The Vasculum

The Society of Herbarium Curators Newsletter
Volume 14, Number 1: January 2019

Table of Contents **Page**

Message from the President..... 2
From the Editor..... 3
News from the Society..... 4
Friends of the UM Herbarium..... 5
Flora of the Pacific Northwest..... 6
The Herbaria Listserv..... 8
iNaturalist and Herbarium Specimens..... 10
Before You Go Away for Winter, a poem..... 13
Featured Herbarium..... 14
Imaging the Herbarium of the Royal Horticultural Society..... 24
Society Officers and Editorial Committee..... 28

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 —

We invite you to become an SHC member by visiting:
www.herbariumcurators.org/membership

Annual Dues	
Student	$5
Regular	$10
Sustaining	$25
Life	$200

Join us online

SHC Website
www.herbariumcurators.org

Facebook
www.facebook.com/herbariumcurators

Twitter
www.twitter.com/socherbcurators

Linkedin
www.linkedin.com/company/18255007

Message from the President

I would like to wish everyone a happy New Year and thank the Society as we finish up an eventful 2018 and shift our focus to the next calendar year. The upcoming year will be an exciting one for the Society as we offer our complementary Developing Country Membership category, work on several new mission-fulfilling priorities, and offer education and professional development opportunities.

Over the past few months, activity has been taking place that will help set the stage for the upcoming year. Several groups have been engaged in developing new content for the SHC website. The Early Career Section is working on creating new teaching and outreach oriented material, and members of the Herbarium Assistance and Membership Committees and the Early Career Section are working on content for the Curator's Toolbox. The results of these efforts will be visible on the website during the upcoming year. The Society leadership has been laying the groundwork for establishing an endowment and is currently strategizing about fundraising activities. Please send me an e-mail if you have any fundraising ideas to offer. My hope is that we can have all of the pieces in place for an official launch of the endowment later in 2019.

Our education and professional development activities continue. I am excited to share that we will offer a post-Botany symposium entitled: Early-Career Innovators in Herbarium-Enabled Research and Future-Proofing for the Next Waves of Inventiveness. This symposium will feature a series of talks by recent NSF Postdoctoral Fellows to present their herbarium-enabled research and provide a fresh opinion on how curators can position the specimens and data that they curate for maximum research relevance in the future. We also plan to offer again the SHC Strategic Planning for your Herbarium course. Be on the lookout for announcements with further details about both of these offerings. And, don't forget about our Student Research Grants. The deadline for applications is February 1. Visit the SHC website to learn more.

The success of the Society and our ability to sustain our various activities relies on our membership. This spring, we will be electing a new President-Elect, Secretary, and Member-at-Large. The Nominating Committee will be meeting in early February. If you would like to offer a nomination for an elected position, contact the Nominating Committee Chair Austin Mast (amast@bio.fsu.edu). If you would like to be considered for a committee role, contact me. Additionally, please renew your membership, if you have not done so.

I'm looking forward to seeing the Society keep the positive momentum going during the upcoming year. Thanks for your past and future support in these efforts. Please don't hesitate to contact me to offer your ideas on how to make the Society more successful.

Patrick Sweeney
Yale University Herbarium, Senior Curator
patrick.sweeney@yale.edu

From the Editor

In just the short time that I have been a member of The Society of Herbarium Curators, it amazes me to see how much the Society has grown. From the creation of a new chapter that focuses on Early Career members, to the post-Botany workshops being offered, the SHC is truly an organization that actively promotes and enhances its members' careers. The complementary Developing Country membership further speaks to how the Society is one that represents and supports a global community of herbarium scientists. I am particularly excited about this year's post-Botany workshop on innovative herbarium research by early career members (read more about it in the Message from the President on page 2). It has truly been exciting to have the opportunity to document the growth of the Society within the pages of The Vasculum.

The editorial team (Abby Moore and Melanie Link-Perez) and I have continued to reimagine The Vasculum and identify new content. We are excited to include some of the new content in this issue. We have included the first Vasculum interview, featuring Dr. Aaron Liston on the history and maintenance of the Herbaria Listserv (read the article on page 8). It was fascinating to learn about how such an important staple of our community first came to be and to hear about how it has and will continued to grow.

This issue's featured herbarium is the Ada Hayden Herbarium, located at Iowa State University in Ames, Iowa, United States. I remember visiting the Herbarium in 2015 and how I was immediately impressed by its size and rich history. So many of Botany's greats have passed through its halls, including Charles Bessey, Ada Hayden, Richard Pohl, Robert F. Thorne, Albert S. Hitchcock, and Lynn Clark; names that should all be easily recognizable. I anticipate that you too will find the history of the collection, including a lesson on merging large collections, of particular interest. We thank Deb Lewis, the Ada Hayden Herbarium Curator, for her wonderful contribution.

As the editorial team looks toward the next issue of The Vasculum, we again invite you to submit your contributions. We would still like to see articles that explore how herbaria are used in innovative ways to engage undergraduate or high school students. We would also love to include content on grant updates, outreach programs, expeditions, interesting specimens, and botanical history. Please consider submitting your articles for the August issue.

Happy New Year!

John J. Schenk
Georgia Southern University Herbarium Curator

News from the Society

SHC Student Research Grants

The Society of Herbarium Curators is please to accept proposals for the annual Student Research Grants to support research that contributes to or uses herbarium resources in ways that augment the collections. Two $500 grants will be made to graduate students and one $250 grant will be made to an undergraduate student.

Scope: Research that contributes to or uses herbarium resources in ways that augment the collections. Research on any taxa typically accessioned in herbaria including all plant, fungal, lichen, and algal lineages is eligible. Supported activities could include, but are not limited to, fieldwork to generate vouchers for revisionary or floristic work, collecting morphological data from specimens, traveling to herbaria, or making and distributing physical specimens. Thus, students' overarching research could include molecular approaches, but the merit of the proposal would be based on the ability of the work to contribute to building or improving herbarium resources. Additionally, meta-analysis of herbarium data would also be eligible, provided that a component of the research includes direct study of specimens.

Eligibility: Undergraduate and graduate student SHC members may apply. It is expected that only student research projects with the clear potential to lead to publication will be competitive. Both the student and the student's research advisor, who should provide a letter of recommendation, must be members of SHC at the time of application. Dealine is 1 February 2019.

Please see www.herbariumcurators.org/grants for more information.

Please join us for the 14th Annual Meeting of the Society of Herbarium Curators in Tucson, Arizona

A Herbarium Can always Use a Few Friends

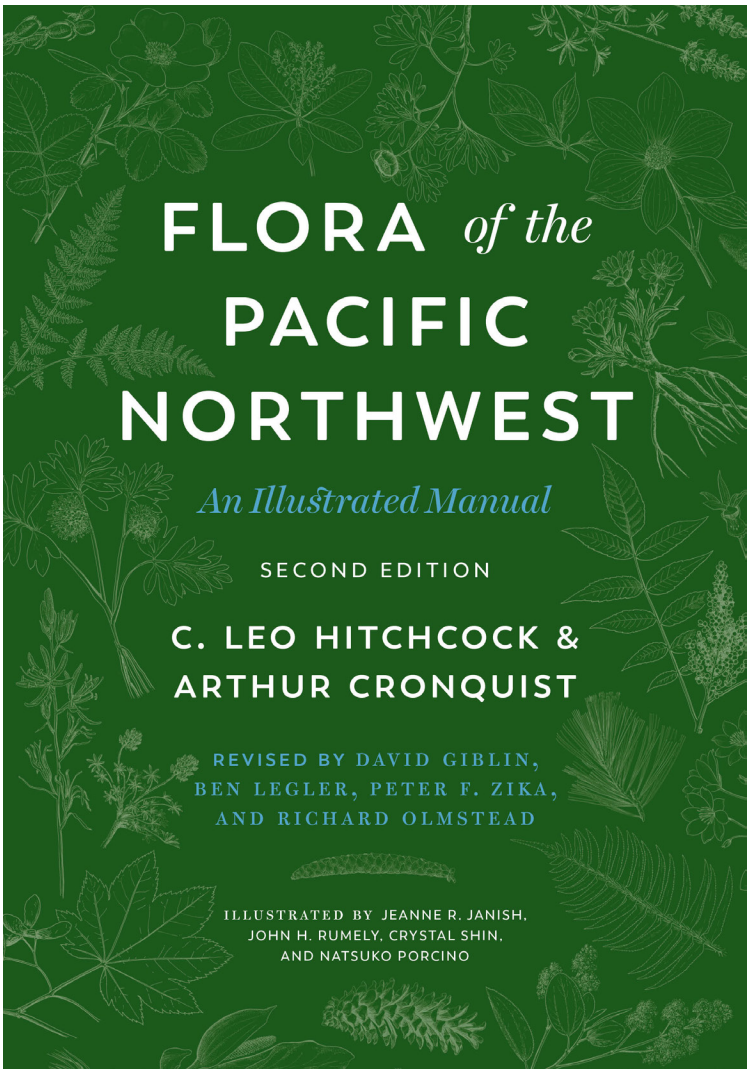
The University of Montana Herbarium (MONTU) is a facility that belongs to the people of Montana, U.S.A. Although it is housed at the University, it is used by people from many walks of life and from all across the state. As many of us know, smaller natural history museums are losing support from their parent institutions. A little over two decades ago our herbarium was beginning to see signs of waning interest by the University. Rather than wringing their hands, a small group of botanists and concerned citizens decided to be proactive and, under the auspices of the University of Montana Foundation, founded the Friends of the UM Herbarium (FOH). The group sent out letters to over 250 people and within a year the Friends had 75 members. A board of directors was elected, composed of two consultants, two biologists from the U.S. Forest Service, a concerned citizen and the MONTU collections manager. The UM Herbarium clientele now had a voice.

Over the past 20 years FOH has supported MONTU's collections through their biennial dues and volunteer work parties. Twenty-five people have served on the board of directors including state and federal biologists, consultants, ranchers, and interested lay people. Our first order of business was to relieve the overcrowded shelves of the specimen cabinets. The first cabinet drive, held from 1996 to 1999, raised $13,000 and allowed the purchase of 16 new cabinets. Over the next two decades the FOH Board developed new policies for specimen annotation and specimen use in molecular genetics studies as well as providing guidance on day-to-day activities such as what geographic areas should be the focus of the collections.

Twenty years after the first cabinet drive it again became apparent that cabinets were at capacity and more were needed. A second cabinet drive was initiated in 2017. A year later FOH had raised $17,000 allowing the curator to purchase 11 new cabinets. In the summer of 2018 these were delivered to the third floor herbarium through a window using a hydraulic lift (see figures on left). Staff are now busy rearranging specimens in the old cabinets and filling the new cabinets. We believe that the new cabinets will provide adequate space for specimen acquisition for the next 15–20 years.

The Friends of the UM Herbarium has been indispensable in these days of shrinking budgets. Perhaps even more importantly, FOH has provided advice from a diverse array of practitioners, people who use MONTU for managing biological diversity on public and private lands. If the value of the herbarium is ever questioned by university administrators, FOH will be there to set them straight.

Peter Lesica & Shannon Kimball
University of Montana Herbarium



Flora of the Pacific Northwest, 2nd Edition Now Available

The University of Washington Herbarium of the Burke Museum is pleased to announce the publication of Flora of the Pacific Northwest: An Illustrated Manual, 2nd Edition (Flora, hereafter). It has been 45 years since C. Leo Hitchcock and Arthur Cronquist published the one-volume, condensed version of their 5-volume Vascular Plants of the Pacific Northwest. Interest by regional botanists for a revision was strong, and the timing was right, after creation of the Consortium of Pacific Northwest Herbaria database (http://www.pnwherbaria.org/index.php) through National Science Foundation funding.

Hitchcock was curator of the University of Washington (WTU) from 1937–1972, where his research interests were the taxonomy and floristics of Pacific Northwest vascular plants. Over his career he developed WTU into the world's largest collection of plants from the region. Given WTU's history of floristic work and the extensive collections, it was both logical and pragmatic for us to initiate and lead the revision effort.

The geographic region covered in the 2nd edition Flora is nearly identical to the 1st edition: southern British Columbia (including all of Vancouver Island), all of Washington, the northern half of Oregon, the mountainous areas of Montana, and Idaho north of the Snake River Plain. In the 2nd edition, digital mapping and databases permitted a fine tuning of the regional boundaries based on records of plant distributions.

Initial administrative and fundraising work for the project began in 2012, which involved gaining permission from the University of Washington Press and the Hitchcock and Cronquist heirs (collective copyright holders) to update the book. With the assistance of Pat Holmgren and the archives at NY, we were able to secure the permissions needed to reuse the 3,000+ illustrations used in the 1st edition Flora. Without those illustrations, the project would have confronted prohibitive time and costs associated with generating new illustrations for all taxa included in the original edition.

Work on the project began in earnest in 2013, took approximately five years to complete, and raised a little over $500,000 to support the project. Expenditures covered revising approximately 800 pages of text, generating over 1,300 new illustrations, placement of over 7,000 images into the text, and printing a first run of 5,000 copies. Significant financial support for the project came from Chris Davidson and Sharon Christoph, Region 6 of the U.S. Forest Service, and the OR/WA office of the Bureau of Land Management. Individual donors, regional foundations, and native plant societies from Washington and Idaho rounded out the philanthropic support.

Changes between the two Flora editions are extensive:

- 25% net increase in the number of species and infraspecies treated;
- 38% net increase in the number of genera treated;
- 23% net increase in the number of families treated;
- 42% of species and infraspecies treated in the 1st edition Flora have seen nomenclatural or taxonomic changes

Like its predecessor, the 2nd edition Flora is compact enough (7" x 11"; 936 pages) to be taken into the field. Providing identification keys and illustrations to over 5,000 taxa in a book of this size is achieved through the novel format developed by Hitchcock and Cronquist in the 1st edition: embedding species descriptions across key leads and illustrating a diagnostic feature for nearly each taxon in the adjacent margin. For those interested in using a digital version of the 2nd edition Flora, the University of Washington Press is working to produce an ebook version that should be available in the near future.

Because any printed flora is a snapshot of what is known at the time of publishing, our efforts over the next year will focus on creating an editable, online presence for the Flora that builds on the project's current website: http://www.pnwherbaria.org/florapnw.php. The site currently contains a map of the Flora boundary, a quantitative summary of the Flora contents, a table comparing the two editions, and a downloadable checklist of the 2nd edition Flora that allows unambiguous crosswalks between the taxa treated in both editions. Going forward we plan to post revised keys as new information becomes available, provide nomenclatural and taxonomic updates to taxa treated, and post corrections to the printed text.

We are confident that publication of the 2nd edition Flora will have significant impacts on plant conservation, land management decisions, and undergraduate instruction across the Pacific Northwest. Such an outcome would not have been possible without the more than 100 financial supporters, 26 authors, 20 illustrators, and nearly 100 volunteers who made this project possible. Finally, we are simply pleased to finally have a comprehensive, contemporary flora for the region and a plan in place to ensure that it is not another 45 years before the book's contents are updated.

How to cite the new Flora:

C.L. Hitchcock and A. Cronquist. 2018. Flora of the Pacific Northwest: An Illustrated Manual, 2nd Edition. Edited by D.E. Giblin, B.S. Legler, P.F. Zika, and R.G. Olmstead. University of Washington Press, Seattle, WA. 936pp.

David Giblin, University of Washington, dgiblin@uw.edu

Ben Legler, University of Idaho

Richard Olmstead, University of Washington

Herbaria Listserv

The Herbaria Listserv has become one of the most important threads that connects our community, as it has allowed us to freely exchange ideas and quickly get expert advice. This important platform, however, was not always around. In order to learn about how and why the listserv was started, and its' future, we spoke with Aaron Liston (Director of the Oregon State University Herbarium), who created and continues to maintain the listserv.

VASCULUM: What year did you start the herbaria listserv?

AARON: The first message was posted on August 20, 2003.

VASCULUM: How did you start the listserv and was it immediately adopted by the herbarium community?

AARON: I was serving on the American Society of Plant Taxonomists (ASPT) Council at the time. It was Lucinda McDade's (Executive Director, Rancho Santa Ana Botanic Garden) idea that ASPT needed a forum for herbaria issues, and I volunteered to set up an e-mail listserv. We sent an invitation to the ASPT membership, and it was rapidly adopted.

VASCULUM: What need did you see the listserv meeting?

AARON: When we discussed the listserv at the ASPT council, our goal was providing a place to share ideas related to herbarium management, fundraising, and maintaining relevance in academia and society. Looking back, I see that these issues dominated the listserv in the first few weeks (there was a heated discussion about the potential for herbarium accreditation). The first curatorial question was posted on September 18 (about mounting techniques) and curation has been the predominant theme ever since. Clearly there was an unmet need.

VASCULUM: Have there been any challenges to the listserv over the years?

AARON: Remarkably few. The listserv is lightly moderated, which means that the first time a subscriber posts a message, it needs to be approved by an administrator. I was the sole administrator until a few years ago, when we added Mark Mayfield (Kansas State University). We receive an e-mail when there is a first posting, and one of us needs to log in and approve it. That is the majority of the work, and it only happens a few times a month. Occasionally we get a message from a user who has subscribed but is not receiving any messages. This typically happens when someone has two different versions of their e-mail address that go to the same place (e.g., listona@science.oregonstate.edu and listona@oregonstate.edu). Unfortunately, the listserv does not understand synonymy. Once we are notified (e-mail to herbaria-owner@nacse.org), it is simple for Mark or me to reconcile these.

VASCULUM: Have you been surprised by the longevity and importance of the listserv to the herbarium community?

AARON: I am not surprised by the longevity and importance of sharing ideas and information about herbaria. The technological stability has been surprising: we are still using the same software, and it is still hosted (for free) by the same organization at Oregon State University, the Northwest Alliance for Computational Science and Engineering (NACSE).

VASCULUM: How do you think the listserv has benefitted the herbarium community?

AARON: It is most important in providing a place for the community to share their questions and experience with herbarium curation. It also provides a good conduit for disseminating information and providing support when herbaria face emergencies (e.g., floods, fires, earthquakes).

VASCULUM: What has surprised you about the listserv?

AARON: The listserv has never been hacked, has almost no spam (due to the moderation settings), and in over 15 years, there have been only one or two times when the discussion became uncivil. For an online forum, this is remarkable, and speaks very highly of the kindness and generosity of our community.

VASCULUM: How many posts have been made on the listserv over the years?

AARON: 5811. These are all archived and searchable at https://markmail.org/list/org.nacse.herbaria

VASCULUM: How many users have taken advantage of the listserv over the years? How many people are signed up now?

AARON: There are 879 current subscribers. One hundred users have sent 14 or more messages. I would guess another 200–300 have posted at least once.

VASCULUM: In what regions of the world do the listserv subscribers primarily reside?

AARON: We have subscribers from at least 32 countries (based on e-mail domains). The vast majority are from Anglophone countries.

VASCULUM: What do you see as the future of the listserv regarding how it connects the herbarium community?

AARON: Since September, 2016, all messages are automatically posted on a Twitter account @HERBARIA_listserv. The number of followers has grown rapidly, and now stands at 382. The Twitter audience is younger and more diverse than the e-mail audience, but at this point it is a one-way communication (they see the listserv messages, but cannot reply back). I can envision a future where parallel discussions will start to emerge on the Twitter account, and we will need to give some thought on how to manage that and integrate the two platforms.

VASCULUM: Has the role of the listserv changed over the years with Twitter and other social media platforms?

AARON: In the past there were many requests for help with specimen identification, but those have declined in recent years. This is probably due to the availability of forums that better support images and are dedicated to plant ID.

VASCULUM: How does one get added to the listserv?

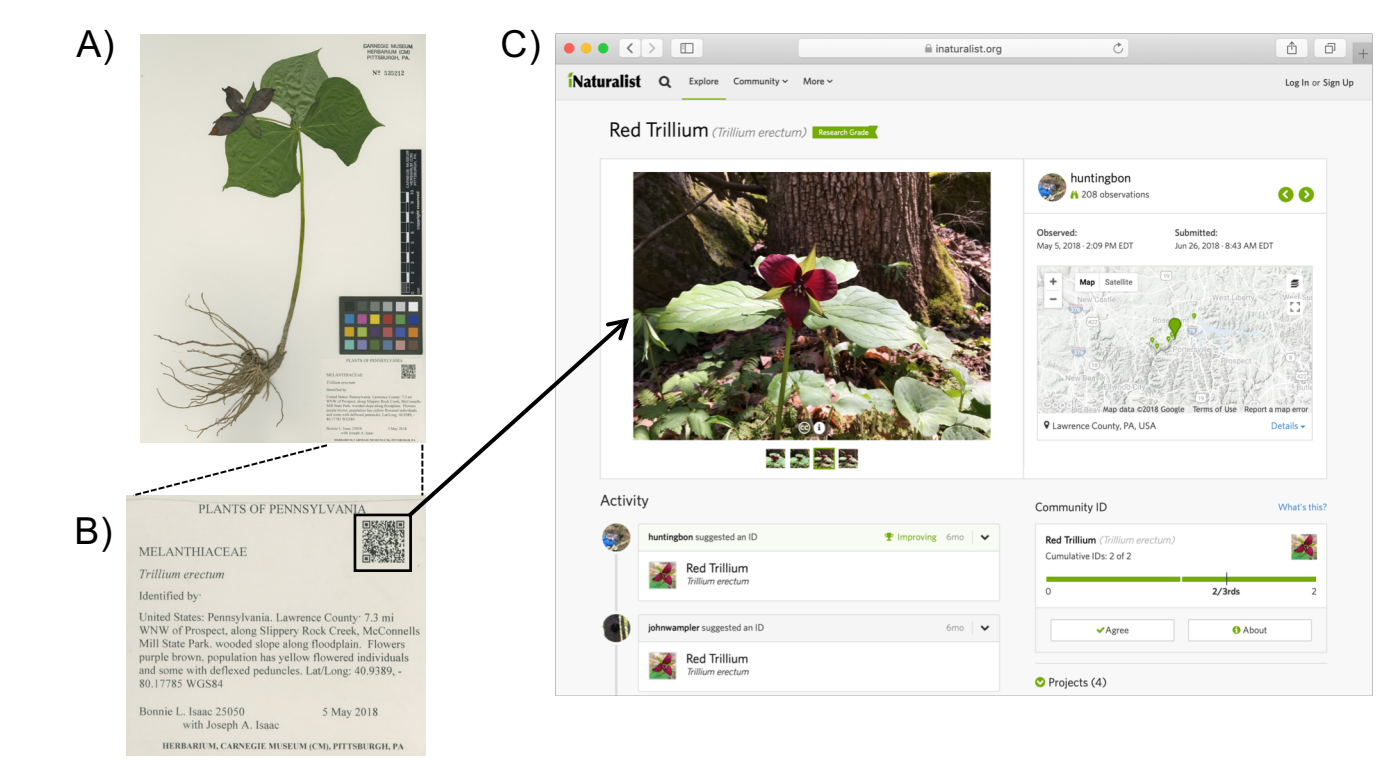
AARON: Signing up is easy at: https://www.nacse.org/mailman/listinfo/herbaria

VASCULUM: The listserv is co-sponsored by ASPT and SHC, how much do they pay for this?

AARON: Nothing. I enjoy doing this as my contribution to these societies.

Expanding the Value of Herbarium Specimens with iNaturalist

Herbaria are receiving unprecedented levels of attention. This new era for specimen use is motivated by many factors, including widespread digitization initiatives that increase data accessibility, renewed appreciation of the longstanding traditional uses of specimens, and recent innovations that enable new areas of collections-based study. For herbaria to maintain their societal and scientific relevance, we must continue collecting in order to maximize current and future use. However, the standard practice for the collection of new specimens has changed remarkably little through time. In a recent article in Applications in Plant Sciences (2018, vol. 6: e1193), we outline an approach to plant collecting that leverages the free, popular citizen science platform, iNaturalist (https://www.inaturalist.org/), as a tool for plant collectors, herbarium managers, and downstream researchers that use herbarium specimens. iNaturalist is a free resource available online or as a mobile app that allows users to record biodiversity observations. Our approach to plant collecting using iNaturalist has several advantages, including (1) it is freely and widely available; (2) it permanently links images and other metadata collected in the field with herbar-



Example herbarium specimen and its associated iNaturalist observation record. (A) Herbarium specimen (B.L. Isaac 25050; CM535212) of *Trillium erectum* L. (Melanthiaceae). http://midatlanticherbaria.org/portal/collections/individual/index.php?occid=20565839&clid=0. (B) Close up of herbarium specimen label that includes standard core metadata plus a QR code to directly connect users to the associated iNaturalist observation data. These QR codes can be scanned with any smart device (e.g., tablet computer or smartphone), which automatically opens the online record in the device's internet browser. (C) The iNaturalist observation record associated with this herbarium specimen (https://www.inaturalist.org/observations/13798756), which includes not only the digital metadata on the specimen label but also other ancillary data such as in situ color images taken at time of collection, a map illustrating specimen's location (which can be explored further for associated observations), crowdsourced phenology status, and the complete identification history and other comments by the iNaturalist community of citizen scientists.

ium specimens; (3) it connects observation-based records with physical specimen-based records; (4) it facilitates data collection in field and label making; and (5) it has the potential to engage our herbarium practice with the citizen science community.

What color were the flower petals? What was the size of the plant? Did it have a unique pattern on the bark? What was the branching pattern? These questions and more are not often well preserved through traditional herbarium specimens. Digital images from the field are routinely collected with recent herbarium specimens, but they often remain inaccessible and are rarely curated alongside the associated physical specimens, which limits future data use. We suggest the use of iNaturalist can fulfill this need to expand the research value of herbarium specimens.

Before collecting a specimen, we take images in the field of the specimen in real life. These images are uploaded to iNaturalist, including other automatically recorded data such as date, time, and location, as well as a number of other metadata fields, such as taxonomic identification and any number of user-defined fields following the Darwin Core standard. Other iNaturalist users can also contribute directly through verifying the identity of the specimen or making other comments.

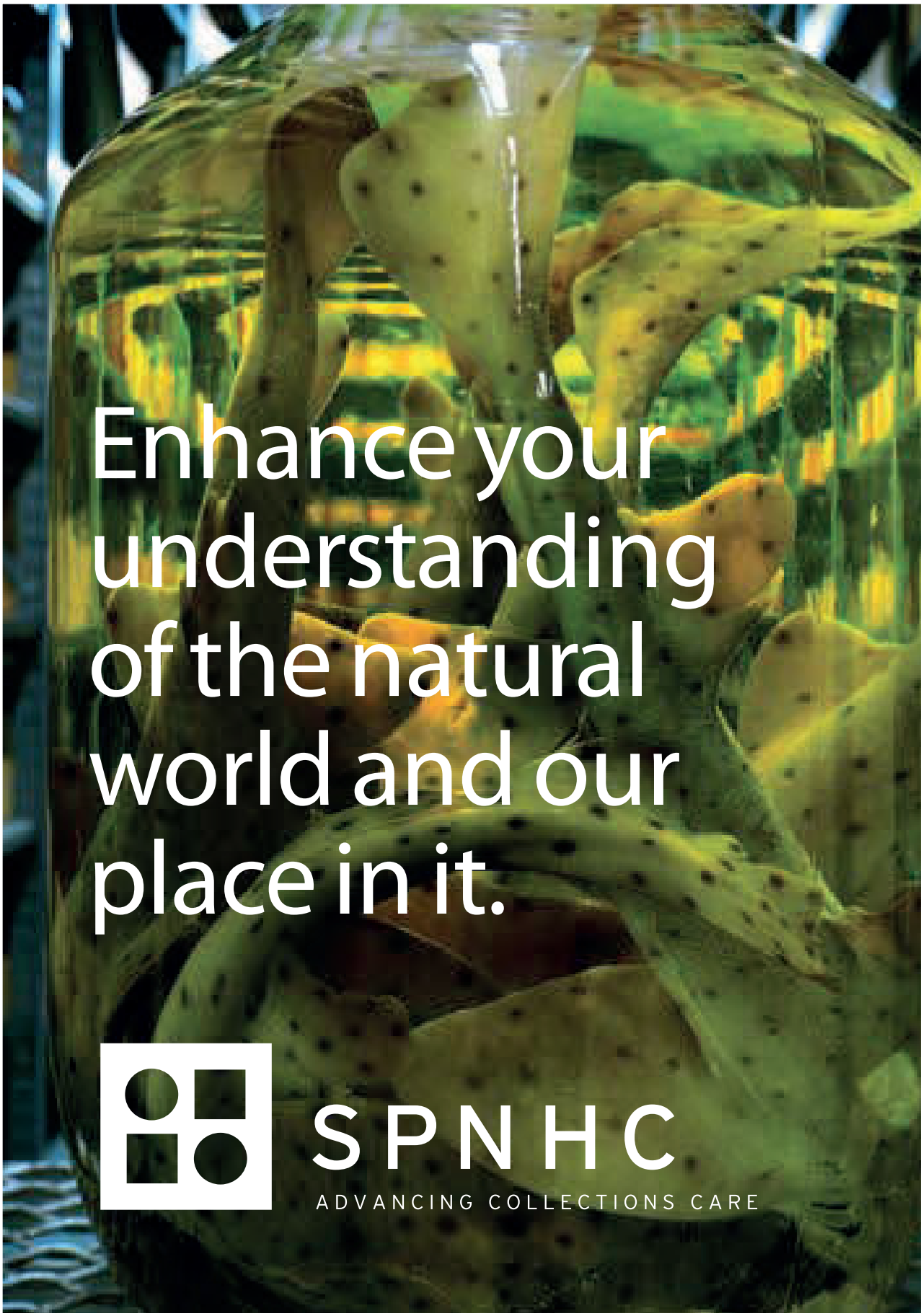
Back in the herbarium, we exported these data from iNaturalist to create unique herbarium labels for each specimen. We are using QR codes to link the specimens to the online iNaturalist observation. It is important to note that we do not suggest using iNaturalist to replace herbarium database management (e.g., Symbiota data portals or in-house databases). Rather, iNaturalist is a powerful tool for data collection, label making, and storing field images.

We envision a future where researchers can go through the herbarium with a mobile device such as a tablet or smart phone, scan QR codes on specimens, and be immediately directed to images of the specimen in the field.

Read the article here:
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): e1193. https://bsapubs.onlinelibrary.wiley.com/doi/epdf/10.1002/aps3.1193

Mason Heberling
Assistant Curator of Botany
Carnegie Museum of Natural History

Bonnie Isaac
Collections Manager
Carnegie Museum of Natural History


Enhance your understanding of the natural world and our place in it.
SPNHC
ADVANCING COLLECTIONS CARE

Before you go away for winter,
Put down a dainty maple leaf on sheet,
and fixing it with stripes of paper,
and writing with the ink the date there.
So take the album full of fragrance,
and find the dried leaf of purple orange,
recalling garden in the village –
for I have kept the sun of autumn,
and now delighting with this maple.

Vladimir Nabokov (1899–1977)

Translated by Andriy V. Yena
Curator of Herbarium CSAU
V.I. Vernadsky Crimean Federal University, Simferopol

Featured Herbarium

ISC-IA, Iowa State University's Ada Hayden Herbarium

Figure 1. Charles E. Bessey.

Overview: The Ada Hayden Herbarium (ISC-IA), in the Department of Ecology, Evolution, and Organismal Biology at Iowa State University, is by far the largest herbarium in Iowa and one of the 15th largest university herbaria in the United States. The herbaria at Iowa State University (formerly Iowa Agricultural College and Iowa State College, ISC) and the University of Iowa (formerly State University of Iowa, IA) were each founded in the 1870s. Both universities had active Botany Departments and renowned faculty well into the 20th century. However, by the 21st century, Botany at the University of Iowa was in decline, and in 2004, the Herbarium (IA) was transferred to Iowa State University. The Ada Hayden Herbarium grew from approximately 430,000 specimens prior to the transfer to more than 650,000 specimens today. Strengths of ISC-IA include vascular plants of Iowa and the Midwest United States, Poaceae of the Western Hemisphere, Fabaceae of the contiguous United States, bryophytes, and fungi. Staff are actively engaged in research, teaching, curation, digitization projects, and outreach.

With Iowa being the most biologically transformed state in the United States, ISC-IA takes on added significance of recording the flora of Iowa's past. The collections not only serve to document studies of the past or provide context for Iowa's natural and cultural history, or even to document what was lost, but they also inform restoration efforts, target rare species for which to search, provide a measure of the quality of remnant sites and more. ISC-IA more broadly fulfills the value of herbaria in research, teaching, preservation, and documentation.

History of ISC [date ranges in parentheses indicate years on staff]—Iowa Agricultural College (IAC) opened its doors to students in 1868 as Iowa's land-grant college. Time spent at IAC launched notable botanical careers of a number of its faculty and graduate students. Norton Townshend (1868–1869) spent one year at the new college, teaching botany and geography. Although a popular teacher, he returned to his home state of Ohio to help charter Ohio State University (then Ohio Agricultural and Mechanical College). In early 1870, Charles E. Bessey (1870–1884) joined the faculty as Professor of Botany, Horticulture, Zoology, and Entomology (Fig. 1). In his biennial report to the College administrators in 1871, he stated that the Herbarium contains "representatives of perhaps about 2,500 species." Joseph C. (J.C.) Arthur was one of Bessey's earliest and most outstanding students. Arthur was in the first graduating class in 1872 and was the first to receive a Master's degree from Iowa Agricultural College in 1877. Arthur (1876–1877) was an instructor while at the College, helping to take on some of Bessey's heavy teaching load. In 1876, Bessey and Arthur prepared an exhibit of Iowa plants and woods for the nation's Centennial

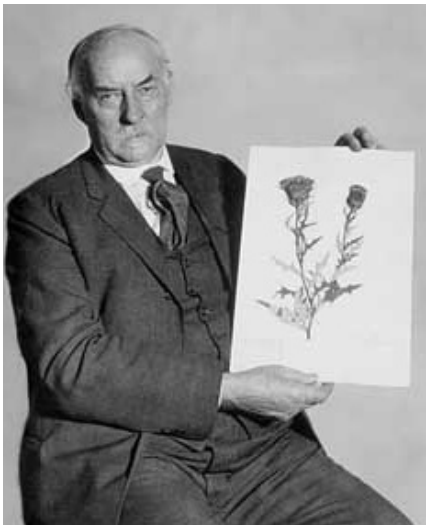


Figure 2. Louis H. Pammel.

Exposition in Philadelphia. Arthur also published a catalog of Iowa's flowering plants in 1876: "Flora of Iowa: A Catalogue of the Phanerogamous Plants."

In 1884, Bessey left IAC to become Dean and Professor of Botany at the newly opened University of Nebraska. The herbarium contained approximately 15,000 specimens at the time Bessey left the College. He was replaced by Byron D. Halsted (1884–1888), who, it is reported, "did not add much to the Herbarium in the way of flowering plants, but he added a considerable number of fungi." However, Halsted did help train another student who became a prominent botanist, Albert S. Hitchcock. Hitchcock first studied with Bessey and received his B.S. in 1884. He continued his studies with Halsted and earned his M.S. in 1886. He remained at IAC as an assistant in Chemistry until 1889, and during this time, he conducted a study of the flora of Ames and central Iowa.

Louis H. Pammel (1889–1929) arrived at IAC in 1889, and his botanical and mycological interests were broad (Fig. 2). As a collector of both plants and fungi, he contributed the largest number of specimens to the Herbarium —likely more than 25,000. He welcomed the first African-American student, George Washington Carver, to IAC. Carver received his B.S. at IAC in 1874 and his M.S. in 1876, just before heading to Tuskegee Institute (now Tuskegee University). While working on his M.S., Carver was an instructor in the Botany Department, and he collected more than 300 vascular plants and 160 fungi while a student (Fig. 3). He lacked a herbarium during his early years at Tuskegee, so sent about 450 additional mycological specimens to ISC from his plant pathology research in Alabama.

Ada Hayden (1911–1950) was another remarkable student of Pammel's (Fig. 4). She received both her B.S. and Ph.D. degrees at Iowa State University. In 1918, she became the first woman (and only the fourth of either gender) to earn a Ph.D. at Iowa State and one of the earliest women to receive a Ph.D. in Botany in the US. Hayden was promoted to Assistant Professor after receiving her degree, and later named as Curator of the Herbarium in

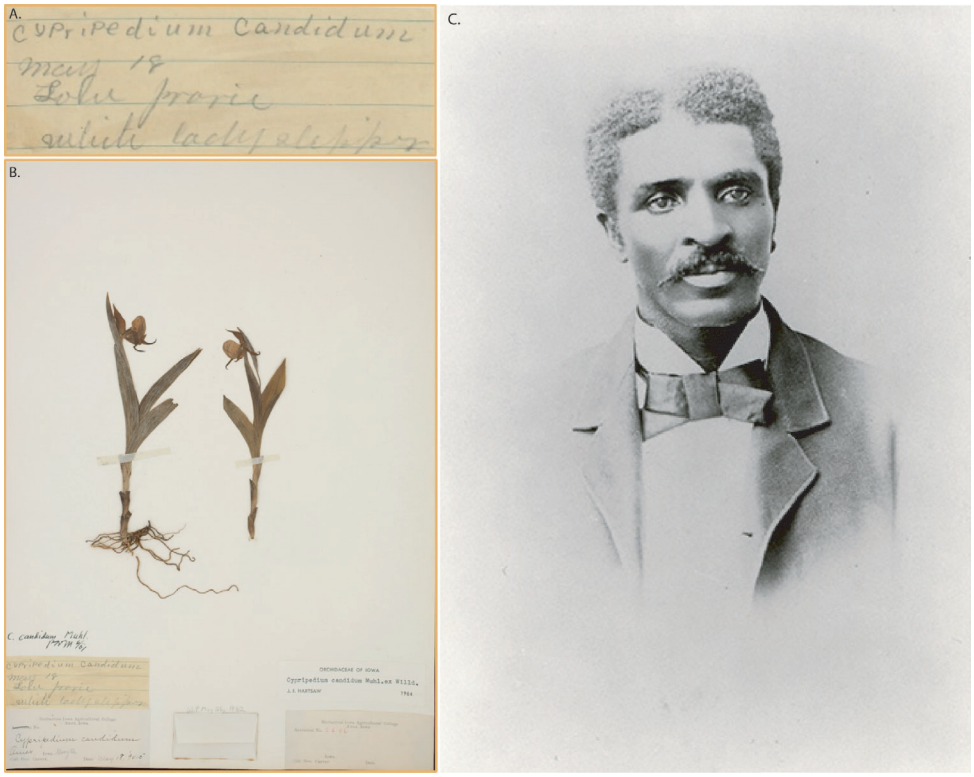


Figure 3. George Washington Carver and his specimen. A and B. *Cypripedium candidum* collected by Carver. C. George Washington Carver, about 1893, Courtesy of Parks Library, Iowa State University

Figure 4. Ada Hayden.

1934. She added more than 16,000 specimens to ISC, and the quality of her specimens, both in care in pressing and in label data, exceeded that of her predecessors and colleagues. Concerned about the loss of Iowa's prairies, she pushed for the establishment of state preserves. Three prairie remnants were purchased by the state by the time of her death in 1950, and one of these is named in her honor.

Richard W. Pohl (1947–1986) became ISC's Curator following Hayden's death in 1950 (Fig. 5). He had come to Iowa State as an agrostologist; his collections of grasses, along with those of his students, from the western hemisphere made ISC one of the outstanding university collections of Poaceae. In 1984, Deborah Q. Lewis (1984–present) was added to the staff as a full-time Curator to manage the growing collection. Pohl then held the title of Director of the Herbarium until his retirement in 1986.

Duane Isely (1944–1989) arrived at Iowa State as an Extension Associate and Assistant Professor in seed technology. His interests soon shifted to the Fabaceae, and he collected more than 15,000 legume specimens from across the contiguous United States. Not only did he explore all 48 states, but he also claimed to have visited well over 90% of the counties

Figure 5. Richard W. Pohl.

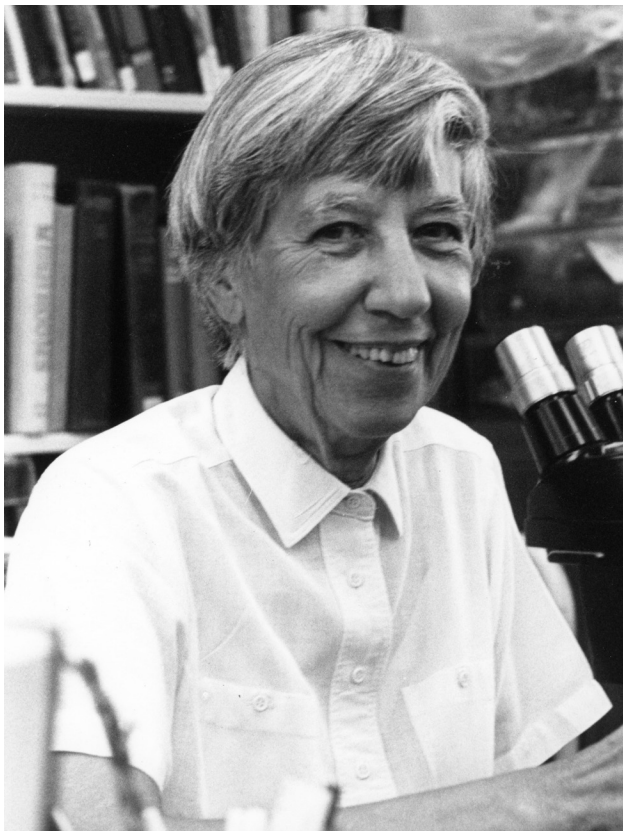


Figure 6. Lois H. Tiffany.

Figure 7. Specimen sent to IA on exchange from BM. The label reads: "*Orchis latifolia* [= *Dactylorhiza latifolia*]" "upsala. 1785."

in these states during his studies! He assumed the directorship of ISC on the retirement of Pohl, a position he held until his retirement in 1989.

Lois H. Tiffany (1950–2003) was a graduate student of Joseph C. Gilman (1918-1966), earning her Ph.D. in 1950 (Fig. 6). She then joined the faculty as a mycologist and eventually became ISC's Curator of Mycology. More than 8,600 of her fungal and lichen specimens are in ISC, and her graduate students added many more.

Lynn G. Clark (1989–present) was appointed as the Director of the Herbarium to follow Isely, and she continues in this position. She had received her Ph.D. from Iowa State as a student of Pohl. The field work and collecting that she and her graduate students have done in their studies of the bamboos (Poaceae: Bambusoideae) have added further prestige to ISC's Poaceae collection.

History of IA—The earliest history of the founding of IA remains a mystery, with geology professor Charles A. White (1867–1873) having referred to the "State University of Iowa Herbarium" and listed a few plant species collected as early as 1869 as part of the report of the "Cabinet of Natural History." Extant specimens indicate the establishment of IA in 1878, with collections made by botanist and mycologist Thomas H. Macbride (1878–1916). The State University of Iowa's (SUI) Botany Department was initiated under Macbride's guidance. His extensive collections of Myxomycetes are primarily at BPI, although a smaller subset remains in ISC-IA. In 1893, the British Museum sent reportedly about 30,000 vascular plant duplicates to IA in exchange, apparently for Macbride's duplicate Myxomycete specimens (Macbride, 1912). Many of these specimens are the oldest held in ISC-IA (Fig. 7). Macbride spearheaded the establishment in 1909 of Iowa Lakeside Laboratory near Milford, Iowa. He and Pammel proposed and pushed for the establishment of Iowa's State Parks system, and the first State Park (Backbone, near Strawberry Point) was dedicated in 1920. Macbride and Pammel State Parks honor their legacy.

Bohumil Shimek (1890–1932) was added to the Botany faculty to assist Macbride (Fig. 8). He was appointed as Curator of the Herbarium in 1895, and he held this position until his retirement in 1932. More than 20,000 vascular plant specimens and 3,000 bryophytes and fungi document his diverse interests and contributions.

A few years after Macbride retired from SUI, George W. Martin (1923–1955) joined the faculty as a mycologist. Although his mycological interests were broad, he teamed with Macbride, and later with C.J. Alexopoulos, in stud-

ies of the Myxomycetes that resulted in the definitive reference books for this group.

William A. Anderson (1931–1949) was named Curator of Vascular Plants at about the time that Shimek retired, a position he held until his death. After retiring from Grinnell College, Henry S. Conard (1944–1954) brought his large collection of bryophytes, as well as some vascular plant specimens, to IA as a Visiting Research Professor. He spent the next decade curating his own collections, as well as those collected by Shimek.

Robert F. Thorne (1950–1962) joined the University of Iowa (UI) faculty and succeeded Anderson as the Curator of Vascular Plants. His dream of producing an Iowa Flora ushered in a new era of plant taxonomy at the University. He and his students accomplished both floristic studies of counties and regions of Iowa and those of plant families occurring in the state. Unfortunately, this project had not been completed by the time he left UI for Rancho Santa Ana Botanical Garden and Claremont Graduate University.

Figure 8. Bohumil Shimek (Coutesy of the University of Iowa Libraries).

Thomas E. Melchert (1963–1982) was named Curator of Vascular Plants following Thorne's departure. Robert L. Hulbary (1963–1981) assumed the role of the Curator of Bryophytes. During this time, some of IA's holdings were dispersed, including most of the Myxomycete collection (approximately 8,500 specimens) sent to BPI and the entire lichen collection containing more than 5,000 specimens sent to MIN.
The last Director of the Herbarium and Curator of Vascular Plants and Bryophytes was Diana G. Horton (1983–2004, as Director). She focused her efforts on floristic studies, including Iowa's rare species, and mosses.

Transfer of IA to ISC—The transfer of IA's holdings to ISC began in 1984 when approximately 25,000 mycological specimens (including the remaining Myxomycetes) were moved to ISC on permanent loan. In 1989, more than 1,500 specimens of IA's algal holdings were also shipped to ISC.

Figure 9. Installing cabinets on new mobile storage system at ISC during merger of IA.

In 1999, IA Director Diana Horton contacted ISC Curator Deborah Lewis, posing the question of whether ISC would be willing to accept the remainder of IA's holdings if IA were forced to be transferred off-campus. In early 2002, ISC Director Lynn Clark was told by UI administrators that IA would not be maintained at UI. Reasons that were given included that IA was located in space that would be renovated and claimed by another UI department, and there was no room for IA in the Biological Sciences Complex. It was also a time when the Board of Regents of Iowa's public universities was pushing for a reduction in duplication of programs between the universities. Other issues included the

Figure 10. Headlines from various newspapers that covered the herbarium lawsuit.

precedent set by past divesting of holdings, a lack of strong constituent support, a shift in departmental priorities, a lack of transparency in decision-making, and a lack of a timely response to issues raised by the proposed transfer.

A Memorandum of Understanding concerning the transfer of IA was signed by administrators at both universities in July, 2002. Work commenced to update the facilities of ISC to be ready for the transfer, including the installation of a mobile storage system, funded primarily by the Iowa State University Foundation (Fig. 9). As the time for physically moving the collection drew near, a civil case was introduced by faculty, students and alumni of UI in Federal District Court on 26 February, 2004, to block the transfer. When the first attempt was made to pack and move IA in early March 2004, a restraining order was issued to halt the activities. After a court hearing, this injunction was lifted, but the civil case remained undecided. Finally, in June, 2005, the case was heard and in late August, the judge's ruling was issued that the transfer would stand (Fig. 10).

Several important lessons were learned from the transfer: (1) Take any perceived threat seriously. Despite a long affiliation with a university, it should not be taken for granted that natural history collections, including herbaria, are immune from such actions. (2) Be proactive instead of reactive. Promote active use of the collections in research and teaching and as a resource for depositing specimens to as many constituencies as possible. (3) Make colleagues, administrators, students and the public aware of the significance of herbaria and natural history collections through tours, presentations, news articles and in other venues.

Figure 11. Charles C. Parry Herbarium, late 19th century.

Special collections in ISC-IA—Charles C. Parry arrived in Davenport, Iowa, in 1846 to set up his medical practice. However, while medicine was his career (at least early on), botanical exploration was his passion. As an early collector in the western US and northern Mexico, he amassed a collection of more than 15,000 specimens from his own studies and exchange with his colleagues (Fig. 11). Following Parry's death, Pammel arranged for the purchase of the C.C. Parry Collection containing specimens, field notes, correspondence and library in 1895 for $5,000. Progress is being made on digitizing this collection, which is rich in types.

The Andrew Price (A.P.) Morgan and Laura V. Morgan Mycological Collection was donated by Laura Morgan to IA in 1909 and is also held as a separate collection in ISC-IA. The specimens collected by A.P. Morgan (and some jointly with L.V. Morgan), mostly in Ohio, have been digitized and are available in MyCoPortal. The beautiful and detailed gouache paintings of fleshy fungi by L.V. Morgan are currently being curated and digitized as well (Fig. 12).

The John Dodd Diatom Collection contains more than 6,000 microscope slides of diatoms collected by Dodd (approximately 1950–1982) and his students, beginning in 1960. These slides represent studies of diatom ecology in

Figure 12. Gouache and ink illustratration of *Agaricus granosus* Morg. [A.P. Morgan], by Laura V. Morgan.

Figure 13. Lynn G. Clark collecting *Neurolepis steubelii* (Photo by Peggy Stern).

Iowa, resulting in publications and dissertations.

The long history of botanical and mycological research at ISC and IA, as well as exchange and gifts for determination from other institutions has allowed the accumulation of a significant number of types. The ISC-IA Types Collection contains approximately 1,200 vascular plants and 1,100 nonvascular plants and fungi. Most of the vascular plant types have been digitized with records available in the Global Plants Initiative Types project (https://plants.jstor.org/), and those for the fungal types available in MyCoPortal (http://mycoportal.org/portal/index.php).

Until 2003, ISC held the Jacob Peter (J.P.) Anderson Alaskan Collection, containing approximately 30,000 specimens. After receiving his B.S. at Iowa State in 1913, Anderson spent 27 years in Alaska, studying and collecting the flora while owning and operating the first florist business in the state. In 1941, he returned to ISC with his large collection to complete nine parts of his Flora of Alaska before his death in 1953. Stanley Welsh added thousands of additional specimens to the collection as he worked to complete Anderson's Flora, and Anderson's Flora of Alaska and Adjacent Parts of Canada, by Welsh was published in 1974. The collection was transferred to ALA to provide space to accommodate the holdings of IA.

Recent and current projects and activities—The combined holdings of ISC-IA provide the most comprehensive primary source of plant, fungal and lichen diversity and distribution information in Iowa. The holdings also document studies by ISC-IA faculty, staff, associates and graduate students, including those of the following: Lynn Clark's lab—Poaceae, especially bamboos (Fig. 13); Jonathan Wendel's lab—*Gossypium* and its relatives (Malvaceae); Donald Farrar—*Botrychium* (Ophioglossaceae); John Nason's lab—*Ficus* (Moraceae); Mark Widrlechner—*Rubus* (Rosaceae); James Colbert's lab—Iowa's lichens; and Deborah Lewis and collaborators—Iowa flora. Floristic projects are also being carried out by others, including citizen scientists across the state, resulting in additional voucher specimens being added to ISC-IA.

Ongoing studies of the Iowa Flora: Lewis continues to host a series of meetings with botanists from around the state to accomplish two goals: the initial goal was to update the coefficients of conservatism for each of Iowa's native species of vascular plants for use in floristic quality assessments of sites as developed by Floyd Swink and Gerald Wilhelm (1994). However, as the team evaluates each species, the status of identity, name, synonyms, and more is also checked in current literature so that the species list for Iowa can be revised as well. Clark is revising keys to Iowa's vascular plants; while this is being undertaken with students in her Plant Systematics course in mind, these keys are also an important addition to efforts toward a state flora.

Digitization projects: ISC-IA has participated in two NSF-funded Advancing Digitization of Biodiversity Collections (ADBC) Thematic Collections Networks (TCNs): (1) Plants, Herbivores, and Parasitoids: A Model System

for the Study of Tri-Trophic Associations TCN and (2) Microfungi Collections Consortium TCN. Funding was also received for an additional NSF-funded project to digitize the bryophyte holdings and from USDA for digitizing records for USDA Plants. This support has allowed many of ISC-IA's specimen records to be made available online, although work continues on these projects. ISC-IA's data have been added to the SEINet Consortium of Northern Great Plains Herbaria Portal (vascular plants), Mycology Collections Portal, Consortium of North American Bryophyte Herbaria Portal and Consortium of North American Lichen Herbaria Portal.

Contributions by volunteers: Lastly, the work and contributions to ISC-IA and to botanical studies in Iowa by citizen scientists and volunteers are gratefully noted. Two volunteers , Jean Day and Robert Nicholson, have assisted with curatorial tasks for more than a decade. Student volunteers have helped with digitization projects. Jimmie D. Thompson, a citizen scientist affiliated with ISC, is currently one of the most prolific collectors and contributors to ISC-IA, as well as being an author or coauthor of six publications on the central Iowa flora. The support provided by all of these promotes ISC-IA's visibility and relevance.

Links to resources on the Ada Hayden Herbarium website:
The Ada Hayden Herbarium website (https://www.herbarium.iastate.edu/) will soon be updated. However, it currently has links to useful information and resource pages (hopefully also updated in the near future) for a number of taxa.

Grasses of Iowa — https://www.eeob.iastate.edu/research/IowaGrasses/

Bamboo biodiversity — https://www.eeob.iastate.edu/research/bamboo/

Moonwort (Botrychium) systematics — https://www.herbarium.iastate.edu/moonwort-botrychium-systematics;

The Iowa lichen project — https://www.herbarium.iastate.edu/iowa-lichen-project

Iowa fungi species descriptions — https://www.herbarium.iastate.edu/fungi-species-descriptions.

Literature Cited

Horton, Diana G. and Paula Bergstrom. 2006. History of the University of Iowa Herbarium: A Legacy Lost. http://bio.cgrer.uiowa.edu/herbarium/history.htm

Lewis, Deborah Q. and Lynn G. Clark. 2018 (updating in progress). Ada Hayden Herbarium – ISC. https://www.herbarium.iastate.edu/

Macbride, T.H. 1912. Twenty-five years of botany in Iowa. Proceedings of the Iowa Academy of Science 19: 43-63.

Swink, F. and G. Wilhelm. 1994. Plants of the Chicago Region, 4th ed., Indiana Academy of Science, Indianapolis, 921 pp.

Deborah Q. Lewis, dlewis@iastate.edu
Currator

Lynn G. Clark, lgclark@iastate.edu
Director

Iowa State University

Figure 1. A specimen being prepared for the RHS herbarium (WSY). A conventional plant press is used, but with foam pressing against a wetted blotter to give an even flatness to the end specimen. Petals and other plant parts are pressed individually to ease the botanist taking precise measurements. All parts are colour-checked using the RHS colour chart. Photographer Joanna Kossak © RHS.

Imaging the Herbarium of the Royal Horticultural Society

Our Herbarium (WSY) is small (at just over 86,000 specimens), but perfectly formed. It is devoted to preserving the UK's cultivated plant diversity, more specifically ornamental plants, and is the only collection in the UK that is actively collecting new and old cultivars (Fig. 1). The Herbarium forms part of the scientific activity of the Royal Horticultural Society (RHS), complementing the work we do with plant variety trials, cultivar registration, and the production of monographs. While the RHS has been in existence since 1804, our present Herbarium has a more recent origin, the first one having been sold off in 1856. It is based at RHS Garden Wisley, our flagship garden in Surrey, about 30 miles from central London, UK.

For those that might not be aware of the Royal Horticultural Society, the RHS is possibly most well known for the Chelsea Flower Show, an annual extravaganza of horticultural display and expertise that draws in exhibitors from all over the world. The RHS was founded by some of the UK's most eminent botanists and horticulturists, such as Sir Joseph Banks and William Aiton, to inspire passion and excellence in the science, art, and practice of horticulture. Since this time, we have grown to become the world's largest gardening charity with just over 500,000 members. The Society is entirely funded by our members, visitors and supporters who help us secure a healthy future for gardening and its charitable activities include education with courses for all ages, training of horticulturists and the promotion of horticulture, sharing of horticultural expertise, in particular through our publications and website, as well as our scientific work.

Our herbarium was established to support the training of students, but soon expanded to include material to record the plants in cultivation in our gardens. Ranging from our earliest specimen, a lavender made in 1731, to our latest collection, still in the drier, this valuable resource is used by our members, horticulturists, researchers, and students, and our horticultural taxonomists, one of whom annually identifies over 3,000 plants sent in for identification by our members. The collection currently has over 86,000 dried specimens, and ancillary collections that include approximately 35,000 photographic slides, 8,500 photographic prints, 3,500 paintings, and 13,000 pages of collectors' notes. Although devoted to cultivated plant diversity, over 30% of the collection is of wild collected plants and many of these were made by plant collectors, part-sponsored by the Society, seeking new plants to introduce to our gardens. The collection is of particular value as it houses possibly the only known genetic source for many cultivars that are thought now to be extinct.

Although we are all familiar with Index Herbariorum and the use of collections (Funk, 2004), diminishing institutional budgets and courses offering plant systematics have inevitably led to a decline in the use of collections. Modern researchers have an expectation of finding all that they need with the click of a button at all times of the

Figure 2. Mandeep Matharu, one of our dedicated digitisers imaging specimens using a high resolution camera. Photographer Arnhel de Silva © RHS.

day, regardless of time-zone. Inaccessibility will inevitably lead to the death of a collection if it is no longer used. With all of this in mind, in 2011 the RHS embarked on an ambitious project to digitise its types and nomenclatural standards (the equivalent of a type, but specifically for a cultivar). With the help of the Mellon Foundation and the 1851 Royal Commission, the Society employed a full-time digitiser, Mandeep Matharu, who started with a flat-bed scanner to image our collection. After completing the types and standards, currently available online via JSTOR Global Plants (https://plants.jstor.org/), the Society supported the herbarium to continue digitising the entire collections and late in 2018, now with the support of a Heritage Lottery Fund grant, Mandeep imaged the final specimen.

Throughout the seven years the RHS has increased its investment in the project. Mandeep was joined by a new full-time colleague in late autumn 2014, and now job-shares with another colleague. A high resolution camera replaced our flat-bed scanner early in 2016 (Fig. 2). This investment resulted in increased imaging productivity (Fig. 3). Our digitisers have also devoted their time to coaching summer students in the art of digitising collections, and our maternity cover digitisers (we can also lay claim to a new life and a marriage proposal during the period) have gone on to forge successful careers in other herbaria and conservation-based projects.

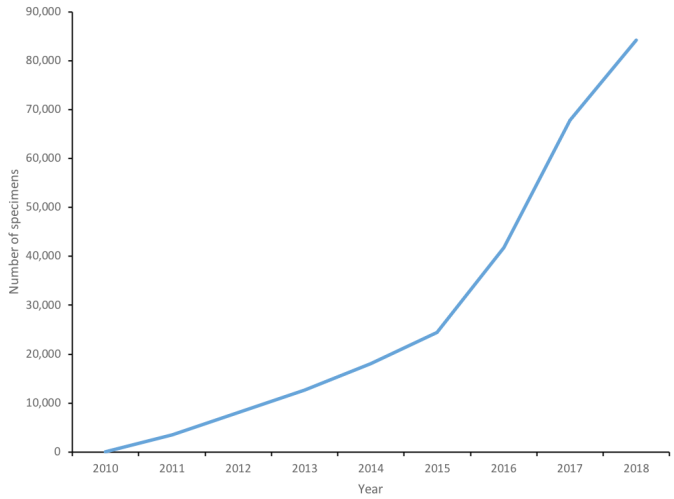


Figure 3. Graphic representation of the imaging process. The effect on enhanced productivity can clearly be seen following the introduction of a camera and the abandonment of the flat-bed scanner.

As alluded to earlier, our specialist collection has a slightly different user base compared to a more conventional herbarium. Because of our policy to collect cultivated ornamental plants, it is used by many in the gardening world to verify the names of plants featured in their collections, be it in a private garden, a park, publicly accessible garden, nursery, or through a grower specialising in maintaining a national heritage collection. In more recent years, our users have included artists and fabric designers who have been particularly attracted to the aesthetics of the specimens. Pressing has pretty much followed the methodology introduced by Luca Ghini in the 1500s, we have merely enhanced this by tweaking the timings used in our drying cabinet and displaying the specimen in a way in which the researcher can easily measure all the parts (Fig. 4).

Figure 4. *Delphinium* 'David Mannion'. This is one of our standard specimens that is already available online via JSTOR plants. The specimen demonstrates our in-house style of pressing and mounting floral parts separately. © RHS.

Now that the imaging milestone has been reached, we are now enhancing our collection database to ensure that 600 dpi images of our specimens are searchable when they are available online. Although it is possible to crowd-source, we are at a slight disadvantage. Because of the style of collecting, or more particularly the way in which we make extensive colour notes, much of the information about the specimen is stored on an additional page that has not been imaged. It is because of this, and the lack of space to accommodate volunteers, we are unable to take advantage of this approach. Our current plan is have the collection online in the summer of 2020, coinciding with the opening of our new Centre for Science & Learning where the herbarium will be housed.

Along with safeguarding, the digitisation process is allowing us to explore the collections more fully. Returning to the roots of the collection, we are currently formulating plans with the RHS's education team for ways of using it to enhance learning opportunities to our teenage audiences. Our own students still use the collections for plant identification, but are now finding it of use for other aspects of their horticultural courses ranging from garden design to tracing the history of cultivars and digitised images of herbarium specimens are a common feature in their presentations.

Along the way some treasures have been discovered and we will have the opportunity of sharing these with our visitors when we are in our new building. To highlight just a few, in 2013, a colleague had a 'eureka' moment, finding a potato that had been collected by Charles Darwin. A short while later, one of our volunteers found that we had, in a donation made in 1936, 24 specimens made by John Sibthorp from the Levant. These formed the basis for his Flora Graeca (1806–1840), executed by others following his death. Flora Graeca has the honour of being the most expensive botanical work to have been produced. Only 25 original sets were made and at a production cost in excess of £6M ($8M) in today's terms. In 2016 the *Rhododendron*, *Camellia* and *Magnolia* Group voted *Rhododendron yakushimanum* 'Koichiro Wada' number one in their top 100 rhododendrons. Our specimen, a nomenclatural standard, is of the actual plant that received the cultivar name. The specimen is multi-layered in stories that we are able share about it: not only with an interesting story attached to how the RHS acquired the plant, but also the nurseryman who supplied the plant and of the cytologist, EK Janaki Ammal, our first female scientist, who made the specimen. We have also recently used the collection (Fig. 5) to show how some of the original Wilson 50 azaleas have become mixed up over the century since they were introduced (Harvey & David, 2017).

We look forward to sharing the collection with you in 2020, and discovering all the new ways in which it will be used in future.

Figure 5. Using old and new specimens of the Wilson 50 azaleas has enabled us to establish anomalies in the current horticultural trade. Seen here *Rhododendron* 'Aya Kammuri' made in the 1950s at Wisley, UK (left) and more recently in Richmond, UK (right). The original rose-colour bloomed plant has been replaced by an orangey-pink imposter © RHS.

Acknowledgements: This work would not have been possible without the support of a number of sponsors including the members of the RHS, the Mellon Foundation, the 1851 Royal Commission and the Heritage Lottery Fund (funded by the UK National Lottery players), and the way in which herbarium digitising folk freely give their help, assistance, coaching and friendship.

Literature Cited

Funk, V. 2004. 100 Uses for an Herbarium (Well at Least 72) (PDF). Division of Botany, The Yale University Herbarium. Retrieved 2015-03-27. http://botany.si.edu/documents/2003_Funk_100Uses.pdf.

Harvey, Y. & David, J. 2017. Revisiting the UK's 'Wilson 50' Kurume azaleas. In Hayward, P. (Ed.). *Rhododendrons*, *Camellias* & *Magnolias* 2017. Pp. 184. Royal Horticultural Society, London.

Yvette Harvey, Keeper of the Herbarium
Royal Horticultural Society's Herbarium (WSY)
yvetteharvey@rhs.org.uk

SOCIETY OFFICERS AND EDITORIAL COMMITTEE