. Beginning in the late 1870s, the Herbarium saw rapid growth, and by 1894, specimens numbered over 75,000 (including 10,000 mycological collections; Barnard, 2003). Important early curators included mycologist William A. Kellerman (who managed collections ca. 1883-1891, prior to joining The Ohio State University), and agrostologist Albert S. Hitchcock (1890-1901, prior to his departure to the USDA and eventually the U.S. National Herbarium (US), Smithsonian Institution). Hitchcock was a particularly prolific collector, who also made important contributions to student training and conducted exchange with other botanists of the time. Barkley (1965) presents documentation of a two-week “grass investigation” field trip by one of Hitchcock’s students, who pushed a “collecting wheelbarrow” nearly 200 miles along a railroad route in central Kansas in 1898. As a result of Hitchcock’s research program, KSC houses the most complete record of Kansas plants from the late 1800s. Figures 2 and 3 provide examples of historical specimens.

Several individuals were instrumental in the development of KSC during the 20th century. Frank C. Gates oversaw the Herbarium from 1919-1955; he added greatly to the herbarium holdings, and his curatorial work is particularly evident throughout the Herbarium. Gates produced important annual reports (including many new



Figure 2. A specimen collected by Albert S. Hitchcock in Kansas in 1895 (*Aristida* L., Haskell Co., KS) (Credit: Kansas State University Herbarium.)

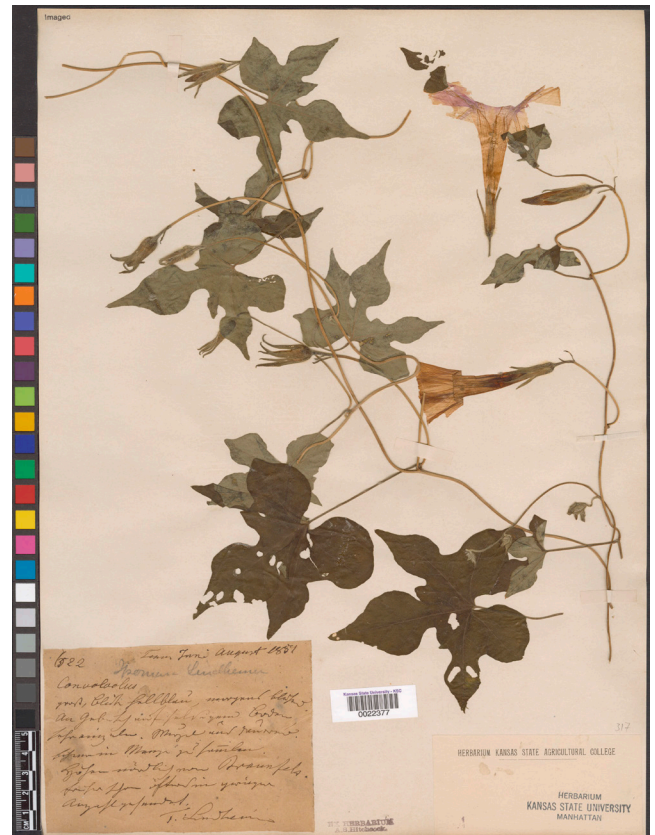


Figure 3. A specimen collected by Ferdinand J. Lindheimer in Texas in 1851 (*Ipomoea* L., Comal Co., TX) (Credit: Kansas State University Herbarium.)



records, etc.) and also authored publications including *Wild Flowers in Kansas* (1932), *Grasses in Kansas* (1937), *Flora of Kansas* (1940), and *Weeds in Kansas* (1941), among other works. KSC also houses ca. 4,000 specimens collected by Gates in the Philippines during his time at the University of the Philippines Los Baños prior to his arrival at Kansas State. Lloyd C. Hulbert managed the collections from 1955-1961, and collected extensively in the Flint Hills region of Kansas. Hulbert was a floristic ecologist and founded Konza Prairie Biological Station (now also an NSF Long-Term Ecological Research [LTER] site). Theodore “Ted” M. Barkley served as Curator from 1961-1998. Barkley was a taxonomic expert on the Senecioneae (Asteraceae), on which he published extensively. He was a co-editor of *Atlas of the Flora of the Great Plains* (Great Plains Flora Association, 1977) and *Flora of the Great Plains* (Great Plains Flora Association, 1986). Barkley was a founding member of the *Flora of North America* editorial board and worked extensively on the Asteraceae volumes.

In 1971, the Herbarium was moved to its current location in Bushnell Hall (from Dickens Hall; although the mycological collections were separated and stored in Ackert Hall; Barnard 2003). This move followed departmental reorganization in 1967 which resulted in formation of the broad Division of Biology (the Herbarium had been part of the previous Department of Botany and Plant Pathology). In 1997, the KSC mycological collections (ca. 17,000 specimens) were donated to New York Botanical Garden (NY). From 2008-2009, KSC specimen cabinets were replaced with new, high-quality cabinets in Bushnell Hall.

### Noteworthy strengths, special collections

KSC has particular strengths in historical specimens from the Great Plains, and in material of interest to agricultural studies (including a separate seed collection focused on weeds of the Great Plains; Davis 1993). Important early specimens from Kansas, in addition to those of Kellerman and Hitchcock, include material of Elam Bartholemew, Mark A. Carleton, and J.B.S. Norton, among many others. The Herbarium also houses noteworthy historical specimens from well beyond the region (e.g., over 100 specimens of Ferdinand J. Lindheimer, obtained by Hitchcock through his botanical exchange; Fig. 3). The Reed Bryophyte Herbarium within KSC comprises ca. 10,000 specimens, with modern curation accomplished from 1988-1992 by Gary Smith Merrill. It is named in honor of Mary “Minnie” Reed, author of the first published flora of the mosses of Kansas (Reed 1896) and one of the first women scientists to graduate from the school in 1886 (Fig. 4). The KSC type collection numbers ca. 300 known types, most of which are isotypes.



### Digitization, and broader context

Extensive specimen digitization was accomplished from 2006-2010 with support from NSF, and subsequent support from additional sources has enabled enhancement of digital resources. Complete label data are available for >95% of collections, and images of >10%

Figure 4: A photograph of Mary “Minnie” Reed in the Herbarium. Reed graduated from Kansas State Agricultural College in 1886, and then earned her master’s degree in Botany in 1893 (Credit: Kansas State University Herbarium)

of specimens are available (imaging is ongoing). KSC currently uses Specify (Specify 6 and 7 interfaces, with updates in progress). The Herbarium has important collaborations with the Libraries as well as the Department of Entomology (College of Agriculture) at K-State, which houses the entomological research collections. Collaborative work currently underway is focused on improvement of digital resources.

Several studies underscore the uniqueness and importance of the Herbarium. KSC was included in the research of Prather et al. (2004) documenting patterns of collecting for U.S. herbaria (and a general decline in collecting activity). That work nicely demonstrates the complementarity of KSC relative to the University of Kansas Ronald L. McGregor Herbarium (KANU): KSC holds the great majority of historical specimens from Kansas, while KANU houses extensive recent (post-1940s) collections. Woods et al. (2005) used data from both KSC and KANU to trace the history of introduced species in the state. Availability of historical specimens is critical to many kinds of studies, and researchers have been able to effectively sample historical KSC specimens for projects including chemical sampling (e.g., McLauchlan et al., 2010).

### **Opportunities for the collections research community**

KSC staff are dedicated to fostering research that utilizes the Herbarium, and particularly expect that the historical collections can provide valuable research opportunities. Queries to the Herbarium can be addressed to: herbarium@ksu.edu or ferg@ksu.edu.

### **Literature cited:**

- Barkley, T.M. 1965. J. B. Norton's grass investigation trip through Central Kansas in 1898. *Transactions of the Kansas Academy of Science* 68: 363-383.
- Barnard, I. 2003. The 137-year history of the Kansas State University Herbarium. *Transactions of the Kansas Academy of Science* 106: 81-91.
- Davis, L.W. 1993. *Weed Seeds of the Great Plains*. Lawrence: University Press of Kansas.
- Gates, F.C. 1932. *Wild Flowers in Kansas*. Topeka: Kansas State Printing Plant.
- Gates, F.C. 1937. *Grasses in Kansas*. Topeka: Kansas State Printing Plant.
- Gates, F.C. 1940. *Flora of Kansas: Annotated List of the Plants of Kansas: Ferns and Flowering Plants*. Topeka: Kansas State Printing Plant.
- Gates, F.C. 1941. *Weeds in Kansas*. Topeka: Kansas State Printing Plant.
- Great Plains Flora Association. 1977. *Atlas of the Flora of the Great Plains*. Ames: Iowa State University Press.
- Great Plains Flora Association. 1986. *Flora of the Great Plains*. Lawrence: University Press of Kansas.
- McLauchlan, K.K., C.J. Ferguson, I.E. Wilson, T.W. Ocheltree, and J.M. Craine. 2010. Thirteen decades of foliar isotopes indicate declining nitrogen availability in central North American grasslands. *New Phytologist* 187: 1135-1145.
- Prather, L.A., O. Alvarez-Fuentes, M.H. Mayfield, and C.J. Ferguson. 2004. The decline of plant collecting in the United States: a threat to the infrastructure of biodiversity studies. *Systematic Botany* 29: 15-28.
- Reed, M. 1896. Kansas mosses. *Transactions of the Kansas Academy of Science* 14: 152-181.
- Woods, T.M., S.C. Strakosh, M.P. Nepal, S. Chakrabarti, N.B. Simpson, M.H. Mayfield, and C.J. Ferguson. 2005. Introduced species in Kansas: floristic changes and patterns of collection based on an historical herbarium. *Sida* 21: 1695-1725.

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# Society of Herbarium Curators Worldwide

Welcome to the column where we highlight individual members from across the globe! For this edition, we interviewed **Dr. Enrique César Crivelli** (Fig 1 and 2) curator of XAL herbarium in Xalapa, México (Fig. 3). This herbarium is part of the National Institute of Ecology (INECOL).

## What is the size of your Herbarium?

The XAL Herbarium has around 315,000 vascular plant specimens, 54,000 fungal specimens, and 4,000 non-vascular plant specimens.

## What is your favourite part about working at the Herbarium?

My favourite part is recognizing the magnitude of biodiversity. Every day I learn something new about it and that is wonderful.

## What kind of training do you have and how did you end up working where you do?

During my master's and Ph.D. programs I did a lot of field work in many different ecosystems, working with both plants and fungi, collecting and herborizing specimens. Now I have more than ten years of experience in field work for both mycology and botanical research.

## What type of support staff does your Herbarium have?

We are three staff members at the XAL herbarium who carry out all the activities and duties, from managing the database to mounting and curating specimens.



Figure 1: Enrique César carrying out field work in the San Martín volcano



**What type of research does your Herbarium facilitate? Are there any specific projects that you are particularly excited about?**

The XAL herbarium provides all the facilities so that anyone can come here and review specimens and collect information from them. Currently we are paying special attention to a macrofungal family, Marasmiaceae, and we are enriching the collection with species of this complex group.

**What are some of the biggest challenges that you face when managing your herbarium?**

The largest challenge by far is specimen digitization and the process of sending loans overseas. The first one is difficult because of the lack of technicians to perform that task; and the second one, for the large number of requirements that governments impose during the export-import process of scientific samples, which usually take a long time to complete and overcome.



Figure 2: From left to right, Israel Acosta, Ángel Saldívar, Enrique César and Santiago Sinaca in the Sierra de Santa Martha region during field-work.

**What is your greatest aspiration in your botanical life?**

I would like to make major contributions to the knowledge of plants and fungi with applied potential for soil conservation and development of sustainable agro-ecosystems.

**What are some of the botanical highlights of your region?**

The XAL herbarium is located in an area dominated by mountain cloud forest, inserted in the Trans-Mexican volcanic belt and surrounded by large areas of warm climate ecosystems. For this reason, the canopy of the cloud forest is dominated by holarctic genera, such as *Liquidambar* L., *Ostrya* Scop., *Carpinus* L., *Cornus* L., etc. but with exclusively tropical genera in lower strata such as *Heliconia* L., *Chamaedorea* Willd., *Costus* L., *Monstera* Adans., etc. This contrast is very attractive and becomes even more complex due to the great diversity of epiphytes. Particularly a grand tree species for me, especially in adult specimens, is *Oreomunnea mexicana* (Standl.) J.-F.Leroy.

**Do you have a dream project for your herbarium?**

I would like to make XAL Herbarium the Mexican flagship in Lamiaceae in plants and Marasmiaceae in fungi, these are two speciose and complex groups that are still very understudied in Mexico.



Figure 3: XAL herbarium in Xalapa, México

If you would like to be interviewed for a future column, please get in touch with us via [membership@herbariumcurators.org](mailto:membership@herbariumcurators.org).

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