

The Vasculum

The Society of Herbarium Curators Newsletter Volume 20, Number 1: January 2025



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Message from the President



Greetings and well wishes to curators and herbarium supporters around the world! I hope you are happily closing the door on the successes and challenges of 2024 and are energetically looking forward to continuing your good works with plant specimens in 2025. Your Society of Herbarium Curators has also had successes and challenges since the summer edition of the *Vasculum*, and I am so grateful to the dedication and hard work of the officers and committee members of SHC. We recently held a meeting of the Executive Board where we renewed our plans to reach out to a larger and broader representation of herbarium aficionados. Planning has begun for the *Botany 2025* meeting, with its new location - Palm Springs, California. Well, as many of you know, the planned conference in Tucson hit a major roadblock late in 2024, when a change in the renovation schedule for the meeting venue made it impossible for the conference to take place there in 2025. The conference organizers have been working at warp speed to pivot to another geographically close site that suits our needs, and I hope by the time you read this the location of the conference will have been announced. I'll look forward to seeing many of you at our symposium and membership meeting, wherever that may be!

In July 2024, SHC held a satellite meeting at the XX International Botanical Congress in Madrid (Fig. 1). Early in the year you will hear more about plans for *Botany 2025*. I wish you the best in the new year, and I look forward to the many discoveries that will be made this year, enabled by the important work we all do.



Figure 1: President Mark Fishbein calls the SHC satellite meeting at IBC to order (Photo credit: Socorro González Elizondo)

There was a fantastic turnout of over 50 people from all corners of the globe. As expected, many herbarium curators were in attendance (Fig. 2). However, I was surprised and encouraged by a strong representation of students, conservationists, and other herbarium users, who may have accounted for almost one-half of the participants. Many topics of broad interest were discussed, including the challenges of dwindling financial and institutional support for herbaria, the opportunities available to build communities of support from outside our institutions, and the tremendous diversity of uses for natural history collections and the data they have mobilized.

I was amazed at the breadth of knowledge and creative problem-solving in our community, notably not just from those who are employed to work in the collections. There was tremendous energy in that room that I hope we can tap and use to fuel our global network of specimen custodians.

There is ample room for each of you to contribute to SHC efforts. Please consider telling us what is happening in your collection or your specimen-based research by submitting a short article to the *Vasculum* (<https://www.herbariumcurators.org/newsletter/>). We all have news of interest. At OKLA (Oklahoma State University Herbarium), like many of our peer institutions, we have been loaning equipment to and training students at small, regional colleges to image and database specimens in their small (5,000–15,000 specimen) herbaria. What's new with you? There are also many opportunities to assist with one of SHC's standing committees that aligns with your interests (<https://www.herbariumcurators.org/leadership-2/>). Currently, we are expanding the Membership and Social Media Committee and are keen to recruit a couple more members to assist with this vital work. If you are interested or would like more information, please send me a note. And, please don't forget to renew your membership. If you have not received a renewal notice, please navigate to our website (<https://www.herbariumcurators.org/membership/>).



Figure 2: IBC attendees discuss challenges and opportunities facing herbaria at the SHC satellite meeting (Photo credit: Mark Fishbein)

Mark Fishbein
President, Society of Herbarium Curators (2024-2026)
Director of the Oklahoma State University Herbarium (OKLA)
Regents Professor and Head, Department of Plant Biology, Ecology and Evolution
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From the Editor's Desk

Dear Fellow Herbarium Enthusiasts and Members of the Society of Herbarium Curators,

As we stand on the threshold of a new year, it is with great pleasure that I extend my warmest greetings to our cherished community of herbarium lovers. Herbaria are more than collections of pressed plants; they are treasure troves of nature's history, revealing stories of evolution, adaptation, and the intricate relationships between flora and fauna across the globe.

In the spirit of our shared passion, I am delighted to announce the release of *The Vasculum* Volume 20, Issue 1. This issue aims to be a source of inspiration, knowledge, and connection for all herbarium enthusiasts. Within its pages, you will find an enriching collection of articles, including insightful research updates, thought-provoking essays, and stories of botanical exploration from herbaria worldwide. Contributors have also highlighted innovative herbarium management approaches, conservation challenges, and the dedication of our members to advancing botanical science and preserving biodiversity.

Your enthusiasm for herbaria is the driving force behind the success of *The Vasculum*. Whether you are a seasoned botanist, an avid nature lover, or someone beginning to discover the enchantment of pressed plants, your unique perspectives enrich our collective journey. I extend my heartfelt gratitude to everyone who contributed to this issue. Your expertise and creativity ensure that *The Vasculum* remains a vibrant platform for knowledge-sharing and community-building among herbarium professionals.

As we embark on this new year, let us continue to nurture and cultivate our passion for herbaria. Together, we can advance the role of herbaria in understanding and conserving plant diversity for generations to come.

Thank you for your dedication and enthusiasm. I encourage you to explore the latest content, share your feedback, and consider contributing to future issues.

Tilottama Roy
Editor, *The Vasculum*
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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 —

SPNHC-TDWG Joint Conference 2024

The 39th Annual Meeting of the Society for the Preservation of Natural History Collections (SPNHC) was held jointly with our partner, Biodiversity Information Standards (TDWG), at the Okinawa Convention Center in Ginowan City, Okinawa, Japan, from 2-6 September 2024. This marked the first time the SPNHC meeting took place in Asia, making SPNHC-TDWG 2024 a significant milestone for the Society (<https://www.tdwg.org/conferences/2024/>). Nearly 380 participants from 30 countries attended in person, with Asian delegates comprising 20% of attendees, representing eight countries. In addition, over 200 virtual participants joined via the hybrid format, making it a truly global event (Fig. 1).

The theme, *Enhancing Local Capacity, Elevating Global Standards*, facilitated vibrant discussions on a broad range of topics (Fig. 2). The program reflected diverse yet shared interests of the community, including the well-attended symposium *Herbarium Procedures and Techniques: Sharing Best Practice from Across the Globe* and its companion workshop. Over 360 abstracts were accepted via the Oxford Abstracts platform and presented during the week-long event. Approximately 40% of the abstracts (142) underwent peer review and are published in Biodiversity Information Science and Standards (BISS; <https://biss.pensoft.net/collection/438/>). The complete playlist of the SPNHC-TDWG 2024 is publicly available on YouTube (<https://www.youtube.com/playlist?list=PLD9-DRLWVl0nrw-FMOYUHe-W82m2VCJjyJ>)—be sure to check it out!

A heartfelt thanks goes to our official sponsors and the government agencies of Japan and Okinawa Prefecture, whose generous support has made this conference particularly memorable. Attendees enjoyed subsidized excursions to mangrove wetlands, an aquarium, a castle, and museums (Fig. 3), as well as opportunities to immerse themselves in Okinawa's unique culture. A highlight was the Eisa folk dance performance at the welcome reception. Additionally, a concurrent BioBlitz (<https://www.inaturalist.org/projects/spnhc-tdwg-2024-bioblitz-okinawa>) proved to be a tremendous success, recording over 5,700 observations of more than 1,000



Figure 1: SPNHC-TDWG 2024 logo (Credit: Prof. Mitsuru Moriguchi, Okinawa Univ. & Takako Tomozawa, Osaka Natural History Center).

species from the subtropical islands. The SPNHC-TDWG 2024 conference also took pride in its commitment to sustainability. Organized in accordance with Okinawan sustainability guidelines and in collaboration with local vendors, the event was delivered as a “green” conference, despite the absence of a Japanese host institution.



Figure 2: Opening plenary introducing keynote speaker Dr. Sarah Beery (Photo credit: JNTO: Japan National Tourism Organization)



Figure 3: Excursion to Shikina-en Garden, a UNESCO World Heritage site; a group strolling under the shade of *Ficus macrocarpa* Blume trees (Photo credit: JNTO)

Looking ahead, the 40th Annual Meeting of SPNHC will take place in Lawrence, Kansas, USA from 27-31 May 2025. The Biodiversity Institute and the University of Kansas will serve as the Local Organizing Committee. Stay tuned for updates on the SPNHC 2025 website (<https://spnhc2025.ku.edu/>), social media and email communications, including details on abstract submissions and deadlines.

For inquiries, please contact the KU Biodiversity Institute at spnhc2025@ku.edu.



Figure 4: SPNHC 2025 logo (Provided by Mariko Kageyama).

Mariko Kageyama
SPNHC-TDWG 2024 Steering Committee

A Hidden Gem: Honoring Henry Judson Jacob for His Contribution to the Delta State University Herbarium

Introduction

The Delta State University Herbarium (DSC), located in Caylor Hall, Room 242, is one of eight herbaria in Mississippi. Its current purpose is to serve as an educational resource for Biology and Environmental Science classes taught at Delta State University (DSU): Conservation Biology, Dendrology, Economic Botany, Elements of Plant Systematics, Materials and Methods of Environmental Science, Plant Anatomy, and Principles of Biology I and II. From 2014–2024, 20 scientific posters and three scientific papers (Olivi et al. 2015, Miles et al. 2024, Yun et al. 2024) have been generated by undergraduate students that pertain to DSC specimens. In recent years, three scientists have also visited the DSC collection (Kevin England, a lichenologist; Wayne Morris, a specialist on southeastern orchids; Lisa Wallace, a molecular plant taxonomist), one scientist (Karl Fener) borrowed and annotated specimens of *Liriodendron tulipifera* L. for his Ph.D. study, and an unknown number of people have had access to our specimen data and images through our herbarium database website and the SERNEC portal.

According to John Tiftickjian, former Professor of Biology at DSU, the DSC collection had its beginning in the 1930s, a few years after Delta State College was established. At that time, Melbourne Miller was hired to conduct a floral and faunal inventory of the Mississippi Delta through the Work Progress Administration (<https://ntweb.deltastate.edu/jtift/dsuherbarium/>). Results from the original inventory are lost to time, but this project served as a nucleus for the Natural History Museum that was housed at DSU prior to building renovations that began around 2011. Richard L. Caylor, who taught in the Science Department from 1931–1958 and was the Department Chair for the last 21 years of his life, may have managed the DSC herbarium throughout the early 1940s to mid-1950s (Robert Stewart, Professor Emeritus of Botany at DSU, written communication). The DSC Herbarium appeared to not have a formal director throughout the late 1950s–1970 due to its small size. About 4 200 herbarium sheets in the DSC collection predate 1970. Robert Stewart managed and curated the collection from 1970–2003 and Nina Baghai-Riding has been the curator and manager of the DSC herbarium since 2005.

Digitizing the DSC collection began in 2007 when John Tiftickjian designed a searchable database that was linked to a File Maker Pro 13 file (<https://ntweb.deltastate.edu/jtift/dsuherbarium/>). Over 11,600 specimens occur on this site; the list can be searched by family and genus. The database file was backed up weekly until Tiftickjian passed away in 2017. Presently, there are 15,300 specimens in the File Marker Pro 13 database. Data and images for 13,000+ DSC herbarium sheets also are found on the Southeast Regional Network of Expertise and Collections (SERNEC; <https://sernecportal.org/>).

Several collectors have contributed 500+ specimen sheets to the DSC Herbarium: Nina Baghai-Riding, Henry J. Jacob, John MacDonald, M. Wayne Morris, Albert E. Radford, Robert Stewart, and Ronald Wieland. Other notable collectors who contributed 200+ herbarium sheets include Harry Ahles, John R. Bozeman, Charles T. Bryson, S. W. Leonard, and Jessie S. White.

Henry Jacob (Fig. 1), not recognized as a plant taxonomist or botanist, collected specimens from 1946–1974. He had a great appreciation of biology, scientific applications, and natural resources as well as a talent for teaching and conveying information. He received his Ph.D. from the Agricultural and Mechanical College, Louisiana

State University in 1953. William Augustus Lawrence served as his major professor and advisor. Chapters in Dr. Jacob's dissertation included: the effects of implementing the scientific method in resource education for elementary-school science classrooms; hands-on activities and experiences encompassing plants, soils, and natural resources; activities for third-sixth grade students included studying and painting pictures of trees, analyzing the shape of leaves, understanding honeybee and flowering plant relationships, cultivating a home garden that contains peppers, cabbage, and tomatoes, making a list of plant food items, determining required soil conditions for each plant, and more (Jacob 1953). He also taught elementary students how to construct plant taxonomic keys and about phyllotaxy, leaf structure, leaf shape, and types of leaf margins.

In the summary section of his dissertation, Jacob explains how Jean-Jacques Rousseau, a Swiss-born 18th century writer, had students make observations and record accurate information. He incorporated Rousseau's ideas by using a three-fold process when teaching elementary science students about the conservation of natural resources. First, students would learn facts pertaining to plant and animal life, soil, and water; second, students would utilize the scientific method in solving problems concerning conservation; and third, the students would become aware of their responsibilities of natural resources (Jacob 1953).

Dr. Jacob incorporated his teaching techniques from his prior education training and quickly rose to prominence at DSU. In 1946, he became an instructor of Education at Delta State University. He was promoted to Assistant Professor of Education in 1948, Associate Professor of Education in 1955, Professor of Education in 1960, Director of Graduate Studies in 1966, and Dean of Graduate Studies in 1971 (DSU Archives). Jacob retired from DSU in 1974, but he remained active in education issues until he died in July 1990. For example, he received a Certificate of Appreciation from the Grenada Kiwanis Club in October 1976 (<https://www.deltastate.edu/library/dr-henry-judson-jacob/>) and was awarded a Life Membership status of the Cleveland, Kiwanis Club in 1980; two annual scholarships given to this organization were named in honor of Dr. Jacob (Anonymous, Bolivar Commercial 1980). Fifteen years after his death, the Delta Room in the College of Education was dedicated to him. An Excellence in Teaching Scholarship Fund also was established in his name.

Dr. Jacob's classes were stimulating, enlightening, memorable, and meaningful; students spoke highly of him. For example, Philene Allen, a resident of Cleveland, MS, wrote, "I know that Dr. Jacob was the strongest influence I met during my undergraduate and graduate days at Delta State. This is my 36th year as an educator, and I am presently serving as State President of Mississippi Professional Educators. Dr. Jacob deserves part of the credit



Figure 1: Portrait of Dr. Henry J. Jacob when he was Dean of Education at Delta State University (Photo credit: Emily Jone).

for my success as an educator because of his encouragement and advice. Many other educators say this same thing about their life and career” (letter to President David Potter, January 11, 2001).

Jacob also mentored DSU students. He helped Delta State College become Delta State University in 1974. Butch Caston, interim DSU President from 2022–2023, told Baghai-Riding that Jacob was the reason he acquired his master’s and Ph.D. degrees. Jacob knew President Caston when he played running back for the DSU Statesmen and encouraged him to obtain a Master’s of Education degree in Guidance and Counseling in 1968 and his Ph.D. in Guidance and Counseling in Education from the University of Southern Mississippi in 1974 (Anonymous 2022).

Jacob’s home bordered the DSU campus, so he could easily be available and serve students, which likely contributed to his success as an educator. He was a Mississippi native and viewed plants for their beauty, ecological value, economic importance, and as an educational resource. He was a major contributor to the book *Elementary Forestry for Mississippi* (Redman et al. 1945) when he was superintendent of Sand Hill Special Consolidated School near Richton, MS, prior to completing his master’s degree.

Curation and Management of Jacob’s specimens

More than 1700 of Jacob’s specimens are housed in the DSC herbarium; there are 1510 catalogued specimens including 180 duplicates. Dr. Jacob mounted several hundred of his own specimens and his handwriting occurs on some of the herbarium sheets along with specimen numbers. Robert Stewart remounted many of the grasses, orchids, and legumes to increase their longevity. When Baghai-Riding became the DSC curator and manager, she noted 500+ of Jacob’s specimens were still in the original newspapers he used for collecting; some newspapers were more than 60 years old. Baghai-Riding and interested biology/environmental science students discovered their importance and worked on them from 2010–2024. Two-thirds of these specimens lacked labels and species identifications, but Jacob’s handwritten notes along the edges of the newspapers sometimes provided the location and taxonomic information of specific specimens. Deciphering his handwriting and making accurate labels tended to be difficult since his field notes and collecting notebook(s) are missing. Occasionally, a group of specimens were tied with string and labeled as being from Baton Rouge, Louisiana; George Co., Mississippi; Dolly Sods, West Virginia, and more, which helped to determine the place of collection. Credible online databases, such as Missouri Botanical Garden’s Tropicos.org, Flora of North America, the USDA PLANTS Database, and Weakley’s Flora were accessed in determining the accuracy of family, genus, and species names for each unidentified specimen. Professional botanists and herbarium curators also assisted in identifying specimens: Mac Alford, Sam Faulkner, Wayne Morris, Kevin England, and Heather Sullivan. Approximately 200 specimens remain unmounted, unsorted, and left in newspapers; these particular specimens require further research to assess species and location data since label information is lacking.

Throughout the 2016–2018 academic years, Baghai-Riding discovered an additional 160 identified specimens that Jacob collected in 1974. These specimens were found glued to yellow notebook paper jammed into a magazine file in an herbarium cabinet; these specimens were remounted in December 2019. The Mississippi Museum of Natural Science, Jackson, Mississippi, also donated and shipped 50 unmounted plant specimens that Jacob collected.

Highlights of the DSC Jacob Collection

Dr. Jacob collected more than 2500 specimens based on his specimen numbers and number of duplicate specimens. Jason Richard Swallen at the Smithsonian (US) identified 63 different duplicate grass specimens that Jacob collected based on annotated labels in the DSC collection; Swallen was the curator of the Division of Grasses and chairperson of the Botany Department. Duplicate specimens of *Equisetum*, ferns, pines, chestnuts, legumes, magnolias, oaks, grasses, irises, orchids, and sedges that Jacob collected are also in other herbaria: the

Botanical Research Institute of Texas - Herbarium (BRIT), Brigham Young University Herbarium (BRY-V), Gray Herbarium (GH), the University of Mississippi Thomas M. Pullen Herbarium (MISS), University of North Carolina at Chapel Hill Herbarium: Vascular Plants (NCU), and Valdosta State University Herbarium (VSC). GH contains 18 of Jacob's specimens, MISS contains 43, and NCU has 94. Some taxa that Jacob collected are at these other herbaria and are not at DSC, for example, *Nemopanthus* Raf. *Desmanthus* Willd., *Epifagus* Nutt., and *Kummerowia* Shindl.

There are 379 of Jacob's herbarium specimens in the DSC collection that lack a collector specimen number: 135 specimens from 1945–1946, 62 specimens from Sept 27, 1951 – January 5, 1952, 35 specimens from August 4, 1957– July 19, 1958, and 147 specimens from July – November 1974. These specimens possess an s.n. or no documentation. His first collection numbers are associated with Pop's Ferry Road, Harrison Co., Mississippi. The digit 1608 is his last collector number on file and represents *Sicyos angulatus* L. from Moon Lake, Lula, Coahoma Co., Mississippi.

Jacob created his own plant labels for many specimens he collected. Herbarium sheets associated with his specimens, from mid-1945 to 1958, possess a header "Plants of Mississippi," "Plants of Louisiana," "Plants of West Virginia," and so forth. The words "Collected by Henry J. Jacob" occur beneath the header. His original plant labels usually possess family and species names with authorities, habitat, location (usually the city of the nearest post office), and date of collection. Occasionally, he added morphological features: tree height, diameter at base, flower color, and species frequency. Many of his herbarium specimens were annotated by Robert Stewart throughout the 1980s–1990s. Stewart, however, would retain Jacob's original labels; the original labels would be attached to the back of herbarium sheets if the specimens were remounted.

Most of Jacob's specimens at DSC are of excellent quality. He primarily collected native plants instead of ornamental, cultivated, and invasive exotic species. Based on his specimen numbers, he would collect small bunches of specimens (from 1– 43) on a given day. He collected an assortment of species representing 148 plant families, six lichen families, and 452 genera. His collection at DSC includes one bryophyte, two lycophytes, one horsetail, 16 ferns, one pine, 23 monocotyledons, and 100 dicotyledons. Families possessing the most genera are the Asteraceae (50), Cyperaceae (12), Fabaceae (39), Poaceae (41), and Rosaceae (15). Families with the largest percentage of specimens are Poaceae (15.1%), Fabaceae (9.7%), Asteraceae (7.4%), Cyperaceae (5.1%), Fagaceae (4.9%), Ranunculaceae (2.4%), Rosaceae (2.0%), Plantaginaceae (1.9%), Iridaceae (1.4%), Lamiaceae (1.3%), Polygonaceae (1.7%), and Ericaceae (1.5%). Five plant families only contain one specimen: Azollaceae, Colchicaceae, Juncaginaceae, Salviniaceae, and Sphagnaceae. *Quercus* L., the most common genus, is represented by 74 herbarium sheets.

The Batidaceae and 25 plant genera, excluding lichens, only exist in the DSC collection because of Jacob's efforts. Twelve of these genera are from Mississippi: *Asemeia* Raf., *Bolboschoenus* (Asch.) Palla, *Centella* L., *Eichhornia* Kunth, *Egeria* Planch., *Gymnostyles* Juss., *Kyllinga* Rottb., *Lemna* L., *Narthecium* Huds., *Palhinhaea* Franco & Vasc. (Fig. 2), *Stuckenia* Borner, and *Vallisneria* L. The other 13 genera are from either Alabama, Louisiana, Tennessee, or West Virginia.

Dr. Jacob's collection also contains geographic diversity. He collected from 37 counties in Mississippi (Fig. 3), representing 72% of his total contribution. Counties with more than 50 specimens are Bolivar, George, Harrison, Jackson, Tishomingo, and Warren. Beyond state lines, Jacob collected from nine other states. Approximately 9% of his collected specimens are from Louisiana with an emphasis from Baton Rouge Parish. Another 9% of his specimens are from Tennessee. The seven other states including Alabama, Florida, Maryland, Michigan, Pennsylvania, Virginia, and West Virginia comprise the remaining 10% of his collection (Fig. 4).

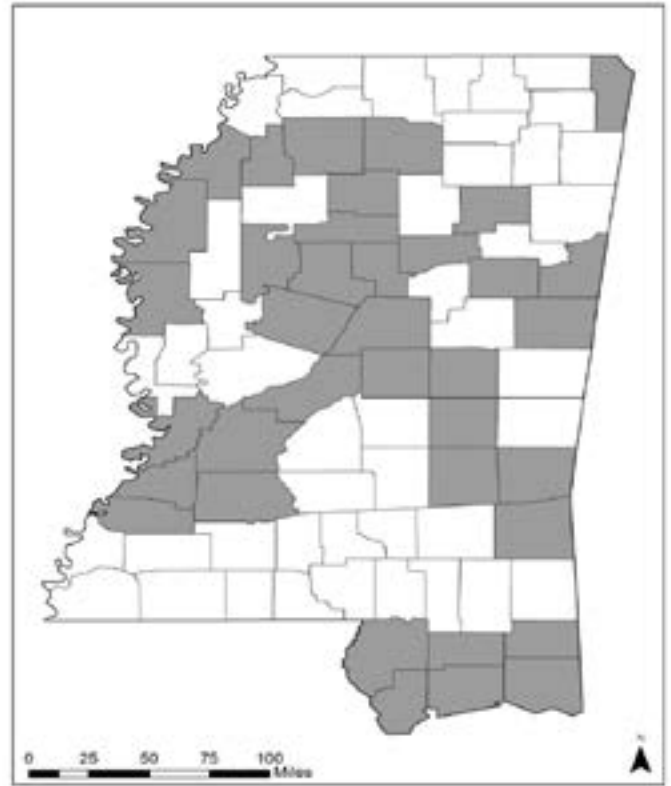


Figure 2 (left): A herbarium specimen of *Palhinhaea cernua* (L.) Franco & Vasc. that Dr. Henry Jacob collected from Mississippi (Photo credit: Ryan Fulgham). Figure 2 (right): Mississippi counties that are associated with Dr. Henry Jacob's plant specimen labels in the DSC collection (Photo credit: Yongqin Zhang).



Figure 3: US States shaded in the map represent states in which Dr. Henry Jacob collected (Photo credit: Yongqin Zhang).

Jacob tended to collect in unexplored areas and diverse habitats. He extensively collected aquatic and wetland plants from brackish areas, bogs, ponds, marshes, shorelines, swamps, and from the barrier islands of Mississippi. Other habitats noted on his specimen labels include cultivated meadows, dense thickets, edges of fields, fence rows, forests, roadsides, and yards. He also acquired specimens from assorted soils: clay, organic rich, rocky, and sandy. According to Mac Alford, some of the Jacob specimens collected from the Mississippi Gulf Coast are rare or no longer exist in the area. Rare species in his collection include *Avicennia germinans* (L.) L. from Louisiana; *Eryngium aquaticum* L., *Paronychia erecta* (Chapm.) Shinnery, *Palhinhaea cernua* (L.) Vasc. & Franco, and *Cypripedium parviflorum* Salisb. from Mississippi; *Senecio suaveolens* (L.) Elliott from Tennessee and West Virginia; and *Cornus canadensis* L. from West Virginia. Additionally, Jacob collected 20 lichen specimens from the Mississippi Petrified Forest, Flora, MS in May and June 1965 before it became a registered national landmark in October 1965. Some of his lichen specimens may represent new state records (England 2019, oral communication).

Jacob's specimen labels infer that he returned and collected from some counties periodically: Bolivar, Chickasaw, George, Harrison, Jackson, and Tishomingo. Return trips were connected to employment, family obligations, and recreation. He managed to collect different plant families, genera, and species on these occasions. As a result, his contribution fills an important historical gap regarding plant diversity and represents an essential resource for ecology, plant systematics, plant geography, and more. The quality of his specimens is useful for DNA analysis, phenological studies, geographical distribution of species, to study impacts of urbanization, habitat destruction, and climate change. Approximately 17% of his specimens possess World Geodetic System 1984 (WGS84) georeferenced coordinates (see SERNEC).

His collections confirm that he understood the educational and research value of an herbarium (Baghai-Riding & Jones 2019). Perhaps, Caylor persuaded Jacob to collect specimens for the DSC collection when he was hired as an Instructor of Education at DSC; only 300 herbarium specimens possess calendar dates older than 1946 in the DSC collection. Baton Rouge, Louisiana specimens relate to when he pursued his PhD.

Additionally, Jacob's duplicate specimens in the DSC collection may have been intended for other herbaria. The donation or contribution of 94 of his specimens to NCU may have created a positive collaboration between the two universities (Stewart 2024, written communication); these plant specimens were collected prior to May 1966 based on specimen records (see SERNEC). This contribution possibly is why the DSC collection possesses 2,100 specimens from the University of North Carolina in the late 1960s (Stewart, 2024 written communication). Over half of the NCU specimens were used for the Manual of the Vascular Flora of the Carolinas (Radford et al. 1968). Jacob's herbarium specimens that are at MISS, NCU, and GH fill gaps about dates, places of collection, and specimen numbers. These herbaria collectively possess 41 of his specimen numbers that are not in the DSC collection. Thirty-six of these specimen records predate 1960 and 30 of these specimens are from southern Mississippi: George, Harrison, and Jackson Counties. These three herbaria also contributed together a total of 17 additional species that Jacob collected: *Isoetes melanopoda* J. Gay & Durieu, *Eleocharis cellulosa* Torr., *Arthraxon hispidus* (Thunb.) Makino var. *hispidus*, *Dichanthelium aciculare* (Desv. ex Poir.) Gould & C.A. Clark subsp. *aciculare*, *Nemopanthus mucronatus* (L.) Trel. ex Loes., *Crotalaria rotundifolia* J.F. Gmel., *Desmodium canescens* (L.) Poir., *Desmanthus illinoensis* (Michx.) MacMill. ex B. L. Rob. & Fernald, *Galactia erecta* (Walter) Vail, *Kummerowia striata* (Thunb.) Schindl., *Stylosanthes biflora* (L.) Britton, Sterns & Poggenb., *Tephrosia hispidula* (Michx.) Pers., *Castanea dentata* (Marshall) Borkh., *Quercus arkansana* Sarg., *Acer rubrum* L. var. *tridens* Alph. Wood, *Epifagus virginiana* (L.) W.P.C. Barton, and *Polemonium reptans* L. var. *reptans*. Digitized records provided by these three herbaria may help to resolve species identification and place of collection of Jacob's specimens that are still unmounted and contained in newspapers.

Following retirement, colleagues most likely will remember Jacob's communication about the economic value of plants. He was an avid gardener and skilled at basket weaving. He also was known for giving slide presentations on wildflowers (Anonymous, Bolivar Commercial 1979). Brief articles from local newspapers, including The Bolivar Commercial, highlighted these talents. One article, "Artichoke with a difference," emphasized how Jacob would pickle Jerusalem artichokes that he grew in his garden. Another newspaper account featured him giving demonstrations on basket weaving (Fig. 5) that Native Americans practiced using splints from oak, ash, hickory, and poplar trees (Brown 1981). Another newspaper photo showed Jacob and his daughter Marynell analyzing a fern frond. An additional newspaper account figures him holding a one-pound lemon that hung from a tall bush at his home.

To herbarium managers, botanists, and conservationists, Jacob's collection of pressed plant herbarium specimens collected over a 28-year span will continue to have purpose as well as provide a glimpse of past plant taxa that occurred in Mississippi counties during the middle decades of the twentieth century. His contributions to the DSC herbarium and other herbaria around the U.S.A. serve as an inspiration to scientists, educators, students, and enthusiasts alike.

Acknowledgements

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Figure 4: A photograph featuring Dr. Henry Jacob weaving a basket (Photo credit: Marynell Jacob).

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The Herbarium as a Repository of Medicinal Plants, Including Rare and Endangered Species

In botanical terms, the Sudan region is truly where north meets south and where east meets west in Africa. The sparse desert flora of the Sahara that dominates the northern portion of Sudan gradually gives way to the south, first to dry scrubby grasslands and then to an increasingly woody vegetation, dominated by vegetation zones that extend all the way to Mauritania and Senegal on the west African coast and that almost reach their eastern-most extent in the Sudan region. Each region has its own characteristic vegetation types, with affinities to variously the Saharan massifs and to the equatorial African mountains (Darbyshire et al. 2015). Erkowit region in the central Sudanese Red Sea Hills receives more moisture than the majority of the Red Sea Hills, mainly in the form of mist. It therefore supports a more luxuriant vegetation than in the surrounding hills, including many medicinal plants in the past and extensive stands of tree: *Euphorbia* spp., *Dracaena ombet* Kotschy & Peyr. (Asparagaceae) and *Aloe sinkatana* Reynolds (Asphodelaceae) (Kassas 1956; Hassan 1974).

The Sudan region is therefore very rich in phytogeographical terms. Sudan, with its rich and diverse flora, is home to variety of plants from many distinct families, many of which possess valuable medicinal properties. These plants, deeply rooted in the country's traditional healing practices, have been used for centuries to treat a wide range of ailments, from digestive disorders and respiratory issues to skin conditions and infections. The medicinal knowledge passed down through generations underscores the immense value of these plants, not only as a cultural heritage but also as a potential resource for modern medicine. With their natural healing power, plants from Sudan's unique ecosystems offer promising solutions for both local and global healthcare needs, highlighting the urgent need to conserve and study these botanical treasures.



Figure 1: Herbarium University of Khartoum (KHU)

There are only a few herbaria in Sudan, the most important and largest of which is the Khartoum University Herbarium (KHU), which contains samples from all over Sudan and represents all plant families in the country (Fig. 1). This herbarium is considered a hidden treasure, filled with rare plants that are diverse in their uses (e.g., *Dracaena ombet* (Fig 2), is used in natural remedies, has aesthetic value, and is used to treat wounds and ulcers). Also, the leaves and roots of *Aloe sinkatana*, considered an endangered species in Sudan, are used as a laxative; for arthritis, eczema, hypertension and stress, and sinusitis; to treat skin ailments, bruises and burns. Other species like *Cordia africana* Lam. (syn. *Cordia abyssinica* R.Br., Boraginaceae; Fig. 3); treat headaches, nose bleeds, jaundice, schistosomiasis, fractures, and fatigue, or *Vernonia amygdalina* Delile (Asteraceae) (Fig. 4), which is well known as a medicinal

plant with several uses including for the treatment of diabetes, fever reduction, and recently for a non-pharmaceutical solution to persistent fever, headache, and joint pain.



Figure 2 (left): *Dracaena ombet* Kotschy&Peyr.; Figure 3 (right): *Cordia africana* Lam. (Syn. *Cordia abyssinica*)

Representing these medicinal plants are the most common succulent families, including Asparagaceae, Cactaceae, Crassulaceae, Agavaceae, Euphorbiaceae, Moringaceae, and Portulacaceae. These resilient plants are rich in bioactive compounds that can help treat a wide range of health issues, from skin ailments to digestive problems.

Medicinal uses of selected common plant species deposited in the KHU herbarium:

1. *Adansonia digitata* L.

A drink is prepared from the fruit pulp which is known as the “cream of tartar.” The drink is used to treat fevers, diarrhea, and haemoptysis. The leaves and bark are used as an anti-inflammatory and anti-diaphoretic (decrease perspiration). It is also used as a remedy for urinary disorders.

2. *Caralluma darfurensis* Plowes

Stems are used in the treatment of rheumatism, diabetes, and leprosy and as antiseptics and disinfectants.

3. *Cissus quadrangularis* L.

Stems and leaves used for obesity, diabetes, high cholesterol, and a cluster of heart disease risk factors called

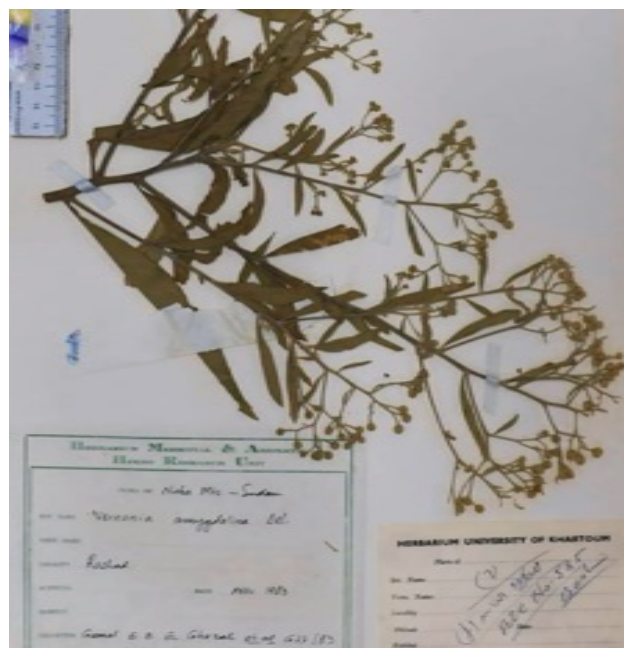


Figure 4: *Vernonia amygdalina* Delile

“metabolic syndrome.”

4. *Citrullus colocynthis* (L.) Schrad.

Stems and leaves used for diabetes and inflammatory diseases, and as an analgesic. It is also used for constipation, stomach and intestinal disorders, elephantiasis, epilepsy, facial paralysis, fever, and gout.

5. *Diospyros abyssinica* (Hiern) F.White

Decoction of leaves used for malaria and wound healing, while the roots are used for dysentery.

6. *Ipomoea aquatica* Forrsk.

Leaves can cure ailments such as jaundice and nervous debility. The plant is used in the treatment of liver diseases, constipation, diabetes, abscesses, mental illness, intestinal problems, nosebleeds, and, high blood pressure; as a central nervous system (CNS) depressant, antiepileptic, antimicrobial, and anti-inflammatory; and also to treat ringworm infection and asthma.

7. *Moringa oleifera* Lam.

Leaves, stems, fruits, and seeds used for treatment of anemia, arthritis and other joint pain (rheumatism), asthma, cancer, constipation, diabetes, diarrhea, epilepsy, stomach pain, intestinal spasms, headache, heart problems, high blood pressure, and kidney stones. Some people use it as a nutritional supplement or tonic. Also used for snakebites, warts, wounds, and other skin diseases. Used for water purification.

8. *Portulaca oleracea* L.

Leaves have a laxative and diuretic effect and are also applied to soothe skin or draw abscesses. The whole plant is effective as a bactericide in bacterial dysentery and diarrhea and also in the treatment of worm infections.

There are three very clear visions for medicinal plants: enhanced quality control, sustainability for the plants, and pharmacognosy for the health care of humankind and the sake of future generations. As traditional medicine continues to play an important role in Sudanese healthcare, the exploration and preservation of medicinal plants could provide a sustainable path to enhancing modern treatments.

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Early Career Advice

Dr. Pamela S. Soltis is a Distinguished Professor and Curator at the Florida Museum of Natural History, University of Florida, Gainesville, USA (Figs. 1, 3 and 4).

What made you first interested in herbaria?

I actually started being interested in plant collections when I was in grade school. My fifth grade teacher had us do leaf collections, so I collected and pressed leaves. Of course, I had no idea there were such things as herbaria to keep collections like this in, but I think the concept of a collection seeped in. I began working in an herbarium as a Curatorial Assistant when I was in graduate school at the University of Kansas.

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

My first collections that were eventually submitted to an herbarium were vouchers for my genetic studies of hybridization and introgression in *Clarkia*, with an emphasis on *Clarkia speciosa* F.H.Lewis & M.E.Lewis and *C. nitens* F.H.Lewis & M.E.Lewis. These species occur in the foothills of the Sierra Nevada in California, especially in Tulare and Kern Counties. I had an exciting field expedition with a fellow grad student to collect this material.

How have herbaria enriched your research and teaching?

Herbaria have been resources for finding locations of populations for genetic and molecular sampling, for scoring morphological traits, as sources of material for phylogenomic analyses, for data on phenological change through time, and for localities that have been used in ecological niche modeling. In other words, they have played a huge role in diverse areas of research. Of course, I use the herbarium in teaching undergraduate and graduate courses in plant taxonomy, in a graduate course on principles of systematic biology, and in an undergraduate course on niche modeling and the predicted responses of Florida plants to climate change. Also, as a co-PI of iDigBio, I have been involved in the development of digitization methods and pipelines and the use of digitized data.



Figure 1: Pam in the Bartram-Carr Conservation Area on the University of Florida campus (Photo credit: Kristen Grace).

What uses of herbaria do you find the most interesting or exciting?

I think we have put herbarium specimens to a lot of fascinating uses over the centuries, but a mostly untapped

area is the use of specimens for extracting traits, especially using AI methods, such as computer vision and machine learning. I think there will be amazing opportunities for scoring specimens for various morphological characters in the very near future.

What advice could you give for early career members to be successful in herbarium careers?

Working with collections is incredibly rewarding: being part of a continuous history of collecting, curating, and using specimens connects us with botanists past, present, and future. I think the herbarium community provides support across career stages, and I encourage early-career herbarium workers to connect with others to help achieve their goals (Fig. 2).

Are there any unique advantages or difficulties faced by current early career herbarium professionals that are different from when you started working in collections?

I think digitization provides huge advantages to the herbarium community compared with a couple of decades ago. There is greater financial support for collections now than there has been in quite some time, and there is greater recognition of the value of collections for biodiversity science and conservation than there has been in a very long time. At the same time, digitization can be its own worst enemy: some institutions have gotten the idea that with collections digitized, the physical specimens are no longer needed. Fortunately, that viewpoint is in the minority, but the need to advocate for collections continues.



Figure 2: Pam and Doug Soltis with *Welwitschia mirabilis* Hook.f. in Namibia (Photo credit: Jim Leebens-Mack).

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

The constant need to advocate for the resources to support herbaria presents challenges that are not necessarily addressed in grad school/post-docs. How does one share the value of collections with administrators? There are plenty of examples of chairs and deans becoming supportive of collections once they know more about them, but we often hear more about the opposite, where collections are underappreciated and undervalued. Certainly, the time needed to manage a collection is not often appreciated by either the faculty/staff member, and there is often a tension between the needs of the collection and the desire and pressure to conduct research, so time management can be a big challenge. It is therefore important to work closely with one's supervisor to ensure that expectations are clear.

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

We teach DNA extraction to elementary school students, host digitization events, set up microscopes to examine specimens, and offer a range of crafts related to pressed plants.

What are some ways herbarium staff can promote and advocate for their collections?

This is related to my comments above. One approach is to bond with other collections on campus, if there are any. Many of the challenges and opportunities faced by herbaria are similar to those of animal museums, entomological collections, anthropological collections, etc., so there may be opportunities for strength in numbers. Make sure to invite your administrators for a visit so that they can see the herbarium as not a place to store dead plants but as a thriving center of research, education, and workforce training. Using herbarium resources in teaching can also strengthen the support, and make sure to involve ecologists and not just those teaching taxonomy, local flora, etc. Community support, based on outreach activities, can also help.



What is the one most important thing that an herbarium does?

Herbaria are at the center of so many important research, training, and outreach activities that it's really hard to identify the single most important role. Probably providing a record of which plants occur where is the most important thing because it is the foundation for so many of the other roles.

Figure 3: Pam climbing a huge dune in Namibia (Photo credit: Doug Soltis).

What is the most exciting thing about the future of herbaria?

I think the most exciting thing is the breadth of unanticipated uses for herbarium specimens. For example, who could have predicted a century ago that specimens could be such an excellent source of DNA, keeping in mind that a century ago it wasn't known that DNA was the hereditary material?

How can early career members best prepare for the future of herbaria?

Herbaria are the foundation of all plant science and also offer exciting new opportunities in genomics and AI methods, so becoming familiar with the history of herbaria and new applications using specimens will be excellent preparation for the future.



Figure 3: Pam was selected 2023 Professor of the Year in the Southeastern Conference and is shown here at the SEC Awards Ceremony in Miramar Beach, FL (Photo credit: D. Soltis).

Early Career Advice is a regular feature of *The Vasculum*. This article was collected by SHC-Early Career section member Garrett Goodrich. If you have questions you would like to ask or if there is someone you would like to see interviewed, please contact the Early Career Section (earlycareer@herbariumcurators.org).



The Australian National Herbarium (CANB)

Introduction

The Australian National Herbarium (CANB), is one of eight major State and Territory herbaria in Australia. The Herbarium is managed as part of the Centre for Australian National Biodiversity Research (CANBR), a joint venture between the Director of National Parks (on behalf of the Australian National Botanic Gardens, ANBG), in the federal government's Department of Climate Change, Energy, the Environment and Water (DCCEEW, formerly the Department of the Environment) and the Commonwealth Scientific Research Organisation (CSIRO), with funding and staff drawn from both parent organisations. This model is similar to the management structure of the Australian Tropical Herbarium (CNS) in Cairns, Queensland, with which the Australian National Herbarium is closely aligned.

The Australian National Herbarium is located on two sites in the central district of the capital city of Australia, Canberra. The majority of collections (vascular plants) are held in the CSIRO Black Mountain Science and Innovation Park site, with the Herbarium's non-vascular and vascular cryptogam collections housed at the Australian National Botanic Gardens, adjacent to the CSIRO site, for reasons outlined elsewhere in this article. Both sites are in the suburb of Acton, at the foot of a large area of urban bushland, Black Mountain Nature Reserve.

Scope and size of the collections

The Australian National Herbarium has a world-wide scope, with an Australasian, and particularly Australian, focus. Material from Australia, its oceanic territories, and adjacent landmasses, especially the island of New Guinea and the Malesian region comprises the majority of the collection (e.g. Figs. 1–3), with a broad representation from all other areas of the world including Antarctica.

Figure 1: Holotype of *Nicotiana simulans* N.T.Burb. (Solanaceae), CANB 34991, from between Mount Willoughby and Mabel Creek, South Australia, collected by Nancy Burbidge and Max Gray, 10 October 1955. This specimen formed part of a revision of the genus *Nicotiana* L. in Australia by Burbidge (1960), as part of research into disease resistance in commercial tobacco in Australia by CSIRO at the time. (Photo credit: Australian National Herbarium).



Non-Australian material is primarily obtained through specimen exchange, although significant holdings from Papua New Guinea (PNG) were collected by CSIRO staff during land survey work undertaken in the 1950s, 1960s and the early 1970s (see Keig et al. 2019), at which time PNG was an Australian dependency, the Territory of New Guinea. All groups are represented, except diatoms, and algal and fungal collections are small in relation to the remainder of the collection. Current holdings are approximately one million vascular specimens, and c. 250,000 non-vascular specimens, with approximately 70% of the collection of Australian origin. Ancillary collections include ethanol-preserved material (c. 25,000 accessions, mostly linked to sheet material) and the Dadswell Memorial Wood Collection, a collection of c. 45,000 wood block and other wood samples, which is currently inaccessible in long-term off-site storage, due to space constraints. A smaller number of wood blocks are held as ancillary items for sheet material, almost all from Papua New Guinea, and are accessible and available for study.

History of the Australian National Herbarium

The institution now known as the Australian National Herbarium was founded in 1930, as part of the Division of Plant Industry in the forerunner to what would become CSIRO, the Council for Scientific and Industrial Research (CSIR). The Herbarium was primarily developed as a reference collection for the activities of the Division in Canberra, especially regarding the introduction of plants for agriculture, mostly through the Commonwealth Plant Introduction program, of which CSIR/CSIRO was a participant (Cook & Dias 2006).

The Australian National Herbarium holds large numbers of cultivated specimens, mainly grasses and legumes, collected from plant introduction trial plots on CSIRO land in Canberra during the 1930s and 1940s. These collections were mostly made by William Hartley, who had been appointed Junior Plant Introduction Officer with Plant Industry in 1930 (Anonymous 2024a), or other staff working in plant introduction at the time. It was not until 1946, with the pivotal appointment of Nancy Burbidge as Systematic Botanist (shortly thereafter, Curator), that the focus and activities of the Herbarium grew to include systematics and taxonomy, along with the existing agricultural and plant introduction work. Nancy's initial role was to provide a plant identification service for CSIR, but her role soon expanded to encompass taxonomic (e.g. Fig. 1), systematic and biogeographic research and development of the herbarium collection at a national scale. Nancy was to play a leading role in the development of modern plant systematics in Australia over the following three decades, prior to her death in 1977 (Chippendale 1993).



Figure 2: Specimen of *Guilandina bonduc* L. (= *Caesalpinia bonduc* (L.) Roxb.) (Fabaceae: Caesalpinioideae), CANB 141308, from Mongi Valley, N of Pindui, Huon, Peninsula, Papua New Guinea, collected by Ru Hoogland, 1 May 1964. This specimen exemplifies the high-quality specimens collected by members of CSIRO Division of Land Research staff as part of land survey work. High quality material, spread over three sheets (top sheet only illustrated here), capturing all available developmental stages, with comprehensive label data and multiple duplicates. (Photo credit: Australian National Herbarium)

Other Plant Industry Herbarium staff during the 1950s and 1960s were Max Gray, who joined the Herbarium as a Technical Officer in 1955, and Nancy's assistant, Edna D'Arney. Max collected extensively in south-eastern Australia, especially in the Canberra region and alpine areas of New South Wales, with a strong focus on the naturalised flora, and published several taxonomic and floristic works, including the Flora of the A.C.T. with Nancy (Burbidge & Gray 1970) and the Kosciusko Alpine Flora (Costin et al. 1979). Max and Nancy's collections formed an important part of the Plant Industry Herbarium, supplemented by the extensive collections of Hugh McKee (then employed by CSIRO, and who would later make substantial contributions to the botany of New Caledonia; Morat 1995), and a small number of other CSIRO Plant Industry staff.

Parallel to the development of the Herbarium at CSIR/CSIRO Plant Industry was the development of two other herbaria in Canberra, both of which would subsequently be amalgamated with the CSIRO Plant Industry collection. In 1946, CSIR commenced land survey work in northern Australia, establishing the Northern Australian Regional Survey Section. This section subsequently evolved into CSIRO's Land Research and Regional Survey Section in 1950, the Division of Land Research and Regional Survey in 1957, and the Division of Land Research in 1965. A reference collection for the northern Australian survey work was established by Rayden (Ray) Perry and Michael (Mike) Lazarides (see Nightingale et al. 2012) in 1949. In the early 1950s, survey work was extended to the Territory of New Guinea (Keig et al. 2019), and in 1952, Dutch-born botanist Ru Hoogland (see Craven 1995; Leenhouts 1995) was appointed as the leader of the plant taxonomy group within the Division. Hoogland's appointment was to prove highly influential, not only in improving collecting and curatorial procedures and standards, but also through the development of an extensive botanical library (as a component of CSIRO's library collections), including many rare and historical works, as well as the appointment of additional staff.

With Hoogland's appointment, and the continuing survey work both in Australian and New Guinea, the reference collection established by Perry and Lazarides grew into a significant herbarium in its own right, with extensive collections made by survey team staff from northern and south-eastern Australia and the island of New Guinea. Non-Australian (especially New Guinea) holdings were supplemented particularly by exchange from the National Herbarium of the Netherlands (L; Leiden, Netherlands), with extensive collections from the western part of the island, historically administered as a Dutch territory until 1962, and adjacent areas of Malaysia. The botanical staff complement of the land survey teams also expanded significantly during this time,



Figure 3: *Heterodermia violostriata* Elix (Physciaceae), CANB 807568, from Mt Hyland Reserve, 20 km N of Hernani, New South Wales, collected by Jack Elix, 30 April 2005. This specimen is part of the extensive lichen collection at CANB, a sizeable proportion of which were collected by lichenologist and former Australian National University Professor of Chemistry, Jack Elix. (Photo credit: Australian National Herbarium).

with the appointment of several individuals who, along with existing staff of the Division, would subsequently make important contributions to Australian taxonomic and systematic botany, both as collectors and researchers, among them Lyn Craven (see Lepschi et al. 2014), Roy Pullen, and Dick Schodde, as well as several others. Collections made by land survey staff of the Division of Land Research in its various guises during the 1950s-1970s are among the highest quality herbarium specimens anywhere in the world. Large, ample sheets, well preserved and beautifully presented with key features present, often accompanied by supplementary material such as ethanol or wood blocks, detailed label data, and (almost invariably) multiple duplicates (fig. 2). These collections are a testament to Hoogland's leadership, and the staff of the survey teams and their skills as field botanists.

The herbaria of CSIRO's Plant Industry and the Division of Land Research remained separate entities until 1968, at which time the decision was made to amalgamate the collections and associated staff under the auspices of Plant Industry. Amalgamation was completed by 1973. In 1975, the combined Herbarium was formally gazetted as 'Herbarium Australiense'. The herbaria of the Commonwealth Forest Research Institute, based in Canberra (FRI) and Atherton (QRS), also became components of Herbarium Australiense without physical amalgamation at the time. FRI comprised material of economically important forestry species, mainly *Eucalyptus* L'Hér. species, including vouchers for seedlots maintained by the Australian Tree Seed Centre, established as part of the Forest Research Institute in 1962. QRS focused on the flora of tropical north Queensland, especially forest trees, and eventually became part of the Australian Tropical Herbarium (with the new Herbarium code of CNS), established in 2008.

Nancy Burbidge stepped down from her role as Herbarium Curator in 1973, to concentrate on the establishment of a proposed Flora of Australia, which commenced under the auspices of the federal agency the Australian Biological Resources Study (ABRS), also established in 1973. Burbidge was succeeded as Curator by Hansjörg Eichler (see Orchard 1995; Robertson 1993), formerly Keeper of the State Herbarium of South Australia. Eichler retired from his role 1981, and was succeeded by Bryan Barlow, who implemented another name change, this time to the 'Australian National Herbarium' in 1984. Barlow stepped down in 1989, with Judy West appointed as Director of the Australian National Herbarium in the same year.

In 1984, further restructuring within CSIRO saw the herbarium of the Forest Research Institute physically amalgamated with the Australian National Herbarium, following its administrative amalgamation just over a decade prior. Seedlot vouchers for the Australian Tree Seed Centre continued to be collected by Seed Centre staff and were sometimes deposited with the Australian National Herbarium, along with other collections made by staff of CSIRO's forestry Division in its various forms prior to the cessation of forestry research by CSIRO in 2008. Post-2008, Australian Tree Seed Centre seedlot vouchers continue to be added to the Australian National Herbarium.

Since its founding in 1930, the Australian National Herbarium occupied various (and at times several) buildings on the CSIRO Black Mountain site, until the construction of a purpose-built herbarium building in 1974. However, by the mid-1980s the Herbarium had outgrown this building and staff and collections were housed in additional buildings on the site. An extension to the Herbarium was completed in 1994 (fig. 4), coinciding with the merger between the Australian National Herbarium and the Australian National Botanic Gardens Herbarium (CBG). CBG was founded to support the activities of the Gardens, and despite being physically located close to the Australian National Herbarium (separated by approximately 700 m), the two herbaria and their staff operated independently of one another for several decades.

During early postwar development of the city of Canberra, the Department of Interior oversaw the development of amenity and other plantings throughout the city, including the establishment of a botanic garden, the



Figure 4: The Australian National Herbarium building on the CSIRO site, housing CANB vascular collections. Pictured is the extension constructed in 1994. The earlier wing built in 1974 is to the rear left of this building and is not visible in this image. (Photo credit: Murray Fagg).

Canberra Botanic Gardens (founded in 1949, later renamed the National Botanic Gardens in 1978, and the Australian National Botanic Gardens in 1984), under the direction of Lindsay Pryor, Director of Parks and Gardens. Erwin Gauba (see Beer 2024) was appointed (Temporary) Botanist for the Department of Interior in 1950, mainly for the Canberra Botanic Gardens, and together with Pryor, amassed a substantial herbarium, much of which was later transferred to form the herbarium of the Canberra University College (later the Australian National University), GAUBA, following Pryor's appointment as Foundation Professor of Botany at the Australian National University in 1958. Some c. 700 specimens remained at the Canberra Botanic Gardens and formed the basis for CBG. Gauba left the Department of Interior to join Pryor at the University as a part-time lecturer in 1960 and was succeeded at CBG by Marie Elizabeth (Betty) Phillips (see Anonymous 2024b). Phillips was largely responsible for a major acceleration in the development of the CBG herbarium and for devising a rigorous cross-referencing system tying the living collections to vouchers in the herbarium. She collected widely, both for living collections and herbarium purposes, in southern, eastern, and western Australia. Phillips resigned from the Gardens in December 1973 and was succeeded by Arthur Court (Anonymous 2024c) in January 1974, with Bob Makinson assuming the role of Curator of CBG in 1991, following Court's retirement.

The existence of two national herbaria virtually side-by-side continued until 1993, when negotiations between the then Australian National Parks and Wildlife Service (parent organisation of the Australian National Botanic Gardens) and CSIRO led to the eventual merger of CBG and CANB, as part of the Centre for Plant Biodiversity Research (later renamed the Centre for Australian National Biodiversity Research in 2010), a joint venture

between the parent organisations of the two herbaria. The establishment of the Centre saw the bringing together not only of the collections of the two herbaria, but also staff, an arrangement that continues to the present day. The herbarium code for the merged institution is CANB, although specimens originally from CBG continue to be cited as CBG in internal databases and in publications.

The physical merger of the CBG and CANB collections took place during 1994 and 1995. Unfortunately, while an extension to the existing Herbarium building on the CSIRO site was planned and completed immediately prior to the decision to merge the two collections, the newly extended building was insufficient to house the expanded collection. Accordingly, vascular and non-vascular cryptogam collections were retained or moved to the former CBG building on the Australian National Botanic Gardens site (Fig. 5), with vascular plants located in the newly extended Herbarium building on the CSIRO site (Fig. 4). Staff roles were largely maintained following the merger, with Judy West assuming the role of Director of the Centre, and Bob Makinson as Curator of the Australian National Herbarium. Makinson resigned from this role in 2002 to accept a position at the National Herbarium of New South Wales (NSW), at which time Brendan Lepschi commenced as Curator, and remains in that role at the time of writing.



Figure 5: The Australian National Herbarium building on the ANBG site, constructed in 1974, housing CANB non-vascular collections. The Australian National Botanic Gardens Herbarium (CBG) formerly occupied other buildings on this site, as well as elsewhere in Canberra, prior to its amalgamation with CANB in 1994. The building to the left houses the ANBG Library, as well as horticultural and scientific staff of the Gardens. (Photo credit: Murray Fagg).

Databasing of the holdings of CBG and CANB commenced concurrently, during c.1986–1987, with databasing activity receiving a major boost as part of coordinated data capture across Australian herbaria as part of the Australia's Virtual Herbarium (AVH) project in the early 2000s. In-house databasing has continued since that time, with approximately 90% of the collection databased, including all Australian material. Undatabased accessioned material comprises mostly non-Australian material, although a sizeable portion of New Guinea material has been databased. Most of the Australian National Herbarium collection (c. 1.1 million specimens) has also been digitally imaged, through services provided by Picturae and funded by CSIRO and DCCEEW, supplemented by in-house digitisation, which is ongoing. Access to digital images of Australian National Herbarium specimens is currently through CSIRO's Data Access Portal (DAP, <https://data.csiro.au/domain/nrca>), with access via Australia's Virtual Herbarium planned for the near future. Note that at the time of writing only c. 10% of Australian National Herbarium images have been error checked and are available through the DAP, with more added every day. Images that are not available via the DAP can be requested by contacting the Curator (see CANB *Index Herbariorum* entry). Label data for Australian National Herbarium specimens is available via the Australian National Botanic Gardens (<https://www.cpbr.gov.au/cgi-bin/herb-detail>) and through Australia's Virtual Herbarium (<https://avh.chah.org.au/>).

Other recent important curatorial activity at the Australian National Herbarium has included the physical curation and databasing of ethanol-preserved material, prior to its relocation to the newly constructed Diversity building, recently (2024) completed adjacent to the existing herbarium. Diversity houses the staff and collections of two of the Herbarium's sister collections within CSIRO's National Research Collections Australia, the Australian National Insect Collection, and the Australian National Wildlife Collection. Ethanol holdings of all three collections will be co-located in purpose-built storage vaults within that building. Additional staff resources to complete this work have been available as part of relocation works from 2020 onwards. Curatorial work in this collection has included replacing often deteriorating containers (jars) with new, standardised containers, replacement of preservative (e.g., removal of FAA), improved labelling, development of new storage trays, and reorganisation of the collection from a taxonomic system to a numerical one.

The Australian National Herbarium is a founding member and active participant of both the Council of Heads of Australasian Herbaria (CHAH) and the Managers of Australasian Herbarium Collections (MAHC).

Important collections

The Australian National Herbarium includes extensive collections from Australia and Papua New Guinea, mostly from the middle decades of the 20th Century onwards. Lichens (Fig. 3), bryophytes, Myrtaceae (especially tribe Eucalypteae) and Orchidaceae are particularly well represented, with extensive ethanol-preserved collections of Orchidaceae also prominent. Important collectors and their collections represented include L.J. Brass (Australia and New Guinea), M.I.H. Brooker (Australia, *Eucalyptus* and related genera), R. Brown (historical collections, many types), N.T. Burbidge (Australia), C.E. Carr (New Guinea), L.A. Craven (Australia and New Guinea), J.R. Croft (New Guinea), J.A. Elix (Australia, lichens), T.G. Hartley (New Guinea), R.D. Hoogland (Australia and New Guinea), M. Lazarides (Australia), C.W.E. Moore (Australia), M.E. Phillips (Australia), R. Pullen (Australia and New Guinea), R. Schodde (Australia and New Guinea) and H. Streimann (Australia and New Guinea, particularly bryophytes).

Type material

The Australian National Herbarium holds approximately 10,500 type specimens, primarily from Australia and New Guinea, particularly for taxa described from the mid-20th Century onwards, although several historical types are also held, chief among these taxa described by Robert Brown. All types have been imaged, and are available either through JSTOR Global Plants, CSIRO's Data Access Portal, or by request to the Curator (see CANB *Index Herbariorum* entry).

Traineeship and Volunteer Programs

The Australian National Herbarium runs two outreach and training programs. The Volunteer Mounting Program is an essential component of the Herbarium, and is managed by a Volunteer Coordinator, who oversees a diverse team of volunteers of all ages, abilities, and backgrounds. The volunteer mounters are responsible for all specimen mounting across the collections, as well as repair/re-mounting and other selected curatorial tasks, such as replacement of old or damaged specimen flimsies (the protective paper folder around each specimen, as distinct from the thicker card taxon folders which group several specimens together in the collection), bulk flimsy annotations, etc. At present, the Volunteer Mounting Program has between 10 and 15 participants. The Herbarium also runs the Volunteer Botanical Training Program (VBTP), now in its 32nd year of operation. The VBTP is primarily aimed at undergraduate university students studying botany, environmental science, or related fields, although graduates and non-students with suitable skills are also encouraged to participate, via an application review process based on academic results and interest. The program is designed to allow participants the opportunity for scientific work experience in the Herbarium and Centre. Participants assist with various work areas and receive both task-specific training and general botanical training. A certificate of participation and a personal employment reference are supplied upon completion of the Program and many universities in Australia recognise participation as a credited academic unit.

The Program runs for seven weeks full-time over January and February each year. Post-COVID, the Program has moved from an entirely in-person model based at the Australian National Herbarium, to a hybrid model, with online sessions in the first part of the Program and in-person sessions in the latter part, including local field trips. Other Australian herbaria have also hosted participants in-house for the duration of the Program, in a limited collaborative model which has proven successful for participants unable to travel to Canberra for the duration of the Program.

Since its inception in 1993, a total of 391 individuals from 61 institutions have participated in and completed the Program.

Staff and Research

The unique nature of the joint venture Centre for Australian National Biodiversity Research means that Herbarium staff are drawn from both parent bodies, CSIRO and DCCEEW, with CSIRO as the administrative host. Staff from both organisations work closely and seamlessly together, and staff from either organisation may have supervisory responsibility for those from the other. Internal management structure reflects institutional priorities across both organisations, with considerable interaction, research collaboration and support from other areas within CSIRO and DCCEEW, particularly in relation to digital activities (e.g., imaging, data management and manipulation, application of artificial intelligence and machine learning, etc). The Australian National Herbarium also has strong links to the living collections of the Australian National Botanic Gardens, through housing of vouchers for living plants at the ANBG, as well as the Australian National Seedbank, the Australian Plant Image Index, and the activities of a dedicated position, the Identifications and Living Collections Botanist. The Herbarium also manages the Australian Plant Name Index (APNI) and the Australian Plant Census (APC) on behalf of the Council of Heads of Australasian Herbaria as part of the National Species List (Cooper 2023).

The Curation and Collections management team (the Herbarium sens. str.), led by Brendan Lepschi, is responsible for the management and development of the Herbarium collection, and currently comprises thirteen staff, undertaking a range of activities, including curation, databasing, imaging, loans and exchange, destructive sampling, mounting and management of outreach program (the Volunteer Mounting and Volunteer Botanical Training Programs), and taxonomic research. Other research activity in the Herbarium is undertaken by staff of the two research teams of the Centre, along with the Centre's Bioinformatics team. Current taxo

onomic research activity in the Herbarium includes revisionary studies in both vascular groups (e.g., Asteraceae (various genera, primarily within tribe Gnaphalieae), *Dampiera* R.Br. and *Goodenia* Sm. (Goodeniaceae), *Kennedia* Vent. (Fabaceae), *Melaleuca* L. (Myrtaceae), *Melichrus* R.Br. (Ericaceae), various genera in the Orchidaceae, *Pleioluma* (Baill.) Baehni (Sapotaceae) and *Ptilotus* R.Br. (Amaranthaceae)) and non-vascular groups (e.g., *Asterella* P.Beauv. (Aytoniaceae), *Fossombronia* Raddi (Fossombroniaceae), hornworts (various genera), *Riccia* L. (Ricciaceae), and Verrucariaceae (various genera).

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