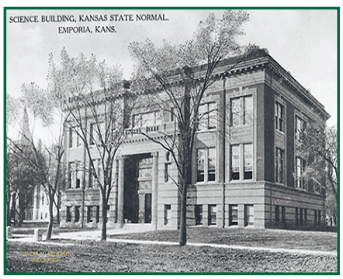
PLANT SCIENCE BULLETIN

SUMMER 2023 VOLUME 69 NUMBER 2

A PUBLICATION OF THE BOTANICAL SOCIETY OF AMERICA

IN THIS ISSUE...

Travels in Tanzania with North American Undergraduates: A Botanical Safari...p. 114



155 Years of Botany at Emporia State University: A Case Study of College Botany in the U.S.... p. 92

Meet the new student representative, Josh Felton! ... p. 141

FROM the EDITOR

Greetings,

It's summer in Omaha, which means college baseball games, afternoon thunderstorms, and incoming undergraduate advising. At my institution, at least, it is rare to find a first-year student who knows they want to pursue a career in botany. It can be a struggle to recruit and develop potential young botanists and the landscape for botanical education has certainly undergone significant changes. In this issue, you will find a case study of Botany as a discipline at Emporia State University that discusses some of these challenges and changes, both historical and recent. We also include an article describing a travel course which seeks to introduce botany to students who are more focused on zoology. In this summer issue, you will also find resources that may be helpful for navigating Botany 2023.

I hope to see many of you there!

Sincerely,

Mackenzie

TABLE OF CONTENTS

Logo designed by Johanne Stogran
Background image credit: Xiao-Xue Mo and Lian-Bin Tao

Botanical Society of America's Award Winners (Part 1)

BSA Emerging Leader Award

The Emerging Leader Award of the Botanical Society of America is given annually in recognition of creative and influential scholarship as well as impact in any area of botany reflecting the breadth of BSA. Awardees have outstanding accomplishments and also have demonstrated exceptional promise for future accomplishments in basic research, education, public policy, exceptional service to the professional botanical community, or a combination of these categories.

DR. JOYCE G. ONYENEDUM

CORNELL UNIVERSITY

Dr. Joyce Onyenedum is currently Assistant Professor of Plant Evolution in the Liberty Hyde Bailey Hortorium at Cornell University. She earned a bachelor's degree in plant sciences from Cornell and a doctorate in integrative biology from the University of California, Berkeley. The fundamental question driving her research is understanding how plants climb. She studies patterns through classical plant anatomy, morphology, molecular systematics, and statistical phylogenetic comparative methods; she complements these findings with an understanding of the developmental, cell, and molecular processes that shape the climbing habit in disparate lineages. This integrative approach allows her to link macroevolutionary patterns to fine-scale mechanistic processes, thus uncovering the evolution of development (evo-devo) of climbing plants.

Charles Edwin Bessey Teaching Award

(BSA in association with the Teaching Section and Education Committee)

Dr. Cynthia Jones, University of Connecticut
Dr. Eddie Watkins, Colgate University

Donald R. Kaplan Memorial Lecture

This award was created to promote research in plant comparative morphology, the Kaplan family has established an endowed fund, administered through the Botanical Society of America, to support the Ph.D. research of graduate students in this area.

Erika Edwards, Yale University

The Grady L. and Barbara D. Webster Structural Botany Publication Award

This award was established in 2006 by Dr. Barbara D. Webster, Grady's wife, and Dr. Susan V. Webster, his daughter, to honor the life and work of Dr. Grady L. Webster. After Barbara's passing in 2018, the award was renamed to recognize her contributions to this field of study. The American Society of Plant Taxonomists and the Botanical Society of America are pleased to join together in honoring both Grady and Barbara Webster. In odd years, the BSA gives out this award and in even years, the award is provided by the ASPT.

Alberto Echeverría, Emilio Petrone-Mendoza, Alí Segovia-Rivas, Víctor A. Figueroa-Abundiz, and Mark E. Olson
The vessel wall thickness–vessel diameter relationship across woody angiosperms
American Journal of Botany, April 2022 109: 856-873

The BSA Developing Nations Travel Grants

Rafael Acuña-Castillo, Universidad de Costa Rica, Costa Rica

Tami C. Cacossi, UNICAMP, Brazil

Idowu Obisesan, Bowen University Iwo, Nigeria

Malka Saba, Quaid-i-Azam University, Islamabad, Pakistan

Jayani Wathukarage, Department of Agriculture, Sri Lanka and University of the Philippines, Diliman

The BSA Professional Member Travel Grants

Ana Andruchow-Colombo, University of Kansas

Nina Baghai-Riding, Delta State University

Israel L. Cunha Neto, Cornell University

Jessamine Finch, Native Plant Trust & Framingham State University

Julia Gerasimova, Senckenberg Research Institute and Natural History Museum Frankfurt

Margaret Hanes, Eastern Michigan University

Adriana I. Hernandez, California Academy of Sciences

Pankaj Kumar Ph.D., FLS, Texas Tech University, Department of Plant and Soil Science

Francesco Martini, Trinity College Dublin

Elizabeth McCarthy, SUNY Cortland

BSA Public Policy Award

The Public Policy Award was established in 2012 to support the development of tomorrow's leaders and a better understanding of this critical area.

Katherine T. Charton, University of Wisconsin-Madison

Lauren M. Orton, Sauk Valley Community College

Botanical Advocacy and Service Grant

This award organized by the Environmental and Public Policy Committees of BSA and ASPT aims to support local efforts that contribute to shaping public policy on issues relevant to plant sciences. To learn more about the winning projects, go to https://botany.org/home/awards/special-funds-and-awards/botany-advocacy-leadership-grant.html.

Zeta Phi Beta Sorority, Inc State of Hawaii/New Mexico State Social Action Coordinator:
Maya L. Shamsid-Deen
For the proposal: Zeta Day at City Council: Social Action for Integrative Botanical Education, Access to Land, & Food Sovereignty

AWARDS FOR ESTABLISHED SCIENTISTS GIVEN BY THE SECTIONS

Samuel Noel Postlethwait Award (Teaching Section)

The Samuel Noel Postlethwait Award is given for outstanding service to the BSA Teaching Section.

Janelle M. Burke, Howard University

AWARDS FOR EARLY CAREER SCIENTISTS

AJB Synthesis Papers and Prize

The AJB *Synthesis Prize is intended to showcase early-career scientists and to highlight their unique perspectives on a research area or question, summarizing recent work and providing new insights that advance the field. The Prize comes with a $2000 award and recognition at the BSA Awards Ceremony at the Botany Conference. This is the first year of this award.*

Dr. Liming Cai, University of Texas at Austin, for her article "Rethinking convergence in plant parasitism through the lens of molecular and population genetic processes," 2023, *AJB* 110: e16174. (To read more about Dr. Cai, see the Publications Corner article in this issue.)

AWARDS FOR STUDENTS

Donald R. Kaplan Dissertation Award in Comparative Morphology

This award was created to promote research in plant comparative morphology, the Kaplan family has established an endowed fund, administered through the Botanical Society of America, to support the Ph.D. research of graduate students in this area.

Haylee Nedblake, University of Kansas
For the Proposal: Evolution of bee-exclusionary corolla width differences in Penstemon

Graduate Student Dissertation Award in Phylogenetic Comparative Plant Biology

This award supports the Ph.D. research of graduate students in the area of comparative plant biology, broadly speaking, from genome to whole organism. To learn more about this award click here.

Zachary Muscavitch, University of Connecticut
For the Proposal: The evolutionary dynamics of fog lichen symbionts: going global

The BSA Graduate Student Research Award including the J. S. Karling Award

The BSA Graduate Student Research Awards support graduate student research and are made on the basis of research proposals and letters of recommendations. Within the award group is the Karling Graduate Student Research Award. This award was instituted by the Society in 1997 with funds derived through a generous gift from the estate of the eminent mycologist, John Sidney Karling (1897-1994), and supports and promotes graduate student research in the botanical sciences.

The J. S. Karling Graduate Student Research Award

Jordan Argrett, University of Georgia
For the Proposal: Stealing from the rich to give to the poor: Are hemiparasitic plants the "Robinhood" of sub-alpine communities?

The BSA Graduate Student Research Awards

Anna Becker, University of Florida
For the Proposal: The evolution of Hawaiian blueberries

Akriti Bhattarai, University of Connecticut
For the Proposal: Exploring the genetic mechanisms of white pine blister rust disease resistance in whitebark pine (*Pinus albicaulis*) and Siberian pine (*P. sibirica*)

Ryan Carlson, University of Minnesota Duluth
For the Proposal: Resolving euphrasia taxonomy in Minnesota

Brendan Connolly, Northwestern University and The Chicago Botanic Garden
For the Proposal: Not all pollinators are created equal: The effects of differences in pollination efficiency on plant genetic diversity and reproductive success

Alexander Damian-Parizaca, University of Wisconsin-Madison
For the Proposal: Evolution, Taxonomy and pollination of New World Vanilla (Orchidaceae)

Anthony Dant, University of Arizona
For the Proposal: Beyond sidewalks: using a dynamic urban classification system to study the evolution of an invasive plant

Melissa Duda, Northwestern University
For the Proposal: Using reproductive biology and ecological niche models to predict the potential impact of hybridization in rare species

Caroline Edwards, Indiana University
For the Proposal: The spatial scale and environmental drivers of local adaptation in *Viola pubescens*

Emma Fetterly, Northwestern University and the Chicago Botanic Garden
For the Proposal: Understanding biotic and abiotic drivers of floral color polymorphism in *Castilleja coccinea* to inform restoration in a changing climate

Clayton W. Hale, University of Georgia
For the Proposal: Left in the shade: understanding the impacts of phenological mismatch between overstory leaf out and understory herbs

Brooke Kern, University of Minnesota
For the Proposal: Is low hybrid fitness driving selection for increased reproductive isolation between *Clarkia xantiana* subspecies?

Ashmita Khanal, Texas Tech University
For the Proposal: Unravelling the genetic basis of sex chromosome evolution in Black Willows (*Salix nigra* Marshall)

Izai Kikuchi, University of British Columbia
For the Proposal: Reconstructing the evolution of mycoheterotrophy in Gentianaceae and Dioscoreales using nuclear phylogenomics

G Young Kim, University of Connecticut
For the Proposal: Facultative CAM (Crassulacean Acid Metabolism) photosynthesis in Native Hawaiian Peperomia

Kira Lindelof, North Carolina State University
For the Proposal: Applied conservation genetics: GBS and building a genetic inventory for the recovery of *Houstonia montana*, an imperiled high-elevation, southern Appalachian endemic

Amee Maurice, University of Connecticut
For the Proposal: Molecular mechanisms of white pine blister rust disease resistance among the threatened whitebark pines

Hannah McConnell, University of Washington
For the Proposal: Using the model fern *Ceratopteris richardii* to investigate genes regulated by LEAFY orthologs

María de Jesús Méndez Aguilar, Autonomous University of Yucatan
For the Proposal: Populational structure of the traditional Chaya (*Cnidoscolus aconitifolius*, Euphorbiaceae) used by Mayan communities in the Yucatan Peninsula, Mexico

Thomas H. Murphy, University of Florida
For the Proposal: Linking morphological and niche evolution in a ubiquitous neotropical climber

Rodrigo Nicolao, Universidade Federal de Pelotas
For the Proposal: The role of hybridization in the evolution of the Southeastern South American wild potatoes (*Solanum* ser. *Commersoniana*, Solanaceae)

Diego Paredes-Burneo, Louisiana State University
For the Proposal: The role of the Amotape-Huancabamba zone on the diversification of the high-Andean flora: a case study of the genus *Brachyotum* (Melastomataceae)

Seth J. Raynor, University of Colorado Boulder
For the Proposal: Lichens of the Indian Peaks Wilderness, towards a complete state inventory

Senna Robeson, University of Chicago
For the Proposal: Seeking the source of geographic range shifts in tarflowers (Bejaria, Ericaceae)

Katie Kobara Sanbonmatsu, Texas A&M University
For the Proposal: Phylogenetics and biogeography of Macromitrioideae (Orthotrichaceae): A diverse but understudied group of mosses

Parikrama Sapkota (Pari), University of Texas at El Paso
For the Proposal: Unraveling above-belowground interactions that support restoration of dryland plants communities

Rory Schiafo, Northwestern University and Chicago Botanic Garden
For the Proposal: Understanding the role of light availability and species' characteristics for driving priority effects in oak woodland plant communities

Rachel Tageant, Claremont Graduate University
For the Proposal: A floristic inventory of the Owens River Headwater Area, Mono County, CA

Rina Talaba, Northwestern University
For the Proposal: Investigating the differences of *Cirsium pitcheri*'s floral scent according to the predation of novel weevil, *Larinus planus*

Daniel Tucker, University of Victoria
For the Proposal: Magic carpets of the canopy: the role of epiphytic bryophyte functional structure in driving hydrologic ecosystem processes in a tropical montane cloud forest

Selena Vengco, Claremont Graduate University
For the Proposal: Conservation genetics and the maintenance of flower color polymorphisms in a non-model system of Erythranthe discolor (Phrymaceae)

Mari Wilson, University of British Columbia
For the Proposal: Comparative transcriptomic analysis of mycoheterotrophy in fern gametophytes

The BSA Undergraduate Student Research Awards

The BSA Undergraduate Student Research Awards support undergraduate student research and are made on the basis of research proposals and letters of recommendation.

Melanie Beaudin, Carleton University
For the Proposal: Genetic diversity and population structure of a disjunct Opuntia fragilis population

Max Gray, University of British Columbia
For the Proposal: Testing the pervasiveness of MITE-induced apomixis in Asteraceae

Kaitlin Henry, Bucknell University
For the Proposal: Chemical analysis of extrafloral nectar in western Australian *Solanum tudununggae* (Solanaceae) to explore possible ant-plant relationships

Jonathan Le, University of California, Irvine
For the Proposal: Mapping nutrient localization throughout *Drosera capens*is digestion using MALDI-MSI

Samuel Monger, Auburn University in Montgomery
For the Proposal: Identification of kudzu-associated soil microbes - a first step towards developing more successful restoration techniques

Zach Smith, University of Wisconsin-Madison
For the Proposal: Morphological and physiological adaptation in an ancient plant lineage

The BSA Young Botanist Awards

The purpose of these awards is to offer individual recognition to outstanding graduating seniors in the plant sciences and to encourage their participation in the Botanical Society of America.

Fae Bramblepelt, The University of Alabama, Advisor: Michael McKain

Gurleen Chana, University of Guelph, Advisor: Christina Caruso

Sam Fuss, Connecticut College, Advisor: Rachel Spicer

Erin Grady, Cal Poly, San Luis Obispo, Advisor: Natalie Love

Wolfgang Graff, Miami University, Advisor: Richard Moore

William Gregor, Miami University, Advisor: Richard Moore

Hanna Hickey, University of Guelph, Advisor: Christina Caruso

Ellie Hollo, Connecticut College, Advisor: Rachel Spicer

Megan Keyser, Miami University, Advisor: Richard Moore

Henry Lagasse, Trinity College, Advisor: Nikisha Patel

Claire Marino, Bucknell University, Advisor: Chris Martine and Tanisha Williams

Taylor Michael, Pittsburg State University, Advisor: Neil Snow

Aadia Moseley-McCloud, Howard University, Advisor: Janelle Burke

Celina Patiño, Weber State University, Advisor: James Cohen

Sam Pelletier, Connecticut College, Advisor: Rachel Spicer

Dominique Pham, University of Richmond, Advisor: Carrie Wu

Sierra Sattler, South Dakota State University, Advisor: Maribeth Latvis

Rachel Savage, South Dakota State University, Advisor: Maribeth Latvis

Madeline Wickers, Bucknell University, Advisor: Chris Martine and Tanisha Williams

Matthew Yamamoto, Connecticut College, Advisor: Rachel Spicer

Noah Yawn, Auburn University, Advisor: Robert Boyd

Diamanda Zizis, Bucknell University, Advisor: Chris Martine and Tanisha Williams

The BSA Student and PostDoc Travel Awards

Winners were selected by lottery

Sevyn Brothers

Claudenice H. Dalastra

Melissa A. Lehrer

Isabela Lima Borges

Carlos A. Maya-Lastra

Mason McNair

Erika R. Moore-Pollard

Megan Nibbelink

Zach Smith

Tengxiang Wang

Vernon I. Cheadle Student Travel Awards

(BSA in association with the Developmental and Structural Section)
*This award was named in honor of the memory and work of **Dr. Vernon I. Cheadle**.*

Arthur Leung, University of Toronto, Advisor: Rowan Sage
For the Presentation: Ultrastructural modifications facilitated the initial steps in the evolution of C4 photosynthesis in *Tribulus* (Zygophyllaceae)

Oluwatobi Adekunle Oso, Yale University, Advisor: Professor Erika Edwards
For the Presentation: Origin and distribution of leaf teeth in temperate woody angiosperm flora.

AWARDS FOR STUDENTS - GIVEN BY THE SECTIONS

Southeastern Section Student Presentation Awards

The following winners were selected from the Association of Southeastern Biologists meeting that took place at the end of March, 2023.

Southeastern Section Paper Presentation Award

Ben Brewer, Appalachian State University

Southeastern Section Poster Presentation Award

Elizabeth Companion, University of North Carolina Asheville

STUDENT TRAVEL AWARDS

Developmental & Structural Section Student Travel Awards

Yesenia Madrigal B., Universidad de Antioquia (Colombia), Advisor: Natalia Pabón-Mora
For the Presentation: Assessment of the flowering genetic regulatory network in tropical orchids with different lifeforms.

Deannah Neupert, Miami University, Advisor: Richard Moore
For the Presentation: The alteration to vegetative growth and gene expression supports the use of a novel aerial bulbil in *Mimulus gemmiparus* for reproduction.

Ecological Section Student Travel Awards

Annie E. Meeder, California Polytechnic University, Advisor: Dr. Jenn Yost, For the Presentation: Post-eradication transitions and dynamics of Santa Cruz Island vegetation communities.

Charlotte Miranda, San Jose State University, Advisor: Benjamin Carter
For the Presentation: Soil generalist Erysimum capitatum shows differential adaptation to serpentine soil of origin across a California latitudinal gradient

Shan Wong, Texas Tech University, Advisor: Jyotsna Sharma
For the Presentation: Disjunct populations of a hemi-epiphytic orchid (Vanilla trigonocarpa) show segregation of mycorrhizal niches.

Genetics Section Student Travel Awards

Samantha Drewry, University of Memphis, Advisor: Jennifer Mandel
For the Presentation: Conservation genetics in the endangered whorled sunflower Helianthus verticillatus (Asteraceae).

Elizabeth Uzezi Okinedo, University of Massachusetts Boston, Advisor: Brook Moyers
For the Presentation: Pleiotropy and adaptation in the silverleaf sunflower, Helianthus argophyllus

Primarily Undergraduate Institution (PUI) Faculty and Future Faculty Conference Awards

Sarah E. Allen, Penn State Altoona

Chloe Pak Drummond, Mount Holyoke College

Elizabeth McCarthy, SUNY Cortland

Angela McDonnell, St. Cloud State University

Angela Walczyk, Gustavus Adolphus College

Phytochemical Section Student Travel Awards

Abigail McCoy, State University of New York at Cortland, Advisor: Dr. Elizabeth McCarthy
For the Proposal: Relaxed purifying selection is observed in genes at the branches of the flavonoid biosynthetic pathway in Nicotiana species that do not produce anthocyanin compared to those that do. Co-authors: Jacob Landis, Elizabeth McCarthy

Pteridological Section & American Fern Society Student Travel Awards

Lacey E. Benson, San Jose State University, Advisor: Dr. Susan Lambrecht
For the Presentation: A morphometric analysis of western sword fern (*Polystichum munitum*) pinnae and pinnae scales across the coast redwood forest ecological gradient.

You-Wun Hwang, National Tsing Hua University, Advisor: Li-Yaung Kuo
For the Presentation: Frond dimorphism in *Tectaria* ferns: trends of their foliar characteristics and spore investment

2022—2023 Congressional Visits Day Remarks

Each year, the BSA Public Policy Committee awards two early-career botanists the opportunity to attend the American Institute of Biological Sciences' Congressional Visits Day. This event is hosted by the Biological and Ecological Sciences Coalition, and recipients obtain first-hand experience at the interface of science and public policy. The first day includes a half-day training session on science funding and how to effectively communicate with policymakers provided by AIBS. Participants then meet with their Congressional policymakers, during which they will advocate for federal support of scientific research. This article details the experiences of this year's recipients.

Eric Puetz

South Dakota State University

Biological life has always fascinated me for as long as I can remember. At a young age I was exposed to Native tallgrass prairie species of Eastern South Dakota. This landscape of rolling prairie is home to the "Coteau des Prairie" or "Prairie Coteau," as described by French explorers and the homeland of the Lakota Sioux. This region is located within one of the most endangered ecosystems on the planet, Northern Tallgrass prairie, with an estimated 2–14% of Native Tallgrass prairie remaining. Conservation policy is often intertwined with economic interests, and this is especially true in South Dakota, where tourism is a significant industry due to its many natural beauties, including the Black Hills, Badlands, and Missouri River. I am a strong believer that biological conservation of private and public lands is a matter of national security, and this is linked directly to public policy. As the impacts of climate change, geopolitical instability, hunger, and loss of ecosystem services threaten our world's growing population, conserving and investing in our "biodiversity infrastructure" will preserve our nation's ability to provide resources for future generations. To quote the late author and naturalist Aldo Leopold, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." Preserving ecosystem services in the face of climate change will require substantial investment in scientific research, public education, and advocacy.

In April 2022 I was a recipient of the 2022 Congressional Visits Day (CVD) Award and had the honor of representing the Botanical Society of America (BSA) and American Society of Plant Taxonomists (ASPT). Drawing on past hands-on experience and ongoing research training at South Dakota State University, I used my platform to advocate for $11 billion in appropriations for the National Science Foundation (NSF) in support of scientific research, public

education, and ecological conservation, using a practical, no-nonsense approach valued in South Dakota and the Midwest. The NSF's FY 2023 budget request consisted of six themes: climate and clean energy research, equity for underserved communities, discovery engine, emerging industries, research infrastructure, and organizational excellence agency operations/award management. This experience introduced me to the world of public policy and allowed me to develop communication and advocacy skills necessary for communicating with lawmakers. Despite the challenge of the COVID-19 pandemic and communicating virtually, this event opened my eyes to the advancements NSF funding provides in medicine, engineering, biological sciences, and technology we use every day.

This event, which began with a two-day communication bootcamp, allowed me to further build my communication skills and emphasized the importance of incorporating my personal story in advocating for increased NSF funding. Following the communications bootcamp, three constituents and I met with personnel from the offices of lawmakers from South Dakota: Rep. Johnson, Sen. Rounds, Sen. Thune; Montana: Rep. Rosendale, Sen. Daines, Sen. Tester; and Minnesota: Rep. Philips, Sen. Smith. Following the communication bootcamp, my team members and I formed a discussion plan of talking points in relation to our personal stories, which helped to form relationships during the short meetings with lawmakers' staff. Several memorable moments from these interactions include briefly speaking with Rep. Johnson, who had a few moments to listen to our message despite a busy schedule, and the breakthrough moments with lawmakers' staff where our message was truly being absorbed and the spark of a true connection was evident. Bipartisan cooperation during times of stark partisan political divide is vital to achieving legislative success. My team and I experienced strong bipartisan support from Democrat and Republican lawmakers alike, and during the fiscal year 2023 NSF funding was increased by 12% to $9.9 billion. I cherish the memories from this event, and having the opportunity to use my voice to advocate for scientific advancement was a profound experience.

LAUREN M. ORTON, PHD

Sauk Valley Community College

I am honored to be selected as a recipient of the 2023 Botanical Society of America's Public Policy Award. As an early-career Professor of Biology at Sauk Valley Community College in Dixon, Illinois, one of my passions is to advocate for STEM programs across the higher educational spectrum. The trip to Washington, DC, was an amazing opportunity to express the importance of science, not only from a research perspective, but also from the unique perspective of community college education. When we think of projects funded by the National Science Foundation (NSF), we can easily identify needs at research-based universities, independent and non-profit research organizations, and medical

institutions. However, community colleges and their diverse student bodies also benefit greatly from NSF-funded programs that provide research opportunities for 2- and 4-year undergraduate level students (Research Experience for Undergraduate student programs).

After arriving in our nation's capitol, I had some time to sightsee across the National Mall (one of my favorite places). Advocacy, throughout history, has found its voice on the Mall, and it is a great source of inspiration. The following day, our science communication bootcamp, hosted by the American Institute for Biological Sciences (AIBS), began at Southwestern Universities Research Association's downtown DC conference facility. Dr. Jyotsna Pandey of AIBS provided a wonderful bootcamp, and we began by learning about the pillars of communication and how to effectively share our message. Often, scientists are perceived as out of touch, and it can be a struggle to express a technical message in ways that resonate with our audience. Therefore, having Jyotsna's expertise in communicating with our lawmakers was an invaluable learning opportunity for me. With the tools we learned during the day, we were able to begin crafting a message that would be both informative and persuasive while presenting the needs of the scientific community through specific examples in support of our positions. Additionally, a panel of public policy experts joined us to speak about their careers on The Hill and with various federal organizations dedicated to crafting public policy. Their experience and advice were encouraging to those of us seeking to expand our involvement in science public policy.

That afternoon and continuing into the morning of the second day, we learned about the complexities of the federal budgeting process. Already having an understanding of organizational and municipal budgeting, I was amazed by the funding challenges that the federal government grapples with each fiscal year. Discretionary funding, which includes the NSF, is where we tend to hear of the sweeping cuts in favor of increasing funding in other areas. There is never an easy solution when it comes to the budgeting process.

With this knowledge in hand, I began to understand the approach to advocating for funding of the NSF, and how to go about effectively providing that information to our lawmakers. That second afternoon we worked with our assigned regional groups. As a Midwest resident, I was partnered with my fellow BSA Public Policy Awardee, Katherine Charton from the University of Wisconsin, Madison, and Dr. Rebecca Kauten of the Iowa Lakeside Laboratory and University of Iowa. I am so grateful to have been partnered with Katherine and Rebecca, who are not only wonderful colleagues, but passionate policy advocates as well! We worked together to craft a clear and concise message, and request funding of the NSF at or above the current level of $11.9 billion. Each team member spoke to their own strengths and elaborated on how NSF funding has positively impacted their careers. Whether it was discussing the concrete funding numbers and effect on STEM workforce percentages, speaking to the impact of NSF funding on the ability for small and university-independent research organizations to collect crucial data, or advocating for educational opportunities made possible by the NSF for underrepresented student groups and community college science programs, we devised a clear message for our

lawmakers. This message was that the NSF is the primary funding body for science, and each of us has seen or personally experienced the positive impact it provides—the NSF needs your support!

The Congressional Visits Day was an absolute whirlwind! Starting early in the morning, our Midwest team traveled to Capitol Hill where we had for our first meeting in Senator Ron Johnson's (R-WI) Hart Senate Building office. With Jyotsna present to lend her expertise, we spoke with members of Senator Johnson's staff and provided materials from AIBS to support our request to fund the NSF at $11.9 billion. Although the meeting was brief, it was informative and upbeat; also, despite the busy schedules of the congressional staff members, we were well received everywhere we went. We bounced back and forth between the Dirksen Senate Office Building, the Longworth House Office Building and the Hart Senate Office Building, meeting with staff of Senator Tammy Baldwin (D-WI), Senator Chuck Grassley (R-IA), Senator Joni Ernst (R-IA), Representative Mark Pocan (D-WI), Representative Ashley Hinson (R-IA), and Representative Lauren Underwood (D-IL). To conclude the day, I met with staff members of Senator Dick Durbin (D-IL) and Senator Tammy Duckworth (D-IL) from my home state of Illinois. Julie Palakovich Carr, a current member of the Maryland state legislature, former congressional staff member, and AIBS associate, joined me to provide her expertise on NSF funding. It was a pleasure to speak with her regarding her time on The Hill and her passion for meaningful legislation as an elected official.

Overall, my experience was an unforgettable one. It was a remarkable opportunity to not only learn about the ins-and-outs of federal funding and budgeting, but also lend my voice in support of funding an organization that is paramount in the scientific community for financial backing of research. Both large and small projects, undergraduate and graduate student thesis research, non-profit and independent research facility projects, opportunities for students outside of traditional research-based higher education institutions, and so much more fall under the purview of the NSF's funding. Meeting with our representatives keeps them informed of what their constituency values and wants to see supported. I hope more people engage in public policy and speak up for positive change. As a professor, one thing that was particularly impactful from this opportunity was sharing the experience with my students, in real-time, thanks to social media. I was able to update students of my journey by posting to my educational social media channel and engaging them in the civic process. It is my hope that, through my example of advocacy, they will find their voices and become involved in the issues that matter most to them.

PUBLICATIONS CORNER

Celebrating 10 Years of Publication for *Applications in Plant Sciences*

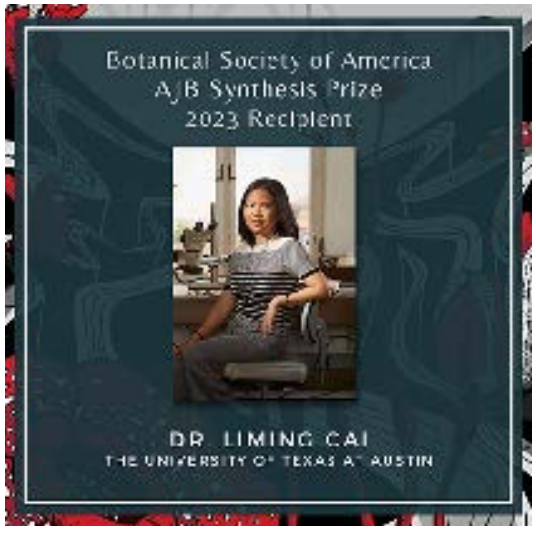
It is with great pleasure that we mark the first 10 years of publication for *Applications in Plant Sciences*. *APPS* was launched as an open access journal in January 2013 with the intention of being "a new source for sharing exciting and innovative applications of new technologies that have the potential to propel plant research forward into the future," according to the journal's first Editor-in-Chief, Dr. Theresa Culley. The journal covers all areas of the plant sciences, publishing novel protocols, software notes, reviews, and application and genomic resource articles, under the leadership of current Editor-in-Chief, Dr. Briana Gross, and Managing Editor Beth Parada, along with the *APPS* editorial board.

Applications in Plant Sciences
Celebrating 10 years 2013-2023

We will be marking this milestone and highlighting some of the remarkable papers published over the past 10 years, including several special themed issues, which have helped to bring in talented early-career and experienced researchers working together as editors, reviewers, and authors. Congratulations to all the dedicated people who contribute to the journal and benefit from reading the papers published!

AMERICAN JOURNAL OF BOTANY SYNTHESIS PRIZE

We are delighted to announce that **Dr. Liming Cai**, of the University of Texas at Austin, is the winner of the first ***AJB Synthesis Prize*** (https://botany.org/home/awards/awards-for-early-career-scientists/ajb-synthesis-papers-and-prize.html) for her article "Rethinking convergence in plant parasitism through the lens of molecular and population genetic processes," *AJB* 2023, 110: e16174. The Synthesis competition was intended to showcase early-career scientists and to highlight their unique perspectives on a research area or question, summarizing recent work and providing new insights that advance the field. The Prize comes with a $2000 award and recognition at the BSA Awards Ceremony at the Botany Conference.



Dr. Cai is currently a Stengl-Wyer Postdoctoral Research Fellow at the University of Texas at Austin focusing on the evolutionary genomics and physiology of parasitic plants. She received her doctoral degree in evolutionary plant biology at Harvard University, and her bachelor's degree, with Honors, in Life Sciences from Fudan University in Shanghai, China. Her research combines natural history and cutting-edge molecular methods to gain a mechanistic understanding of how plants live and evolve. She is exploring how plant parasitism impacts the integrity of mitochondrial function and mito-nuclear interaction using genome sequencing, respiratory physiology, and herbarium-based approaches. Dr. Cai is a member of the BSA's Early Career Advisory Board and has served on the Reviewing Editor Board for *Applications in Plant Sciences*. She has published numerous papers in peer-reviewed journals and received much recognition and many awards for her scholarship.

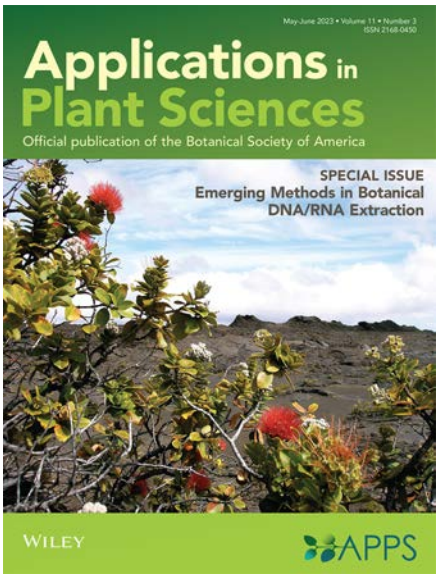
Dr. Cai was one of six early-career scientists whose Synthesis papers were published in *AJB* (https://bsapubs.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1537-2197.synthesis).

CONGRATULATIONS TO ALL THE AUTHORS!

EXPLORE THE NEW *AJB/APPS* SPECIAL ISSUES

The June issue of the *American Journal of Botany* explores the theme of "Pollen as the Link Between Floral Phenotype and Fitness." Guest editors Øystein H. Opedal, Rocío Pérez-Barrales, Vinícius L. G. Brito, Nathan Muchhala, Miquel Capó, and Agnes Dellinger worked with contributors to highlight research that provides new insights into the relationships between pollen production, presentation, flower morphology, and pollination performance (e.g., pollen deposition onto stigmas), the role of pollinators in pollen transfer, and the consequences of heterospecific pollen deposition. Several of the studies demonstrate exciting experimental and analytical approaches that should pave the way for continued work addressing the intriguing role of pollen in linking plant phenotypes to reproductive fitness. A paper in *Applications in Plant Sciences* forms part of the current special issue and presents a new pollen quantification technique that evaluates the use of high-energy violet light for pollen grain classification.

See the full issue at:
https://bsapubs.onlinelibrary.wiley.com/toc/15372197/2023/110/6.



The May–June issue of *Applications in Plant Sciences* explores "Emerging Methods in Botanical DNA/RNA Extraction." Guest editors Richard Hodel, Ed McAssey, and Nora Mitchell have curated a diverse group of papers highlighting the current state of knowledge in nucleic acid extractions, including both the key challenges and creative innovations that have been developed to circumvent these challenges to address a variety of exciting botanical questions. This special issue provides a valuable resource that will help readers to improve their own protocols, expand their toolkits, and consider additional research frontiers enabled by nucleic acid data.

See the full issue at:
https://bsapubs.onlinelibrary.wiley.com/toc/21680450/2023/11/3

One World Botany 2023
Boise, Idaho
July 22-26

JACQUELYN GILL

BOTANY 2023
PLENARY SPEAKER

SUNDAY, JULY 23 7:30 PM
BOISE CENTER, BOISE, ID

Jacquelyn Gill is an associate professor of paleoecology at the University of Maine's Climate Change Institute. She is a paleoecologist and biogeographer, bringing the perspectives of space and time to bear on questions in ecology and global change science. Her work takes a community ecology approach to help understand how species and their interactions have responded to interacting drivers (like climate change and extinction) through time.

She directs the BEAST Lab, which investigates 1) the legacies "biotic upheavals" like the extinction of Pleistocene megafauna on vegetation, 2) biotic interactions and drivers of landscape change on large spatiotemporal scales, 3) plant range dynamics and vulnerability to climate change, and 4) what paleoecology, Indigenous archaeology, and Traditional Ecological Knowledges can tell us about human-environment interactions in the past.

She is a co-host of the podcast Warm Regards and author of the blog "The Contemplative Mammoth", welcoming conversations and advice on science, early career academia, and diversity in STEM. She is a co-founder of the March for Science and a 2020 recipient of NCSE's Friend of the Planet award.

Register now - www.botanyconference.org

Botany 2023 Featured Speakers!

SEE the BOTANY 2023 WEBSITE for MORE INFORMATION
THESE TALKS WILL BE PRESENTED LIVE DURING the CONFERENCE
and RECORDED for the VIRTUAL PLATFORM.

KAROLINA HEYDUK
BSA EMERGING LEADER

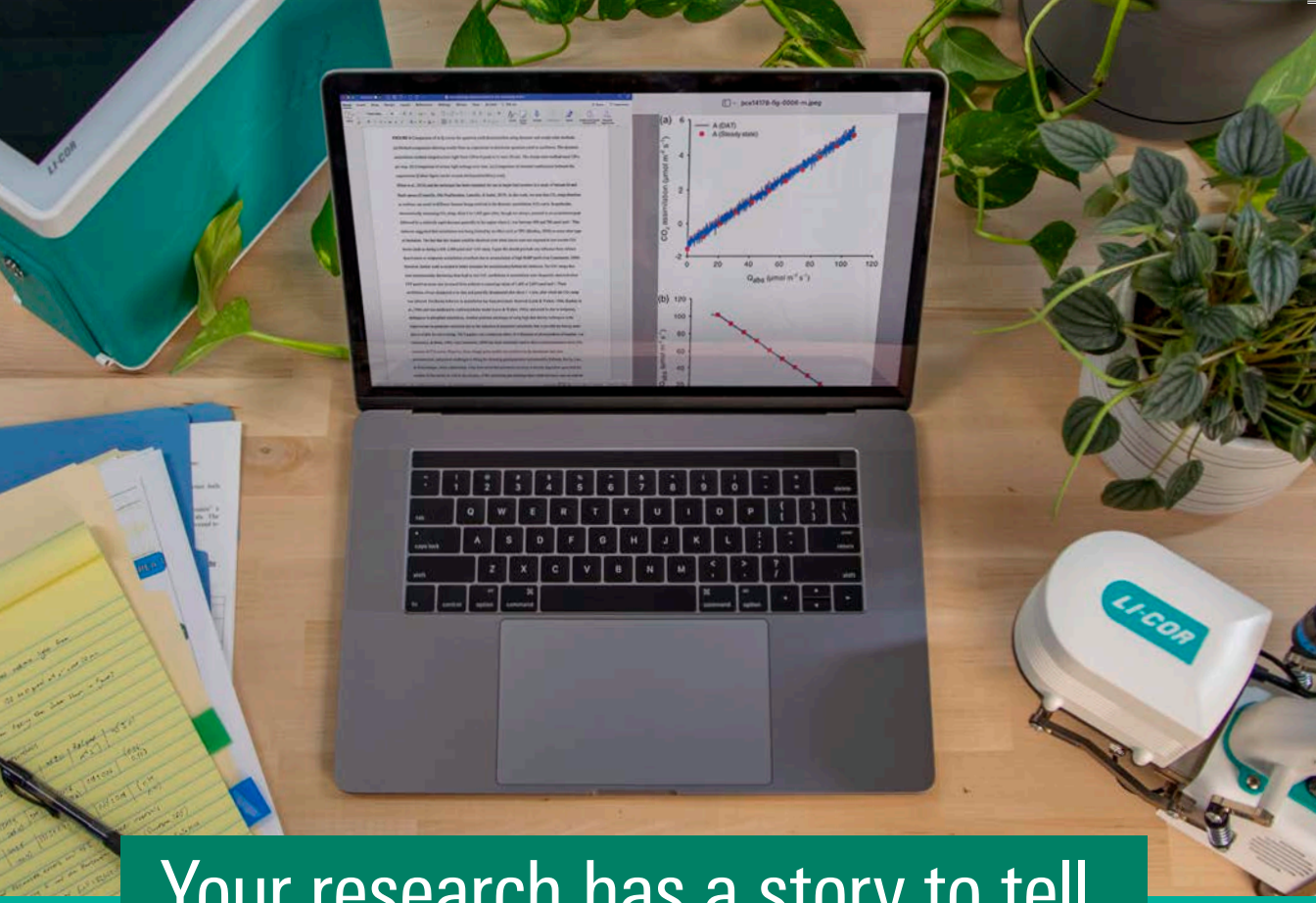
ERIKA EDWARDS
KAPLAN MEMORIAL LECTURE

JILL WHITE
ANNALS OF BOTANY LECTURE

DON MANSFIELD
REGIONAL BOTANY LECTURE

JUN WEN
ASPT INCOMING PRESIDENT

BRENDA MOLANO-FLORES
BSA INCOMING PRESIDENT



Your research has a story to tell.

The LI-6800 Portable Photosynthesis System helps reveal it.

You share your research stories in scientific journals, and the LI-6800 is designed to safeguard the collection and quality of publishable data. Automated adjustments of experimental parameters combined with stable control of non-experimental parameters empower you to test hypotheses with high confidence.

The LI-6800 features novel advancements not found in any other photosynthesis system:

- Aquatic measurements—CO_2 gas exchange from algae and other aquatic samples.
- Multiphase Flash™ Fluorometer—flash intensity of up to 16,000 µmol m^{-2} s^{-1}.
- Dynamic Assimilation™ Technique—faster CO_2 response curves.

The LI-6800 is the global standard for photosynthetic gas exchange and chlorophyll a fluorescence measurements.

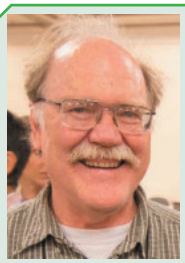
Learn more at **licor.com/6800**


a bunch of
APOCYNACEAE
PICK a bunch of FLOWERS
POCKET SCIART GUIDES TO PLANT FAMILIES
www.abunchofguide.com
@abunchofguide

155 Years of Botany at Emporia State University: A Case Study of College Botany in the United States

INTRODUCTION

Plant Study has been an integral part of the college curriculum in the U.S. since before the founding of the nation. In colonial times, botany was studied primarily as a necessary component of medical education and the earliest botanists were physicians. By the founding of the republic, however, botany found its place in the field of natural history at a growing number of institutions and the teaching of botany was one of the leading developments in what would become the standard scientific curriculum. By the 1850s, botany was one of the premier disciplines represented in the American Association for the Advancement of Science (AAAS). Already in 1875 Huxley and Martin had published their elementary biology textbook and with the founding of Johns Hopkins University, academic biology became closely connected with medicine. In 1882 the Natural History Section of the AAAS split into four subdivisions, including biology, but botanists argued, "Upon even a casual examination these courses, in almost every case, turn out not to be courses in biology at all, but courses in Zoölogy masquerading under an attractive but deceptive name." (Macmillan, 1893) This argument was pivotal in establishing the Botanical Society of America (Sundberg, 2014).



By Marshall D. Sundberg
Roe R Cross Distinguished Professor of Biology – Emeritus, Emporia State University, Emporia, KS
Email: msundber@emporia.edu

Nevertheless, by the 1920s biology overtook botany in the high school curriculum. At the college level, a 1931 survey of 202 U.S. colleges and universities demonstrated that botany remained the most taught introductory course (59%) while zoology (51%) and biology (42%) trailed (Schaefer, 1932); by 1937, biology had replaced botany and zoology in the general education requirements of more than 60% of colleges. To address this problem, the BSA Education Committee obtained NSF funding for a series of summer institutes (1956-1969) for small college, and some high school,

teachers to update concepts in modern botany. Yet, by 1969 it was also clear that botany departments were being merged into biology departments and in biology departments, botany courses were being deleted (Stern). This trend, documented in a series of *Plant Science Bulletin* articles, continues into the 2020s (Sundberg, 2011, 2012, 2014, 2016; Jones, 2020). For the past 125 years, botany in the curriculum of today's Emporia State University, has followed a remarkable similar trajectory.

CREATING A SOLID FOUNDATION

The State of Kansas was admitted to the Union in 1861, and in 1863 three institutions of higher education were established: The State Agricultural College in Manhattan, the State Normal School in Emporia, and the State University in Lawrence. This order of legislation is an indicator of the legislators' (many of them rural farmers) attitudes toward education. The Ag School will be critical to developing the state's (and their) economies, and the Normal school will provide teachers to the schools being opened in many rural communities. Then comes the university.

The Normal School was finally opened after the Civil War ended in 1865, and Lyman Kellogg was appointed as principal. The following year Dr. Henry B. Norton, who trained as a science teacher at the Illinois State Normal School, was hired to teach the natural sciences, including botany. The first classes were taught on the second floor of the Emporia Public School, and the college had no equipment, books, or maps of their own. The following year, the first college building was completed and the 1868 catalog listed anatomy and physiology, botany, and zoology as the available natural science classes. In 1874 Norton left to accept a position at San Jose Normal School in California and S. C. Delap, Graduate of Millersville State Normal School, PA, was hired as a replacement. Unfortunately, the Normal School burned in 1878 and all the equipment and school records were lost. With the facility completely destroyed, the faculty resigned en masse (anonymous, 1889; Prentis, 1899).

A new building was completed in 1880 (Figure 1), and Holmes Sadler was hired as the school librarian and Natural Science and Elocution instructor. The natural history classroom and laboratory were in the basement; on the first floor was a natural history museum and recitation room. It is unclear if Sadler had input into the design of the building, but he was clearly in the vanguard of science education theory. As Charles E. Bessey wrote in 1877, "A college which proposes to keep up with the current must provide botanical and zoological laboratories ... A botanical laboratory is just as necessary for the proper teaching of botany, as is a chemical laboratory for chemistry" (Bessey, 1877). The 1880-81 catalogue states, "This

Figure 1. *Kansas State Normal School, 1880. Botany was taught in the basement, on the far west (left) side of the building.*

subject [botany] is taught more thoroughly than any other branch of natural science, from the fact that the methods of scientific research do not materially differ in the various branches, and the materials for extensive and exhaustive research on this subject are more readily accessible to our students" (Catalog, 1880, p. 35). Indeed, both geology and zoology were scheduled for one 10-week term whereas botany consisted of 20 weeks of study and included field and laboratory work. In the 1881-82 through 1883-84 catalogs, Sadler provides course descriptions. Students should be able to describe the similarities and differences between 40 genera, along with the distinguishing characters of each, and describe general principles of classification. They would also consider the evolution (history) and physiology of plants. The 1884-85 catalog specifies Kellerman's *Elements of Botany* as the textbook (1883). This newly published book was reviewed in *Science* as being "a little bit more comprehensive…than books of this grade usually are…unsatisfactory in its execution in many respects, it comes nearer to filling a serious gap in botanical literature than any other thus far published…" (*Science*, 1884). It is unknown what texts were originally used, but the University library did subscribe to *Science* so it is possible this review influenced Sadler's choice. However, Kellerman, the author, was the new Professor of Botany at Kansas State Agricultural College, so this also may have influenced Sadler's textbook adoption.

It is interesting that for the first time, components of the laboratory course are individually specified in the Catalog. Students were responsible for making a herbarium of 50 species with full descriptions. Each student also had a compound microscope and was responsible for making microscopic drawings of cells and tissues of fungi, algae, and a variety of land plants. Thus, the Normal School in Emporia should have been included in Arthur and Bessey's lists of colleges adopting "The New Botany" and requiring use of the compound microscope in the laboratory (Sundberg, 2012). In lab, students would also do experiments with artificial soils (Catalog, 1884-85, p. 37).

In 1885 the regents organized a Department of Natural History, and Dorman Kelly was hired as Professor of Natural History to replace Sadler, who left education and moved to Memphis. Catalog course descriptions in 1885 were the same as the previous year except the textbook would be *Gray's School and Field Book of Botany* (1880). The following year, Kelly devised a new format for the course. At the beginning of the term, the class would be divided into two sections. The top half of the students, in the first section, would receive more rapid, compressed instruction for the first 10 weeks. If they received a score of at least 80%, they would pass the course and be able to move on to another course. If not, they would join the second section for the second 10 weeks of normal instruction. Except for a change in textbook in 1887, *Gray's Lessons and Manual of Botany*, the structure of the course remained the same for a decade until Kelly was replaced by Lyman Wooster in 1897.

Wooster was primarily a geologist; as a result, few changes were made in the botany offering. The previous year, Bergen (1896) published *Elements of Botany*, a somewhat briefer book than Gray, which Wooster adopted to complement Gray's *Field, Forest and Garden Botany* (1895) in the Botany course. Some of the features that may have influenced Wooster in adopting Bergen were end of chapter summaries and, for some chapters,

review questions to guide student study. Most of Wooster's students were future teachers, so this provided practice. In 1902 he hired one of his graduates, Elizabeth Crary, to assist in teaching the natural history laboratory courses.

In anticipation of a request to upgrade the status of the school, the faculty of the science departments—Biology and Geology, Chemistry and Physics, Political Geography and Physiography—compiled a booklet detailing the course offerings and organization of each department. It also included sections on the Methods of Study. Botany continued to be a 20-week course. During the first section, which focused on morphology and taxonomy, students were required to make 80 to 90 "judgements" (detailed descriptions of characters) for each of 40 to 50 plants. But first the student must make accurate labelled drawings of the "plant for the day." The judgements for a given day must be prepared ahead of time as the class time was spent "verifying" the judgements (compare today's flipped classroom approach). "The knowledge of the plants thus obtained by observation, by the expression of judgements and by the criticism of these judgements is still further tested and corrected by requiring pupils during the class hour to affirm or deny the truthfulness of the statements made in several keys…in so far as they apply to the plants at hand" (Anonymous, 1904). In the laboratory, morphological details were sketched and labelled using water mounts and compound microscopes. During the second section the focus is on performing the 40 experiments described in Bergen (1901) and "from the personal experience of class members and class reference books." Plant anatomy involved hand sectioning and observations with the compound microscope, supplemented with enlarged photographs of tissues, and correlating structure with function. An even richer understanding was obtained by considering the ecology of the plants under examination.

Beyond these specifics, the booklet went on to explain some additional objectives of the curriculum. First, the primary objective is not to make "finished botanists" but rather "growing botanists." The second objective is to develop students' observational skills. Third is to develop students' power of forming valid conclusions about what they have seen, felt, or heard. "Most students in secondary schools and colleges are weak in the ability to form judgements about what their senses report, for most school studies give them small occasion to use their powers in this direction." A final objective is for students to acquire such a knowledge of plants and love of botany that they may successfully teach botany in the elementary and secondary schools of the state (Anonymous, 1904; Catalog 1905, p. 231).

In 1905 the school was authorized both to offer bachelor's degrees and to begin construction of a new science building. The Department of Natural Sciences now became the Department of Biology and Geology, following a national trend of combining botany and geology. Biology programs first began to be offered in U.S. colleges in the late 1880s as an alternative to separate botany and zoology programs. By 1911 about 30% of colleges had biology departments (Sundberg, 2012, 2014). Emporia's approach was a compromise. General Biology was added as a 4-credit (cr.) prerequisite for incoming students who had not had a full year of high school botany or zoology. The course taught the common basic concepts required for both the botany and zoology programs. A full curriculum of

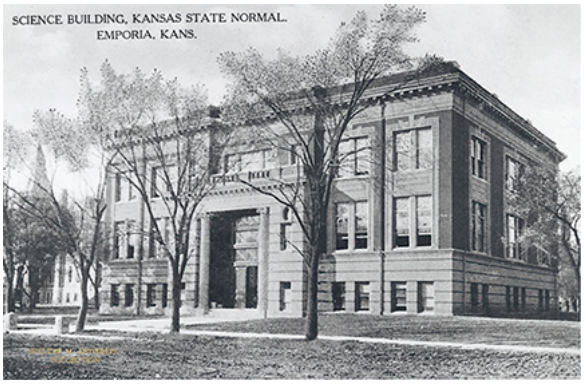


Figure 2. *Norton Science Hall. Botany lecture rooms and laboratories, 2nd and 3rd floors, are on the west (left) side of building.*

Figure 3. *Frank Agrelius, who taught plant taxonomy for 45 years.*

science courses was now required, and Crary was promoted to instructor with primary responsibility for the botany program. Norton Science Hall was dedicated in November 1907 (Figure 2). A botany laboratory and two classrooms were on the west end of the first floor, and another laboratory and the Natural History Museum were on the west end of the second floor.

The following year, the curriculum was expanded and another former student, Alban Stewart, was hired as an additional instructor. After one year Stewart decided to move on for an advanced degree, and Frank U.G. Agrelius was hired in 1911 to teach Bacteriology as well as Botany (Figure 3). By this time Crary had also completed some graduate work at the University of Chicago and was promoted to Professor. The botany curriculum now consisted of 12 courses under the credit hour system. Freshman Botany remained 4 cr., Advanced Field Botany was a 3 cr. summer course, and the remaining courses were single-semester, 2 cr. courses: Algae, Fungi, Mosses and Ferns; Plant Physiology; Plant Anatomy; History of Botany (summer only); Economic Botany; Botanical Microtechnique (summer only); and Nature Study. In 1913 the Algae and Fungi courses were combined into a single course and a new Botany in the High School was added. Lab fees were also added for some courses: Freshman Botany ($1.25), Plant Physiology ($3.00), Plant Anatomy ($2.00), and Plant Microtechnique ($2.50) (Catalog 1913).

According to the 1913-14 catalogue, a B.A. in biology required 11 cr. in Bacteriology, 11 cr. in Botany, 8 cr. in Zoology, 2 cr. of Plant Nature Study, and 2 cr. of Evolution of Plant and Animal Form; however, the botany offerings were much reduced after Crary left in 1914. For the next three decades Frank Agrelius was the botanist (and bacteriologist) in the department and the only regularly scheduled botany courses were: Freshman Botany, Plant Anatomy, Plant Physiology, Nature Study, and Systematic Botany—each offered once a year and occasionally also in summer. In 1916 the Freshman Botany was divided into two separate courses, the first focusing on development of spore plants and the second on development of seed plants.

In 1923 the Normal School became Kansas State Teachers College in Emporia. Although there were some major changes to the biology department, losing several zoology and microbiology courses to newly formed Department of Agriculture and Health Education, botany was unscathed. Agrelius, who had now completed a master's, was promoted to Associate Professor. In 1929 the department hired a new head, John Breukelman, who initially focused on advanced courses as the regents now authorized master's degrees for the college. In 1930, 2-4 cr. of research was added to each of the sub disciplines, including botany. The following year three graduate-level courses were added: Forest Botany, Special Morphology of Algae, and Special Morphology of Fungi. Breukelman's reorganization of the department was completed in 1935 when the Department of Agriculture was merged with the Department of Biology and Geology to become the Department of Biological Sciences. With Wooster now retired, geology was split out to join with chemistry and physics in a Department of Physical Sciences. Breukelman, a charter member of the National Association of Biology Teachers, also instituted a Bachelor of Arts in Education degree for prospective secondary teachers and a biology minor for the master's program. There were no further significant botanical changes to the department until after the war (Catalogs, 1931-1935; Breukelman, 1963).

In 1946 the department was approved to offer a graduate major in biology, and Merle Brooks received the initial graduate teaching fellowship. He completed his master's the following year and was immediately hired as an instructor in biology while spending summers at the University of Colorado pursuing a doctorate in botany. Initially he taught only the introductory botany and secondary education courses, although when Agrelius retired in 1950, Brooks picked up the rest of the botany courses, except plant systematics, which Agrelius continued to teach until 1956 when Brooks completed his doctorate (Breukelman, 1950, p. 190; Menhusen, 1959, p. 27).

Homer A. Stephens, an instructor–extension agent hired part-time between 1951 and 1955, partially filled the systematics void, but the Agrelius position was not replaced until 1955 when Gilbert Leisman, a paleobotanist from Minnesota, was hired (Figure 4). He changed Systematic Botany into a modern plant taxonomy course and added Plants of Kansas. But several courses were also deleted, including Forest Botany, Spore Plants, Seed Plants, and Elementary Biological Science. In 1957 Joseph D. Novak, also with a botany Ph.D. from Minnesota, arrived to teach

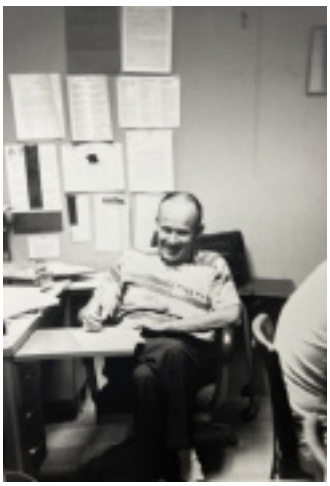


Figure 4. *Gilbert Leisman in his Norton Science Hall office. Leisman was a long-time member of the BSA and served as chairman of the Paleobotanical Section in 1967. He was awarded several NSF grants to study Kansas Coal Balls, Permian shale outcroppings at the Ross Natural History Area, and the late Carboniferous Hamilton Quarry Lagerstätte.*

Introductory Botany and Science Education, but left after only one year for a position at Purdue University and ultimately at Cornell University. The following year Brooks also left, leaving Leisman the only botanist in the department, along with Clarence Glandfelter, who was hired in 1930 by the Agriculture Department to teach agriculture and conservation courses, but since the department merger brought over Forestry and Horticulture to biological sciences (Catalogs, 1951-1955, 1957; Bruekelman, 1963).

THE GOLDEN ERA

The entire country experienced a boom in higher education following World War II, with returning soldiers given incentives to pursue education through the G.I. Bill. It is interesting that before 1890, most high school graduates went on to college, but this was less than 4% of 18- to 21-year-olds (Hurd, 1961; Rudolph, 1977). After WWII, with the dramatic rise in births and the realization that upward mobility in the lower and middle classes depended more and more on a college degree, citizens and legislators put a priority on expanding access to higher education. Ironically, even with this general push toward a college degree, "Scientific illiteracy became a characteristic of college-educated Americans some time toward the middle of the twentieth century if not before" (Rudolph, 1977, p. 255). Science, then, was a special case that required additional culturing.

In my experience, as a low-level administrator at two institutions, three things determine the success you will have in reaching higher goals for the unit: support from the top, a person or core of people on the cutting edge of innovation, and money–external grant support. The Department of Biology in the late 1950s and 1960s was fortunate to have all three of these components come together at the same time general support for higher education was rising. In 1953 the College inaugurated a new President, John E. King, who was a strong supporter of the liberal arts and sciences and in full agreement with Bruekelman's philosophy: "To prepare good teachers you've got to first prepare them intellectually" (Prophet, 1998). A new science building for the physical sciences was begun in 1956 and complete in 1959. Although biology remained in Norton Science Hall, it expanded to fill the building (Figure 5). In 1963, Brighton Lecture Hall was added to the science building, and a new biology wing (now Bruekelman Hall) was begun in 1966 (the last year of King's tenure) and completed in 1970. In addition to these improvements in physical infrastructure on campus, in 1958 the College received an option to lease 1040 acres of prairie on the edge of the Flint Hills, 14 miles west of Emporia, for a natural history reservation to be named after the benefactors, the late F.B. Ross and Rena G. Ross. Breukelman, a field

Figure 5. *Original Botany Laboratory, 2nd floor, Norton Science Hall, now dedicated to structural studies after plant physiology moved into a wet laboratory vacated by Chemistry's move to the new Science building.*

biologist, was persuasive and the college took the lease. Three years later the estate gifted the southwestern 200 acres of the F.B. Ross and Rena G. Ross Natural History Reservation to the College, a gift accepted by the State Board of Regents and Legislature. This facility would turn out to be very important in the department's growth during the next decade.

In 1953 Bruekelman was well-aware of the state of biology education in the country, having recently completed 11 years as Editor of the *American Biology Teacher*. The time was ripe for change and post-war enrollment increases were anticipated. In the fall of 1952, there were 5 faculty members serving 236 undergraduate majors and 10 graduate students; ten years later there would be 13 faculty serving more than 705 undergrads and more than 60 grad students. Graduate summer registration rose from 15 to more than 100. In 1958 Breukelman retired as chair, but he had been grooming his replacement, Ted Andrews, for 10 years and Andrews hit the ground running. Andrews graduated from Emporia in 1940 and went on for a master's from Iowa, 3 years in the Naval Reserve, and Ph.D. from Ohio State in 1948. He immediately accepted a faculty position in the biology department. Like Bruekelman, Andrews was very active in NABT and both served as President of the organization.

Major external grants at Emporia began with the 1953-1959 Summer Conservation Workshops, supported by the National Wildlife Federation and led by Bruekelman. The Initial NSF Summer Institute for Secondary Science Teachers at Kansas State Teachers College was received in 1957 and co-directed by Merle Brooks, along with a physicist and a mathematician. This program supported about 120 high school teachers, mostly from Kansas and adjacent states, to complete two summer courses in either biology, physical sciences, or mathematics (about 40 in each). This grant subsidized tuition and provided room and board for the participant (and spouse and family) and a small stipend. It was renewed annually from 1957 to 1968. The grant also supported a seminar series by distinguished scientists who would come to campus for a few days to a week during the session. Among the botanists presenting over the duration of the program were: Henry Andrews, Washington University, Paleobotany; Leslie John Audus, University of London, plant hormones; George W. Beadle, Cal Tech, genes and enzymes; John Dodd, Iowa State, Algology; Harry J. Fuller, Illinois, economic botany; Arthur Galston, Yale, photosynthesis and plant metabolism; Richard Keeling, Purdue, anatomy; Samuel Postlethwait, Purdue, science education; Peter Raven, Stanford, ecology, evolution; Paul Sears, Yale, plant ecology; Bruce Stowe, Yale, plant physiology; Ian Sussex, Yale, plant development; and Billie Turner, Texas, systematics. Brooks also coordinated the second year of the program before leaving Emporia in 1959 for a position at the University of Nebraska, Omaha.

Ted Andrews, who had just become head of the department, took over leading the Summer Institute while searching to replace Brooks and add additional faculty positions to the Department. Emily Hartman, with a Ph.D. in plant taxonomy from Kansas, was hired from California State Polytechnic College to replace Brooks in 1958, taking over both his botany and microbiology courses. However, in 1960 she returned to a position in California. For two summers (1959 and 1960), Vincent Weber, a plant anatomist from Minnesota, had a visiting appointment specifically for the summer institutes. Another short time hire, Gilbert Hughes, replaced Weber in the summers of

1961 and 1962, but also taught Microbiology and Mycology during the academic year, filling some of Brooks' former role. A tenure-track plant taxonomist, James Wilson was also hired in 1959 specifically to replace Agrelius and take over systematics. When Hughes left in 1962, two new botanists were hired, Jack Carter and Donald Ahshapanek. Carter was an alumus (B.S. '51, M.S. '53) who went on for a Ph.D. from Iowa. Although trained in taxonomy, Carter was hired primarily to teach the plant organismal courses and to take over as Coordinator of the NSF Summer Institutes. Like Andrews, Carter was already involved in NABT, so he was a natural to take over the grant programs. Ahshapanek, with a PhD in Plant Physiology from Oklahoma, returned to Kansas, where he did undergraduate work at the Haskell Institute (now Haskell Indian Nations University). The following year Richard Keeling was hired specifically to teach Microbiology and Mycology. Between 1960 and 1965 the number of biology faculty grew from 13 to 23; botanists grew from three to five (plus one part-time).

Realizing the potential for generating master's degrees, Andrews evolved the summer institute program into a sequential institute so that a student making satisfactory progress the first summer could be supported to return the following two summers. Under this format, approximately 40 more biology majors could be added to the graduate program for up to 8 years (Table 1). Furthermore, a diversity of upper level / graduate courses could be offered on a regular basis, with fieldwork, class, and research, based at the Ross Reservation (Table 2).

Andrews was also PI on two additional NSF Grants. Research Participation for High School Teachers in Biology at Kansas State Teachers College ran from 1961 to 1968 and selected 5-8 teachers to spend the summer taking a research course under the direction of one of the faculty members. Carter also coordinated this grant during his tenure at Emporia.

The Academic Year Institute for High School Teachers in Biology at Kansas State Teachers College, which ran from 1962 to 1964, was also a team project with Andrews as P.I. and Carter coordinating implementation of the grant. Its purpose was to broaden teachers' scientific knowledge and to improve their ability to motivate their students to consider STEM careers. The focus was specifically on the subject matter rather than the methods of teaching. Thirty teachers were chosen each year to participate in a full load of graduate courses and research with the option of partial support the following summer to complete the master's. The program also included optional spring break field trips. The first involved caravanning through Tamaulipas, San Luis Potosi, and Nuevo Leon, Mexico; subsequent years involved backpacking trips

Table 1. Biology Participants in NSF Summer Institutes and Number of Master's Graduates

Year	1957	1958	1959	1960	1961	1962	1963	1964
Participants	50	50	44	49	50	50	49	38
1st time	50	50	32	23	17	17	23	15
Returning	0	0	10	26	38	38	26	33
Graduating	5	3	8	10	9	18	26	46

(NSF, 1957-1968)

Table 2. Botany Courses Offered, and Enrollments, during NSF Summer Institute Years.

Course	1960	1961	1962	1963	1964	1965	1966	1967
Gen Botany	48	113	116	49	102	94	122	98
Pl Taxonomy	66	58	63	46	46	46	22	30
Pl Morphology	28	36	14	31	24	39	24	—
Pl Anatomy	—	10	52	10	12	13	21	21
Grasses	2	11	11	7	4	4	5	8
Farm Crops	—	8	9	—	—	—	—	—
Bot for Teach	25	6	5	7		4		
Pl Physiology	—	—	—	15	25	20	0	3
Mycology	—	—	—	9	38	34	50	34
Paleobotany		11	5	8	10	16	12	—
Pl Kingdom	—	—	—	—	—	—	28	54
Phycology	—	—	—	—	—	10	0	3
UG Proj				6	4	2	7	8
Grad Proj	3	1	2	5	—	—	—	—
Grad Res	—	—	2	0	7	14	15	22

in the Rockies. Twenty-two of the first 30 participants completed their master's by 1964, and 5 went on for a Ph.D. Approximately 400 students participated in the Summer Institutes and/or the Academic Year Institutes between 1957 and 1968, and of these 282 received an M.S. and 11 received an Ed.S. (NSF, 1957-1968; Prophet, 1998).

In 1964 Andrews took a leave of absence to become Associate Director of the Biological Science Curriculum Study (BSCS) in Boulder, Colorado. Andrews did not return in 1965 and instead recruited Carter to take over for him at BSCS in 1966; after leaving Emporia, Carter directed BSCS for two years before moving to the faculty at Colorado College and Andrews moved on to become Associate Director of the Commission on Undergraduate Education in the Biological Sciences (CUEBS) in Washington, D.C. The year Andrews took leave, another former alum, Bernadette Menhusen (M.S., 1959) was hired to teach non-vascular plants and natural history for education majors. Meanwhile, botany was well represented in the NSF Research Participation Program. Of the eight year-long participants in 1965, two worked with Ahshapanek in plant physiology, two worked with Leisman in paleobotany, two worked with Wilson in plant taxonomy, and one worked with Keeling in mycology.

A new plant physiologist, Robert Parenti, who, like Ahshapanek had a PhD in plant physiology from Oklahoma, was hired in 1966 to replace Carter. Bruekelman accepted the position of acting chair so the department could do its first national search for a new chair. Edwin Kurtz, a plant physiologist and science educator from the University of Arizona, was hired in 1968. This marked a high point for botany at Emporia with 6 botanists and a mycologist out of 19 tenure-track faculty members (Archives, Box 1, staff meeting notes 1964-1966, Biology minutes 1965-1968). It was also a high point for the university with enrollment reflecting the height of the baby boom generation. A new president, John Visser, was hired in 1967 and he immediately began the work

to seek university status for the college. He hired a mycologist, John Peterson (trained by Constantine Alexopolis at Michigan State in 1953, 10 years before Alexopolis was elected President of BSA) to be professor of Biology and Dean of Liberal Arts and Sciences in 1971. The reorganization plan was finally approved in 1974 and the name was changed to Emporia Kansas State College and then, in 1977, to Emporia State University (ESU). Peterson continued as Dean of the new College of Liberal Arts and Sciences for the next 12 years. With the reorganization, the Biology Department became the Division of Biological Sciences with five areas of concentration available for specialization: general biology, botany, environmental biology, microbial and cellular biology, or zoology. Biology courses were renumbered with prefixes reflecting the area of concentration. The botany emphasis required: 15 hours of physical sciences, the Biology Core consisting of GB 100 (Introductory Biology), MC 150 (Introductory Microbiology), BO 212-213 (Biology of Plants and Lab) ZO 214-215 (Biology of Animals and Lab), MC 216 or MC 346 (Cell Biology or Molecular Biology), EB 220 (Ecology) and at least 8 additional botany courses from the following: BO 338-339 (Trees and Shrubs and lab), BO 409 (Botany Projects), 450 (Special Topics in Botany), BO 542-543 (Plant Taxonomy and Lab), BO 552-553 (Plant Kingdom and Lab), BO575-576 (Paleobotany and Lab), BO 752-753 (Plant Anatomy and Lab), BO 755-756 (Plant Physiology and Lab), and BO 865 (Grasses and Lab). Separate courses in Bryology, Morphology and Paleobotany of Vascular Plants, and Phycology were combined into BO 552 (Plant Kingdom). This curriculum would remain basically unchanged until 2021-2022.

THE BOOM ENDS AND A SLOW DECLINE BEGINS

Unfortunately, Kurtz and Peterson arrived at the end of high times. The last successful summer institute grant had just been awarded for 1968, and the 1969 submission for an academic year institute in 1970 would be the last successful submission for that program. Menhusen was successful in obtaining 3 years of support (1970-1973) for an NSF Cooperative College/School science program, and she teamed with science educator John Ransom on an NSF Implementation Projects for High School and Elementary School Science Program, but only two other external projects were funded in the department during the 1970s. University enrollment began to level off in 1967 and peaked at 7150 in 1969, declining thereafter. Ten years later, enrollment was less than 5850 and still going down. This decrease was the result of two major factors: the increase in the number of community colleges throughout the state and the entrance of Wichita University into the state system. The result was college-wide loss of 70 faculty, mostly through retirements or resignations. During this decade, biology continued to graduate more undergraduates and graduate students than any other department in the college, but tenure-track lines decreased by 4 to 15 by 1980. Four botanists resigned. In 1971 Don Ahshapanek, who also advised pre-dental, pre-mortician, and pre-optometry, left to accept a position at his alma mater; Haskell Institute had just been redesignated Haskell Indian Junior College. In 1972, Chair Edwin Kurtz left to chair the biology department at the University of Texas Permian Basin. In 1974 Menhusen left to teach at other universities, and in 1980 Parenti left for a position in the U.S. Fish and Wildlife Service.

There were certainly some unpleasant dynamics occurring among the biology faculty at this time, which may be related to more than one of these faculty losses. The staff meeting minutes of 17 February 1971, says there was a straw poll among the faculty to consider an evaluation of the department chair (Kurtz) – 11 in favor, 5 against, which was sent to the President. The President's reply on 4 March was "…to wait until fall when the new Dean [Peterson] takes over." On January 3, 1972, Kurtz distributed most of his duties as chair among 5 faculty members, and 3 days later a letter from Dean Peterson to the faculty states he "intends to back the chair – whatever!" Nevertheless, Kurtz left at the end of Spring semester (Archives, Box 24, Staff Meeting Minutes; Box 6, Biology Faculty Memos 1970-1971).

There are some intriguing clues as to what was going on in the department. In addition to being a very productive botanist, Kurtz was a nationally known science educator and the October 11, 1971 KSTC Round Table noted that the previous summer Kurtz had spoken in Virginia on "Accountable learning systems: Results from a college classroom" and later in Oklahoma on "Designing instruction based on behavioral objectives." Furthermore, that year he required all faculty members to turn in a copy of their complete syllabus for every course and a full CV! Coincidently, Emporia State has been requiring this of faculty for the past decade, and it has not been popular. I suspect that the biology department in 1971 felt the same way about these requirements from their chair who obviously had an agenda for curriculum re-design and assessment (Archives, Box 10, Biology Faculty Memos 4-71 to 4-72; Table 3; Figure 6).

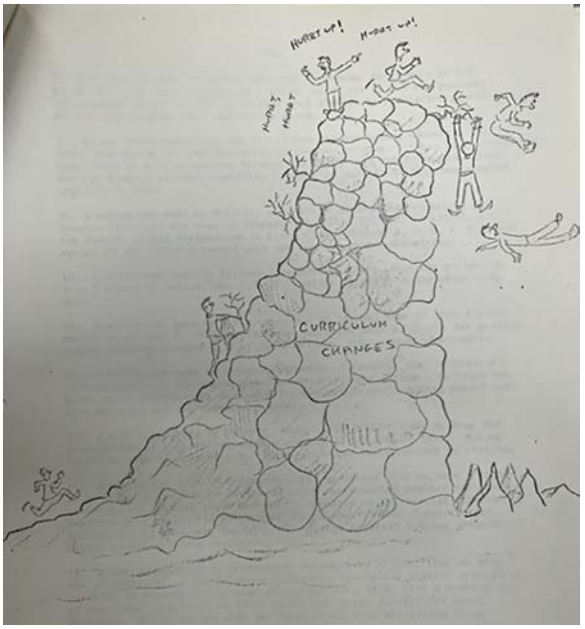


Figure 6. *Doodle by Don Ashapanek from 19 August 1971 Biology Faculty Memos (Archives, Box 10).*

University enrollment continued to decline and in 1978 the administration sent down guidelines to the departments for contingency planning. Among other things, departments should "reorganize, consolidate, and prune programs wherever possible"; at the graduate level, classes of fewer than seven students should be offered "only under exceptional circumstances." (11/3/1978). On March 2, 1979, the Biology Executive Committee considered 14 items in the Department's contingency plan; no. 13 specifically addressed the botany concentration. "What courses do we keep, in light of enrollment? How many botanists? What about Wilson?" On January 9, 1980, Parenti resigned, leaving the department in the lurch. To partially fill the gap in botanists, Tom Eddy, an entomologist/conservationist, took on teaching plant taxonomy in the spring of 1980 to allow Wilson to focus on economic botany and trees and shrubs. That fall, a search for a "field-oriented plant scientist" was approved and James Mayo, was hired the following spring.

Table 3. Textbooks Used for Botany Courses in 1971 (from Faculty Syllabi).

Subject	Author	Title
Bryology	Conard	*How to Know the Mosses and Liverworts*
Evolution	Stebbins	*Processes of Organic Evolution*
Grasses	Gould	*Grass Systematics*
Morphology and Paleobotany of Vascular Plants	Foster & Gifford	*Comparative Morphology of Vascular Plants*
Mycology	Alexopolis	*Introduction to Mycology, 2nd ed*
Phycology	Smith	*Freshwater Algae of the United States*
Plant Anatomy	Esau	*Plant Anatomy, 2nd ed* *Anatomy of Seed Plants (summer course)* *Laboratory Guide in Plant Anatomy, 2nd ed*
Plant Kingdom	Scagel et al. Bold. Bold.	*An Evolutionary Survey of the Plant Kingdom* *Morphology of Plants, 2nd ed* *Morphology of Plants Laboratory Manual.*
Plant Physiology	Devlin	*Plant Physiology*
Plant Taxonomy	Porter Cuthbert Jaques	*Taxonomy of Flowering Plants* *How to Know the Fall (or Spring) Flowers* *How to Know the Weeds*

A specific qualification in the job description was to "develop a course concerned with the ecological and physiological intersection between soils and plants." Eddy continued to teach plant taxonomy, but Mayo taught plant ecology and plant physiology, and eventually a new course in soils was approved in 1984. (Archives, Box 6, Faculty Memo's 7/1/1981–1984; Box 9, Faculty Meeting Minutes 1-1-79 through 6-30-82).

By fall of 1981, biology undergraduate enrollment was down to 240 majors, the lowest since 1952—yet it was still one of the largest departments on campus. Wilson retired in 1982 and was not replaced, although Peterson resigned as dean the following year and moved to the department to assist in teaching introductory courses. In 1984 the Kansas Board of Regents proposed dropping all master's degrees in the College of Arts and Sciences because of low enrollments. Upon completing their review, the Regents were surprised to discover that the ESU Biology department awarded more M.S. degrees in the previous 5 years than any other biology program in the state, except for Kansas University. This threat was overcome, but a number of other departments did lose their master's programs and the regents formulated a

new policy of 5-year reviews of all departments in all system universities. ESU Biology was back in the spotlight for an intensive review in 1986, which included two external reviewers. Undergraduate enrollments had leveled off at about 235 and graduate at 32 with about 28 and 10 graduates per year, respectively. Four of 15 faculty members were botanists. The reviewers labelled the programs "exemplary" but noted the lack of state-of-the-art equipment in the teaching labs and recommended greater financial support from the university. The dean made a commitment of $90,000 for equipment over five years and leveraged permission for the department to borrow against this amount from a special state fund with payback deferred over 5 years.

In addition to dealing with Parenti's departure, and in an effort to increase graduate enrollment, the department voted to delete the GRE requirement for admission to the program. They also decided to offer only one section of the core organismal courses, including Biology of Plants, and their corresponding labs. Wilson retired in the spring of 1982 because of health problems, and that fall the department decided to save his position by offering it to Dean Peterson the following year when he was stepping down as dean.

In January 1983, there was a proposal to combine majors and non-majors into a combined investigative style lab, but this was not passed. Ironically, this would have incorporated many of the CUEBS principles developed the previous decade and involved some former department members (Sundberg, 1991). Peterson also retired from teaching in 1986 and that position was not replaced. In the spring of 1988, John Parrish, a science educator who had been teaching the Field and Laboratory Course required for elementary and middle school certification, left to become a chair in South Carolina, and Gil Leisman and another zoologist were planning to retire the following year. The department decided they could hire a botanist if that person would split between botany and the Field and Lab course. The following year Laurie Robbins, a plant systematist with a science education background, was hired to replace Leisman. This maintained 3 botanists among the 14 full time faculty members, and Paleobotany was deleted from the program. Although Robbins was a trained systematist, and had post-doc'd at the Missouri Botanical Garden, Eddy continued to teach Plant Taxonomy and Lab; he now had many years of experience, although his training was entomology and natural history. Robbins focused on Biology of Plants and Lab and the Field and Lab course, occasionally teaching Economic Botany (Archives, Faculty Minutes, 1984-1988, 1988-1989).

STASIS AND RAPID EXTINCTION

In 1995 the administration convinced a distinguished alumnus of the Department, Dr. Terry Johnson, a Dean at Kansas State University, to do an external review of the Biology Department. With budgetary constraints throughout the university, the faculty situation was precarious. One faculty member had just retired, leaving 13, and four more retirements were imminent in the next few years. The department was having difficulty replacing a microbiologist, with two unsuccessful hires, and none of the senior faculty members were interested in taking on the chairmanship. Among the undergraduates, there were only 8 Botany majors, one of whom was to graduate that year along with 3 botany graduate students. Johnson reported that the

department was doing remarkably well with minimal support but that they should conduct an external search for a new chair. This search was conducted the following year; there were 44 applicants but none of the top four accepted the position. The position description was immediately recycled and sent out to begin in spring 1997. Meanwhile, in the fall of 1996, "ESU had a significant drop in enrollment which has put us out of the funding corridor (Biology dropped from 325 to 260)." (Oct. 22, 1996).

That fall, while attending the Education Committee breakout during the AIBS Board Meeting, I discussed this position with two of my colleagues. Jack Carter, who in 1990 was selected as the ESU Distinguished Alumnus, was extremely encouraging that I apply for the chair position; Gordon Uno cautioned me that I might find it very difficult to effect curriculum changes with an outspoken traditionalist entrenched as the science educator in the department. During my interview visit in January, I was very encouraged that Dean Lendley Black, Provost David Payne, and President Robert Glennen were all excited about my ideas of employing formative assessment strategies to facilitate curriculum change. I accepted the position and arranged to visit the department again in April during spring break. I did not know that in March the department was told to prepare for another $10,000 to $17,500 cut in the 1997 department budget, nor that both the President Glennon and Provost Payne were moving on and presidential candidates were already being interviewed (Archives, Biology Minutes, 1994-1997). The dean continued to be supportive, however, and spearheaded a $320,000 grant from a local foundation to remodel and re-outfit two microbiology laboratories and the associated supplies/media room along with an instrumental water chemistry laboratory.

In the late 1960s, Kurtz recognized that there was need to re-evaluate the department's curriculum and to employ more active-learning pedagogy, yet the core curriculum was virtually unchanged from the 1950s. I charged the curriculum committee to survey and evaluate introductory courses and core curricula at other institutions and come up with a proposal to modify ours. I also assigned myself to teach in the non-majors courses and implemented an assessment strategy in the majors and non-majors courses similar to what we had done at LSU (Sundberg and Dini, 1993; Sundberg et al., 1994). During the previous decade nearly 40 students/year were enrolled "on paper," but fewer than half completed their degree and the average time to completion was 9 semesters. I charged the graduate committee to strengthen the program by increasing the graduation rate and decreasing the time to completion. In the fall of 1999, I began teaching an Honors Biology alternative to the Majors Biology but which was open as a general education course for both majors and non-science majors, including lecture and laboratory and taught in inquiry mode.

In 1998 we received a $32,000 NSF equipment grant for microscopy and in 2000 a $156,000 3-year NSF Research Experiences for Undergraduate site grant with 2 new hires as co-PIs and a $180,000 U.S. Army Corps of Engineers grant to study invasive *Lespedeza*, with a new hire and a senior faculty member as co-PIs. By this time the graduate committee recommended that we strengthen the application requirements to (1) require the GRE, (2) require that applicants indicate up to three faculty members they would like to work with, (3) require that the faculty member accept the applicant, (4) require that Research Design and Analysis be taken the first semester, and Scientific Writing the second

semester and (5) require a thesis proposal for MS students be approved by the end of second semester. They also recommended that students choosing a non-thesis option receive an MA, not the MS. These changes were approved by a narrow majority of the graduate faculty. The curriculum committee had not been as successful and were not yet ready to make any recommendation.

In 2001 Jim Mayo retired and the department was not allowed to replace the position. In the spring of 2003, Lori Robbins also retired and it became necessary to hire a new person to primarily teach the Field and Laboratory Biology courses (and hopefully Biology of Plants). Karrie Rathbone, an ESU alum who had just completed her Ph.D. at the University of Kansas, accepted this position to begin in the fall. By this time some of the freshmen from 1997 were graduating and I was able to start using the freshman pre- and post-course assessment as an informal exit exam for graduating seniors. I presented these data to the department in an effort to jump-start the curriculum committee, but we were never able to achieve a majority vote to implement any program changes. Some of the results were published later that year (Sundberg, 2003).

By 2004 we were beginning to see positive results in the graduate program. The average time to graduate was down to 6 semesters and the graduation rate was over 80%. The problem was that total graduate enrollment dropped from about 40 to about 20, and two years earlier our supportive dean left and was replaced by a new dean who was more concerned with immediate headcount. I was told to convince the department to undo the more rigorous graduate requirements we had implemented, or turn in my resignation as chair. The following semester we had a new chair from within the department. The faculty was now down to 11, but there were still 3 botanists. The next year Dr. Rathbone, who had been teaching Biology of Plants as well as Field and Laboratory Biology, left for a position at another university, but we were allowed to hire Brenda Koerner (A.B.D.) as a full-time instructor for the Field and Laboratory course. In 2006 the department lost an ecologist and Koerner picked up Ecology and Field Ecology. Upon completing her PhD in 2007, she was promoted to tenure track and began teaching the Soil Science and lab formerly taught by Mayo. We maintained three botanists in the program.

In 2014 Tom Eddy announced he would retire the following year and immediately the department requested to replace him. Luckily our previous chair, a herpetologist, had just been promoted to dean and he realized that Plant Taxonomy was not only important for the Botany Emphasis (which did not carry much weight), but also the fisheries and wildlife program, which is strong in the department. We were thus given permission to search for a botanist qualified to teach Plant Taxonomy. David McKenzie, who was completing a teaching Post-doc with Gordon Uno, was hired and we maintained three botanists on the faculty.

The curriculum of the department, including the Botany Emphasis, remained virtually unchanged since 1977. Botany course enrollments also remained stable (but low relative to other concentrations) until the COVID-19 pandemic—when the department, like the entire university, experienced a massive enrollment drop (Table 4). The timing of the pandemic was particularly unfortunate. Koerner had just been elected second vice-president of the Faculty Senate, and because of the 3-year heavy service commitment this entailed, she decided not to bring any new

Table 4. Botany Course Enrollments by Decade (based on Faculty Load Reports)

Decade/Year	1970s	1980s	1990s	2000s	2010s	2019*	2020	2021	2022
Total	1874	1375	1892	1267	1446*	97	114	96	85
Undergraduate	1494	985	1296	927	1117*	74	86	77	69
Graduate	380	390	596	340	329*	23	28	18	16

*2019 represents only single semester because of COVID-19.

graduate students to her lab. At the same time, the University President left in the summer of 2021 and was succeeded by two interim Presidents, until the second, Ken Hush, was named President in June of 2022. (Hush has a terminal Bachelor's degree in Business from ESU, but a long career as an administrator in Kansas' Koch Industries). Koerner's time was consumed by the administrative and budgetary turmoil throughout her term on the Senate Administrative committee. In addition, in the spring of 2021 the biology department voted to change its core curriculum to be more in-line with the other Kansas regents' universities. The Principles of Biology, Biology of Plants, Biology of Animals and Microbiology requirements, first instituted in the 1970s, were dropped in favor of a two-semester biology sequence of cell/molecular and organismal/ecology/evolution. Introductory Botany would be grandfathered for three more semesters to allow current students to complete their original program of study, but it would no longer be offered after Fall 2022. The Teachers College also dropped the elementary/middle school requirement for Field and Laboratory Biology in the fall of 2021. Koerner's teaching load dropped immediately from 4 sections to 0 sections of that course.

One we changed the core, I decided that I would retire at the end of fall semester 2022, after which Introductory Botany would no longer be offered. We knew that I would not be replaced, but between them Koerner and McKenzie would be able to pick up some of the upper division courses I had been teaching. On September 15, 2022 Koerner was one of 33 Faculty members (mostly tenured) to receive a letter from the President stating that their faculty appointments were ending effective the last day of spring semester, 2023. The university was forced to make this decision because of the "extreme financial pressures… low enrollments … and restructuring of programs." The Teachers College's curriculum restructuring already eliminated Koerner's major teaching responsibility, and the Biology Department was now restructured, eliminating the Botany and Physiology emphasis areas. (The letters to Koerner and the other terminated biologist were how the department was informed it had been restructured.) It was only because of my already announced retirement that I did not receive a similar letter. McKenzie is the sole botanist remaining. His major responsibility is team-teaching the new organismal introductory course. Presumably he will be able to continue teaching Plant Taxonomy; it has had an annual enrollment of 10-20 students for decades and is a popular course for wildlife biology students interested in working for state agencies. An ironic unintended consequence of the administration's decision to drop the botany emphasis in the department, as I noted in a supporting letter for Koerner's appeal, is that although one of the stated reasons for restructuring biology is to strengthen the wildlife and fisheries component of the Ecology and Environmental Biology Emphasis, they have now made it impossible

for our graduates to meet requirements for Federal Wildlife Biologist Certification. Nine college Botany or Plant Science Credits are required (Wildlife Biologist [0486])! Perhaps they will allow McKenzie to teach two additional botany courses in rotation?

As I write this article, 155 years after college Botany was first taught in Emporia, ESU has joined a growing number of U.S. colleges and universities where there is no longer a botany program. The trajectory of our program was a remarkably parallel microcosm of the national trends of botany in colleges and universities for the last century and a half. In the late 19th century, botany was the predominant natural history course taught, but early in the 20th century biology began to displace first zoology and then botany as the organizing discipline. Botany maintained a vital role nationally, and in the department, through the mid-1960s, and NSF grant support was a key tool employed by both the college, and the BSA, to attract new students/new members. Since that time there has been a steady erosion in botany courses and course enrollments. The final straw at ESU was the full-on acceptance, with state support, of the business model for higher education in response to Covid-related enrollment declines. Thirty-one botanists have taught in the department, with tenures ranging from 1 to 54 years. Several have been active in national science education organizations and two had leadership positions in the BSA. Several had very active research programs, most actively mentored undergraduate and graduate student research, and all, from the very beginning, had a focus on promoting student learning (Box 1 on the following pages).

ACKNOWLEDGMENTS

Rebeka Curry and Shari Schribener, University Archivists, Emporia State University.

Carrie Cornelius, Head Librarian, Haskell Indian Nations University.

Cristy Schreck, Assistant Director for Institutional Research. Emporia State University.

Box 1. Botany Faculty at Emporia State University (ESU), 1868–2023.

Agrelius, Frank U. G. M.S., University of Kansas. 1911–1956. Botany, Nature Study, Plant Anatomy, Plant Morphology, Plant Physiology, Plant Systematics.

Ahshapanek, Donald. Ph.D., University of Oklahoma. 1962–1971. Plant Morphology, Plant Physiology, Plant Ecology.

Brooks, Merle E. Ph.D., University of Colorado. 1947–1959. Botany, Plant Anatomy, Plant Physiology, Morphology of Lower Plants, Morphology of Higher Plants, Science Education.

Carter, Jack. Ph.D., Iowa State University. 1962–1966. Botany. Coordinator of NSF Institutes, Plant Ecology, Plant Morphology, Plant Taxonomy.

Crary, Chalotte Elva. B.A., Kansas State Normal School (ESU), graduate work University of Chicago. 1902–1914. Algae, Botany, Field Biology, Fungi, Mosses and Ferns, Nature Study, Plant Anatomy, Plant Morphology.

Delap. S.C. B.A. Millersville State Normal School, PA. 1875–1879, Botany.

Eddy, Thomas A. Ph.D. Kansas State University. 1960–2014. Botany, Plant Taxonomy.

Gladfelter, Clarence F. M.S. Kansas State University. 1930–1967. Agriculture, Horticulture, Forestry.

Hartman, Emily L. Ph.D. University of Kansas. 1958–1960. Botany, Plant Morphology.

Hughes, Gilbert, Ph.D. University of Florida. 1961–1962. Mycology, Plant Anatomy, Plant Morphology,

Kelly, Dorman S. Ph.D. Indiana State Normal School. 1885–1897. Botany

Koerner, Brenda. Ph.D. Arizona State University. 2004–2023. Ecology, Field Ecology, Plant Anatomy and Physiology, Soil Science, Field and Laboratory Biology.

Kurtz, Edwin B. Ph.D. California Institute of Technology. 1968–1972. Plant Physiology, Science Education.

Leisman, Gilbert A. Ph.D. University of Minnesota. 1955–1989. Botany, Ecology, Paleobotany, Plant Anatomy, Plant Kingdom, Plant Morphology, Plants Useful to Man.

Mayo, James M. Ph.D. University of Washington. 1981–2001. Grasses, Plant Anatomy and Physiology, Plant Physiology, Range Management, Soil Science.

McKenzie, David. Ph.D. University of Wyoming. 2015–present. Plant Ecology, Plant Taxonomy, Forensic Botany.

Menhusen, Bernadette. Ph.D. University of Kansas. 1964–1974. Botany, Bryology, Natural History, Plant Kingdom, Phycology, Field and Laboratory Biology.

Mentzer, Loren W. Ph.D. University of Nebraska. 1946–1947. Botany.

Norton, Henry B. A.M. Illinois State Normal University. 1868–1875. Botany.

Novak, Joseph D. Ph.D. University of Minnesota. 1957–1958. Botany, Science Education.

Parenti, L. Robert. Ph.D. University of Oklahoma. 1966–1980. Botany, Plant Physiology.

Peterson, John E. Ph.D. Michigan State University. 1971–1983. Botany. Mycology.

Rathbone, Karrie. Ph.D. University of Kansas. 2003–2005. Botany, Field and Lab Biology.

Robbins, R. Laurie. Ph.D. Texas Tech University. 1989–2003. Botany, Economic Botany, Field and Lab Biology.

Sadler, Holmes. B.A. Yale, L.L.B. Union College. 1880–1885. Botany.

Stephens, Homer A. M.A. Columbia University. 1954. Taxonomy.

Stewart, Alban. B.A. Kansas State Normal School. 1910–1911. Botany

Sundberg, Marshall D. Ph.D. University of Minnesota. 1997–2022. Botany, Plant Anatomy and Physiology, Plant Kingdom, Economic Botany, Forensic Botany.

Weber, Vincent. Ph.D. University of Minnesota. 1959–1960. Plant Anatomy, Plant Taxonomy.

Wilson, James S. Ph.D. University of Michigan. 1959–1982. Botany, Grasses, Plant Anatomy, Plant Ecology, Plant Taxonomy.

Wooster, Lyman C. Ph.D. Milton College. 1897–1935. Botany.

REFERENCES

Anonymous, 1889. *A History of the State Normal School of Kansas for the First Twenty-Five Years*. Miscellaneous Publication, Kansas State Teachers College of Emporia.

Anonymous, 1904. *The Natural Sciences as taught in the State Normal School, Emporia, Kansas*. Miscellaneous Publication. Archives copy: Np.2bi 1904.

Archives, Emporia State University, Biological Sciences, 003.004.002, 24 Boxes.

Bergen, J. Y. 1896. *Elements of Botany*. Boston, Ginn and Company.

Bergen, J. Y. 1901. *Foundations of Botany*. Boston, Ginn and Company.

Bessey, C. E. 1877. Letter to W.J. Beal, University of Michigan, in: Ross, Earle Dudley. 1942. *A History of the Iowa State College of Agriculture and Mechanic Arts*. 1942. Iowa State University Press, Ames.

Breukelman, J. 1950. The Kansas State Teachers College of Emporia and the Installation of Delta Kappa Chapter. *Bios* 21: 187-191.

Breukelman, J. 1963. A History of the Department of Biology in Honor of the Centenary of the College. Unpublished—Emporia State University Biology Department Records.

Catalogues, 1880-1922. Annual Catalogue of the offices and students of the state Normal School, Emporia, KS.

Catalogues, 1923-1973. Annual Catalogue of the Kansas State Teachers College of Emporia.

Catalogues, 1974-present. Annual Catalogue of Emporia State University.

Gray, A. 1880. *Gray's School and Field Manual*. New York. Ivison, Blakeman, Taylor and Company.

Gray, A. 1887. *Gray's Lessons and Manual, Revised: The elements of botany for beginners and for schools*. New York. American Book Company.

Gray, A. 1895. *Field, Forest, and Garden Botany: A simple introduction to the common plants of the United States east of the 100th Meridian, both wild and cultivated*. New York. American Book Company.

Hurd, P. D. 1961. *Biological Education in American Secondary Schools. 1890-1960*. Biological Sciences Curriculum Study, Bulletin 1. Washington, D.C. American Institute of Biological Studies.

Jones, C. 2020. The shapes of botany. *Plant Science Bulletin* 66: 174-184.

Kellerman, W. A. 1883. *The Elements of Botany: Embryology, Organography, Histology, Vegetable Physiology, Systematic Botany and Economic Botany arranged for School Use or for Independent Study together with a Complete Glossary of Botanical Terms*. Philadelphia. John E. Potter and Company.

Macmillan, C. 1893. The emergence of a sham biology in America. *Science* 21: 184-186.

Menhusen, B. R. 1959. A History of the Department of Biological Sciences of Kansas State Teachers College of Emporia (A Survey from 1885 to 1958). Unpublished. Emporia State University Biology Department Records.

National Science Foundation, 1957-1968. Grant preparations, operational details, and final reports for: Summer Institute for Science Teachers at Kansas State Teachers College (1957-1968); Research Participation for High School Teachers in Biology at Kansas State Teachers College. (1961-1968); Academic Year Institutes for High School Teachers in Biology at Kansas State Teachers College. (1962-1964). Emporia State University Archives. ESU 003.004.002, Np:2bi.pr, Boxes 10 & 11.

Prentis, N. L. 1899. *A History of Kansas*. Winfield, KS. A.P. Greer.

Prophet, C. W. 1998. History of the Division of Biological Sciences 1960-1998: 130 Years and Counting. Unpublished. Emporia State University Archives.

Rudolph, F. 1977. *A History of the American Undergraduate Course of Study since 1636*. San Francisco. Jossey-Bass.

Schaefer, H. 1932. The College Biology Curriculum. *School Science and Mathematics*. November: 852-856.

Science, 1884. Kellerman's Botany: The Elements of Botany, Embracing Organography, Histology, Vegetable Physiology, Systematic Botany, and Economic Botany. Volume no 3, issue 62: 460-461.

Stern, W. L. 1969. *Quo Vadis, Botanicum? Plant Science Bulletin* 15: 1-4.

Sundberg, M. D. 1991. Are we reinventing the wheel? *BioScience* 41:779-783.

Sundberg, M. D., E. J. Kormondy, J. Carter, J. A. Moore, S. N. Postlethwait, and J. W. Thornton. 1992. Reassessing the Commission on Undergraduate Education in the Biological Sciences. *BioScience* 42: 442-446.

Sundberg, M. D., and M. L. Dini. 1993. Majors vs nonmajors: Is there a difference? *Journal of College Science Teaching*. 22: 299-304.

Sundberg, M. D., M. L. Dini and E. Li. 1994. Improving student comprehension and attitudes in freshman biology by decreasing course content. *Journal of Research in Science Teaching*. 31: 679-693.

Sundberg, M. D. 2003. Strategies to help students change naïve alternative conceptions about evolution and natural selection. *Reports of the National Center for Science Education* 23: 23-26.

Sundberg, M. D. 2011. Botanical education in the United States: Part 1, The impact of Linneaus and the foundations of modern pedagogy. *Plant Science Bulletin* 57: 134-158.

Sundberg, M. D. 2012. Botanical education in the United States: Part 2, The nineteenth century – Botany for the masses vs. the professionalization of botany. *Plant Science Bulletin* 58: 101-131.

Sundberg, M. D. 2014. Botanical education in the United States: Part 3, The Botanical Society builds the discipline, 1895-1960. *Plant Science Bulletin* 60: 28-61.

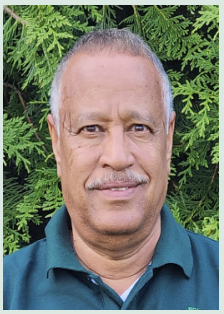
Sundberg, M. D. 2016. Botanical education in the United States: Part 4, The role of the Botanical Society of America (BSA) into the next millennium. *Plant Science Bulletin* 62: 132-154.

Wildlife Biologist (0486). Website: https://www.fws.gov/sites/default/files/documents/Basic%20Qualification%20Requirements.pdf.

Travels in Tanzania with North American Undergraduates: A Botanical Wildlife Safari

As a botanist and an entomologist, taking a wildlife safari tour was never a high priority for either of us. We've both traveled widely and worked with plants and insects in many parts of the world. Wildlife viewing in Africa sounded interesting, to be sure, but we hardly thought of it as worthy of the effort and expense. As faculty members at SUNY Oswego, our professional lives center on undergraduate teaching and small-scale research experiences, with fieldwork conducted in our local New York fields and woodlands.

New York summers are short, though, and we are always looking for more options for our many students interested in field biology. In 2017, while one of us (K.I.M.) was in Tanzania conducting research on the parasitic genus *Striga*, he was introduced to Dr. Alex Kisingo, at the time a senior lecturer and Head of Research and Consultancy at The College of African Wildlife Management (Mweka), in Moshi. Mweka trains students for careers in wildlife conservation, with most graduates finding work as game wardens, park rangers, safari guides, and climbing guides on Kilimanjaro. The college has been expanding its offerings recently, to include a master's degree program, and—fortuitously for us—it is seeking to grow its international programs, bringing in more students from outside Africa, sending more of its students abroad, and enhancing teaching and research collaborations and exchanges with biologists from around the world. During K.I.M.'s visit, Alex encouraged us to bring over Oswego students for a short training course in wildlife ecology. As one of the few U.S. universities offering a bachelor's degree in zoology, we were pretty sure that there would be interest among our students. His tour of Mweka convinced K.I.M. that the infrastructure and expertise Mweka had in place to lead field research and training for its own students would make it an outstanding destination for ours as well.



By Kamal I. Mohamed* and Karen R. Sime
Department of Biological Sciences, State University of New York at Oswego, Oswego, NY 13126
**Corresponding author: kamal.mohamed@oswego.edu*

We have now taught the Tanzania Biodiversity and Conservation class three times, in 2018, 2019, and 2022, to an average of 10 students each time. The format of the course is what SUNY Oswego terms "faculty-led travel," in which students do coursework for a portion of the semester, and then are accompanied by the instructors during travel. For half a semester, we met weekly with the students in Oswego to get them up to speed on

Tanzania's history, people, ecosystems, and wildlife, and to get ourselves up to speed as well. We knew embarrassingly little about Tanzania at the start, but (as is often the case for college professors) we did manage to stay just ahead of the students. Besides references that we specifically cite, these are examples of suggested sources students used to prepare talks and a final paper: Kennedy, 2014; Sinclair et al., 2015; Briggs and McIntyre, 2017; Luke and Beentje, 2020; Makunga, 2022.

Some interesting things we learned:

- The name "Tanzania" is a modern invention. The British colony of Tanganyika gained independence in 1961. A few years later, Zanzibar overthrew Arab rule, and the two young countries joined into a single nation, the Republic of Tanzania, blending their names into one as well (Tan-Zan-ia).

- The population of Tanzania is marvelously multicultural, an amalgamation of some 120 tribes with over 100 languages (Swahili being the *lingua franca*, along with English to some extent). Around two thirds of the population is Christian, another one third is Muslim, with small minorities following other practices (Winks, 2009).

- Tanzania takes conservation very seriously. About 40% of the land area of Tanzania is protected (there are marine preserves as well), one of highest percentages in the world. In contrast about 12–13% of the U.S. is protected, which is roughly the world average. Preserves include national parks, which are completely protected and closed to human habitation, and game and forest reserves and conservation areas in which herding, hunting, and human habitation are allowed to varying degrees (United Republic of Tanzania, 2014).

- Wildlife tourism makes up nearly 20% of the GDP and employs hundreds of thousands of people (United Republic of Tanzania, 2015). Mweka itself is a testament to Tanzania's dedication to protecting these resources. Its founding in 1964, shortly after independence, represented the beginnings of a movement to put Africans in charge of the conservation of their wildlife and other natural resources.

Our two-week visits in Tanzania began with a day of lectures from Mweka faculty on wildlife ecology, local ecosystems (including the vertical vegetation zones of adjacent Mt. Kilimanjaro), and regional conservation practices, followed by a tour of preserves and parks in the northeastern part of the country (Figure 1). Throughout the visit, we kept costs very low by staying in dormitories and camping in tents they provided. We traveled in the back of a repurposed Russian troop carrier (no air-conditioned comforts on this trip), and had communal meals prepared by a team of cooks. Additional lectures and discussions took place in the field, at picnic tables and around campfires.

On our first full day in Tanzania, we explored the Mweka campus and discovered many tree species that our students found to be quite exotic. Some of these are seen in the background of Figure 2: fever acacia (*Vachellia xanthophloea* (*Acacia xanthophloea*)), Senegal date (*Phoenix reclinata*), pencil cedar (*Juniper procera*), Norfolk pine (*Araucaria heterophylla*), and traveler's palm (*Ravenala madagascariensis*). Among others not pictured

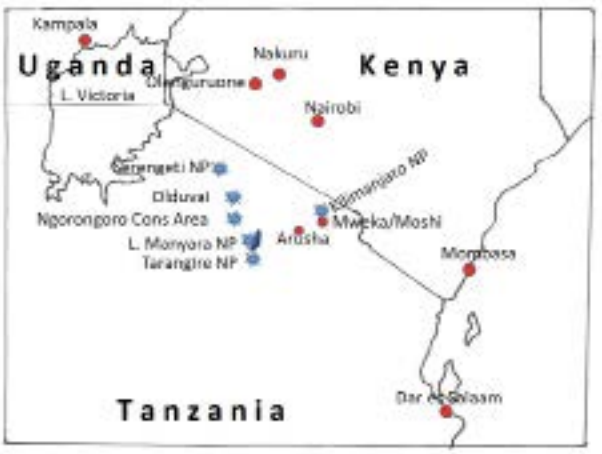


Figure 1. *Star symbols show the National Parks and Olduvai Gorge Museum we visited in Northern Tanzania. The Snake Park, Maasai Museum, and Maasai Boma, just outside Lake Manyara, are other significant sites we visited but are not shown on this map. The College of African Wildlife Management (Mweka) is at the base of Kilimanjaro.*

are strangler fig (*Ficus thonningii*), African tulip (*Spathodea campanulata*), and the giant potato tree (*Solanum macranthum*). Strangler fig is of particular interest to North American students with its unfamiliar appearance and lifestyle. A hemiepiphyte, it starts atop a host tree and sends roots down to the forest floor, squeezing the trunk of the host tree and shading its crown, eventually killing it.

Mweka is located on the lower slopes of Mt. Kilimanjaro at about 1370 m. At slightly lower elevations, the landscape is devoted to coffee plantations. Two wet seasons—a shorter one that runs November to January and a longer one from March to May—supply an annual rainfall of 100–165 cm and support a lush, wooded environment. Hiking up from the college toward one of the entrances to Kilimanjaro National Park at elevation

Figure 2. *Students of the 2018 class on the Mweka campus, along with a Mweka faculty member, Mt. Kilimanjaro in the background. The weather in May was usually overcast, and of the three times we have offered the class, this was the only time we had a sustained clear view of Mt. Kilimanjaro. 1. Fever acacia, 2. Norfolk pine, 3. Senegal date, 4. Traveler's palm, and 5. Pencil cedar.*

1640 m, we passed through a landscape of small villages, home to the Chagga tribe, the houses and other buildings interspersed with household gardens planted with banana, coffee, maize, sweet potato, beans, and cassava. These so-called Chagga homegardens, built into the forest over centuries, are a fascinating example of sustainable land use in a mixed-cropping system (Fernandes et al., 1985; Hemp, 2008). The coffee-banana belt occupying the lower flanks of Kilimanjaro is a modified woodland, with the canopy intact and shade-tolerant crops integrated into the forest; over 500 plant species, 400 of which are not cultivated, can be found in this zone (Hemp, 2006, 2008). The typical Chagga homegarden comprises four main layers: larger trees like avocado (*Persea americana*) and albizia (*Albizia schimperiana* var. *amanuensis*), beneath which grow different varieties of bananas (*Musa x sapientum*) 5–7 m high, then coffee (*Coffea arabica*), and at the base a mixture of smaller food crops like cassava (*Manihot esculenta*) and coco yam (*Colocasia esculenta*). These crops make up a large part of the local diet, and the extras (particularly coffee) are sold for cash. Bananas are perhaps the largest single crop, and we were fascinated by the variety of ways in which the Chagga use them. One interesting use is the making of mbege, a strong beer made up of fermented banana mixed with a borage of finger millet and some quinine-bark flour to adjust the sugary taste of banana. Numerous small pubs serving the drink line the roads outside the National Park. Besides sampling the mbege on our hike, we also introduced our students to several plants with medicinal and folk uses, including castor bean (*Ricinus communis*), misty plume bush (*Tetradenia riparia*) (Figure 3), and dragon tree (*Dracaena afromontana*) (Figure 4).

Figure 3. Tetradenia riparia, *a plant found in the Chagga homegardens, which our hosts claimed worked as a COVID-19 treatment either by chewing the leaves or as steam therapy.*

Figure 4. *Among the Chagga, Dracaena marginata is used to build fences and mend relationships—one must forgive when the plant is offered by the offender.*

The Chagga gardens provided the students an education in a type of agricultural system that, while unfamiliar to North Americans, is fairly widespread, particularly in the tropics, among indigenous cultures. For example, K.I.M. witnessed similar homegardens in southern Ethiopia, with an upper layer of ensete (*Ensete ventricosum*); below it, sorghum, millet, or maize; and a bottom layer of smaller crops, such as beans and vegetables (Zemede and Avele, 1995). In parts of Ecuador, inhabitants practice two systems of agriculture: small fields closer to their homes and homegardens. These gardens and fields contain over 50 plant species including cacao, coffee, banana, pineapple, cassava, and a variety of other food and non-food crops (Gari, 2001). Fields are cultivated and managed, and abandoned according to a complex agroecological system (Gari, 2001). Diversified systems such as these ensure the resilience of ecosystems and at the same time maximize the production of food, medicines, and other resources. The study of these systems has much to contribute to improving the effectiveness and efficiency of sustainable agroecosystems worldwide, by integrating indigenous knowledge with scientific methodology (Dewalt, 1994).

After a couple of days at the college, we piled into the troop carrier, accompanied by two Mweka faculty members who would serve as our guides and interpreters, along with the cook and his helpers. We drove several hours to Mto Wa Mbu, staying in a tent campground in the forested hills above the town. Nearby Lake Manyara National Park is the smallest of the parks we visited, with an area of 325 sq km but known for its diverse habitats, which harbor nearly 700 plant species (Greenway et al., 1972); in fact, the density and diversity of wildlife here is extraordinary. Any fears that our zoology students might have been disappointed in their safari were quashed within minutes of entering this park, as we soon had up-close views of baboons, zebras, wildebeest, warthogs, elephants, monkeys, and lions.

This park differs from the others that we visited in that much of it is densely wooded, whereas the others are characterized by open savannah. Most of the park's roads run through the narrow flats bounded by the alkali lake on one side, and the steep sides of the Rift Valley on the other. The woodland is dominated by large, dense *Acacia* and *Commiphora* species, *Albizia anthelmintica*, and *Cassia singueana*, with a variable understory shrub layer. Notable among these is African myrrh (*Commiphora africana*), from the resins of which incense is produced. The slopes, which rise 600–1000 m above lake level, feature baobabs (*Adansonia digitata*), broad-leaved croton (*Croton macrostachyus*), candelabra tree (*Euphorbia candelabrum*), sycamore fig (*Ficus sycomorus*), quinine tree (*Rauvolfia caffra*), Natal mahogany (*Trichilia roka*) (also noted for its medicinal extracts [Sanogo et al., 2001]), and forest toad-tree (*Tabernaemontana ventricosa*) (Greenway et al., 1969, 1972). Closer to the lake are open alkaline flats beds dominated by grasses, mainly *Sporobolus spicatus* in association with *Sporobolus consimilis*, whereas the drier grassy areas are dominated by *Cynodon dactylon*.

Tarangire National Park is about 70 km south of Lake Manyara. Although both parks receive similar amounts of rain (about 70 cm annually), Tarangire seems drier than Lake Manyara National Park, with open water flow largely limited to the Tarangire River, in contrast to the multiple springs and creeks draining through the steep hillsides of Lake Manyara. It is grassier and much more open, with only scattered trees. Nonetheless, many

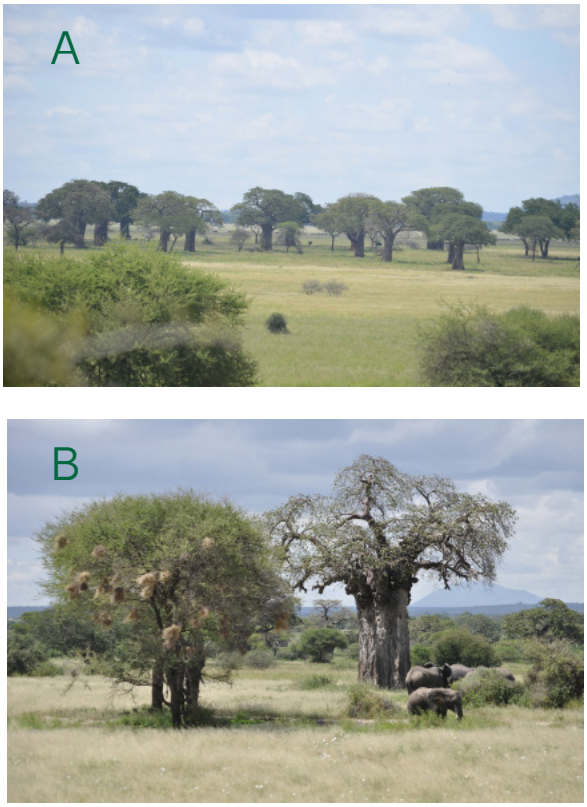


Figure 5. *(A) Tarangire, the land of baobab. (B) Elephants, a baobab, and an acacia bearing dozens of weaverbird nests. Note the cinder cone in the background. There are dozens of such volcanic features in northern Tanzania (including Kilimanjaro), most of them inactive.*

of the same animals occur at the two parks, and there is significant migration between them.

Tarangire is renowned for its large elephant herds, but we were just as thrilled by the botanical "big game" of its many enormous baobabs (*Adansonia digitata*). We saw more extensive stands of these trees than at any other place we visited in Tanzania (Figure 5A, B). These long-lived, majestic trees reach up to 25 m, with wide spreading branches and stout trunks measuring 10–15 m across. Baobabs are known among the most effective plants that control water loss. Some baobabs in Tarangire

Figure 6. *A termite mound in Tarangire National Park, with a young baboon. The rest of his troop was in a nearby baobab, devouring the fruits and plundering bird nests.*

had been heavily damaged by elephants seeking nutrients and water, bringing to our attention the many uses of baobabs by both people and wildlife. They are important for the livelihood of many people in arid zones for uses in food, beverages, and medicine. The hollow trunk of some specimens can provide shelter, and the tubers, twigs, fruits, seeds, leaves, and flowers are common ingredients in traditional dishes and beverages; they provide a reliable food and water source for birds, baboons, and other animals (Gebauer et al., 2002; Venter and Venter, 2007).

Besides the baobabs, Tarangire's vegetation is a mix of *Acacia* and *Combretum* woodlands and seasonally flooded grasslands. Along the riverbanks, we saw pure Acacia stands and occasional sausage trees (*Kigelia africana*). The drier habitats are highly suited for mound-building termites and feature numerous, often very large mounds (Figure 6), to the delight of the entomologist in the group.

Figure 7. *A typical grassland habitat in Ngorongoro crater with a mixed herd of zebras, Cape buffalo, and wildebeest; in the background, the rim rises some 600 m above the floor of the crater.*

Figure 8. *The walls of Ngorongoro crater, visible in the background with their dense forest, descend into stands of large fever acacia around the base (here with a group of vervet monkeys).*

From the dry lowlands (ca. 900 m elevation) around Manyara and Tarangire, we ascended into the cloud forests at the rim of Ngorongoro Crater, where we camped overnight. Through the mists, we began to see astonishing views of the crater, which is the world's largest intact and unfilled volcanic caldera, some 610 m deep and around 17 km across. At 2300 m elevation, the rim is persistently cool and damp. The steep interior slopes of the crater are occupied by a variety of montane forest trees, including red thorn acacia (*Vachellia gerrardii*) and gum acacia (*Acacia senegal*), sweet olive (*Osmanthus fragrans*), African redwood (*Hagenia abyssinica*), and African pencil cedar (*Juniperus procera*), with fever acacia dominating the lower portions. Enormous candelabra trees also cling to the hillside.

The morning after arriving at the rim, we descended the steep switchback road through these woodlands to the bottom, where we were rewarded by views of the elephants, lions, zebras, wildebeest, hyenas, and other wildlife that congregate in the lush grassy wetlands (Figure 7) and the fever acacia stands at the edges (Figure 8). The highlight of the crater was a close view of the gravely endangered black rhino, made possible when we connected with some of the "rhino rangers" assigned to protect the crater's rhino herd. The rangers were alumni of Mweka College and arranged our viewing with our faculty guides, their former professors. Only a few dozen rhinos live here. The ranger team follows each animal's activities closely, using cameras and tracking devices. Injured or sick rhinos are given aid (which is not done for other species). Although the topography limits poaching in this preserve, it is still a serious concern here as elsewhere.

Most of the crater floor is grassland, with some small sections of standing water surrounded by swampy areas (Anderson and Herlocker, 1973). In late May, at the end of the rainy season, we found many roads still muddy or inundated. Few trees exist at the floor, mainly near the swamps and the edges of the crater, including species of *Acacia, Vangueria, Commiphora, Albizzia,* and *Rauvolfia.* Common herbaceous plants include species of *Chloris, Cynodon, Digitaria, Andropogon,*

Sporobolus, and *Leucas*. We also encountered several invasive species: yellow flower bidens (*Bidens schimperi*), wild cannabis or khaki weed (*Tagetes minuta*), and purple flower gutenbergia (*Gutenbergia cordiflora*)—the latter two species in particular implicated in dramatic alterations to the native flora of the crater in recent years (Ngondya and Munishi, 2021). *Bidens schimperi* has edible leaves, and Tanzanians claim that the roots cure coughs and colds.

Ngorongoro Crater is situated between the Serengeti plains on the northwest and the Rift Valley to the east, and together with surrounding lands comprises the larger Ngorongoro Conservation Area (NCA), a UNESCO World Heritage Site that is home to many Maasai, albeit with restrictions on their use of the land. The NCA has been celebrated as a model for cooperative conservation, the semi-nomadic, pastoralist Maasai coexisting with protected game (we saw many mixed herds of cattle, goats, zebras, giraffes, and gazelles), but for the Maasai the story has been fraught with tensions (Buzinde et al., 2014; Melubo and Lovelock, 2019). Many moved to the NCA after being evicted from the adjacent lands that were designated as Serengeti National Park in 1959. The crater itself was made off-limits to the Maasai for pastoral use and habitation in 2009. One of the Mweka faculty members accompanying us was a Maasai who grew up in a village near the crater rim and recalled bringing his herds into the crater as a boy. More recently, the Tanzanian government has moved to further restrict Maasai use of the NCA, leading to the possibility of another round of displacement.

From the crater, we descended into the Serengeti plains, traveling toward Serengeti National Park. This stretch is in the rain shadow of the crater rim and adjacent uplands, an ecosystem dominated by dry grasslands and thickets of stunted acacia species, including whistling acacia (*Acacia drepanolobium* syn *Vachellia drepanolobium*). Before entering the park, we stopped at Olduvai Gorge and its visitor center (Figure 9), with its excellent museum chronicling the paleoanthropological discoveries made in the adjacent ravine by Louis and Mary Leakey and their colleagues. It was here that the Leakeys found the key fossils that consolidated the evidence for an African origin for the human species. Excavations in the area are ongoing. We didn't see much wildlife here—a few troops of baboons—but as evolutionary biologists we were thrilled to explore the Leakeys' field sites. Incidentally, the name "Olduvai" comes from (a mispronunciation of) *oldupai,* the Maasai word for sisal (*Agave sisalana*) (Figure 9), which is abundant in this area. Although native to Central America, sisal has been cultivated for commercial purposes in Tanzania since the 1880s, and grows wild near the gorge (Carr et al., 2006).

Figure 9. *Entrance to Olduvai Museum with sisal plants lining the road on either side.*

We spent four nights in Serengeti National Park. The park is large, extending some 150 km south from the Kenya-Tanzania border and 150 km southeast from points near the shores of Lake Victoria, with elevations ranging from 900 to 1800 m. Much of it is rolling plains, with as many as 200 species of grasses (Williams et al., 2016), characterized by short and tall grasslands and small stretches of woody savannah dominated by *Acacia, Vachellia, Commiphora*, palms, and sausage trees. The short grasslands in the eastern parts of the park are dominated by *Sporobolus* and *Kyllinga* species, while the tall grasslands in the west are dominated by *Pennisetum, Andropogon*, and *Themeda* species (Lind and Morrison, 1974). Intermediate grasslands of *Cynodon* and *Sporobolus* are found between them. McNaughton (1983) divided the Serengeti grasslands into 17 different communities including 6 short grassland communities, 3 tall, and 8 intermediate. Anderson and Talbot (1965) and Lind and Morrison (1974) attributed the distribution and growth of grass species in the plains to a number of factors, including soil depth and texture, salinity, wind erodability, rainfall, and grazing pressure.

The diversity of grasses may have failed to capture the interest of our zoology students, but they could not help but notice the scattered trees, which were focal points for wildlife observation. Predators frequently climb them, to scan for prey and possibly also to avoid biting flies. We often spotted lions and leopards on sausage trees (Figure 10) and acacias; once, we counted 11 lions (females and several cubs) lounging in a large acacia (Figure 11). The sausage trees, which we had first spotted in Tarangire National Park, are particularly interesting. These semi-deciduous trees are common and widespread in African savannah, and they're large, reaching up to 25 m. They are easily identified by the sausage-like dangling fruits, which can be a meter long (Figure 10). The fruits are poisonous if consumed raw, but if prepared correctly have significant food and medicinal value (Jackson et al., 1996; Picerno et al., 2005). Indigenous people make them into a beer and have used them in wound healing and to treat rheumatism, psoriasis, diarrhea, and stomach ailments.

Figure 10. *Serengeti lions resting on a sausage tree after a big meal. Notice the typical open grassland with scattered trees, typical of this park. The insert on the left shows the sausage fruits.*

Figure 11. *There were 11 lions in this umbrella acacia (females and cubs), plus a few more on the ground, obscured by the tall grass (Serengeti National Park).*

Up to our arrival in the Serengeti we had been astonished at the bounty of wildlife sightings; and here we were astonished again, at the sheer abundance and magnitude of the herds in the park. Pools packed with hundreds of hippos; gazelle, zebra, and elephant herds so vast as to disappear into the horizon. We witnessed thousands of migrating wildebeest accompanied by zebras and trailed by cheetahs, lions, and hyenas. Even our guides, who had spent much time in the park, expressed joy, wonder, and excitement at the scene.

While the animal highlights of a Tanzanian safari would be well known to any fan of BBC and PBS nature specials, the many plant highlights are most fascinating as well, and not only within the preserves. Driving between parks, we saw numerous additional species of interest, whether for their uses by locals or for their familiarity as garden and house plants in North America, and we had opportunities to relate their stories to our students. These included desert date (*Balanites aegyptiaca*), with its edible fruits often serving as fodder for goats and camels; sandpaper bush (*Ehretia obtusifolia*), whose distinctive tough leaves are infused into teas to treat pain; frankincense (*Boswellia papyrifera*), African chewing gum (*Azanza garckeana*); toothbrush bush (*Salvadora persica*), which is used as such and has added antiseptic and analgesic effects (Niazi et al., 2016); and plants commonly cultivated in North America such as maidenhair fern (*Adiantum venustum*), lantana (*Lantana camara*), and jimsonweed (*Datura stramonium*). Jimsonweed is a large herbaceous plant with well-known poisonous and hallucinogenic effects (Trancă et al., 2017). It occurs in North America but is seldom seen in our part of New York.

Why would a botanist teach a "safari class"? In a sense, it was under the guise of a wildlife safari that we were able to expose our students to a great many botanical wonders: unfamiliar plants, plant communities, and agroecosystems, as well as new insights into familiar plants and products. They were excited to taste the sweet pulp of the coffee

fruit and dig out the green beans within, to sample mbege made from bananas growing just outside the pub, to see the plants from which frankincense and myrrh originate, and to learn the names of plants that provide habitat, food, and water for animals. They gained a new appreciation of indigenous and folk uses of plants, most of them unfamiliar; they learned about agroecosystems entirely different from, and more sustainable than, the typical North American farm; and they learned about kinds of plants, such as strangler fig, that behave very differently from any they know in the U.S. The opportunity to view animals in their native settings was the bait, perhaps, and the wildlife viewing was wonderful indeed—but we also aimed to stimulate these young zoologists to learn more about the plants with which their objects of study interact. Zoology students, in our experience, are often reluctant to study plants, but in Tanzania, through hands-on study, they discovered that plants and animals are inseparable when studied in the field, and gained a new appreciation for botanical knowledge.

By collaborating with faculty members at Mweka, we were able to provide our students with a rich learning experience focused on wildlife conservation and ecology, subjects outside our own areas of expertise. We learned a great deal as well—about wildlife, about Tanzanian ecosystems, about the effects of climate change in this region, and about political, economic, and cultural aspects of species and habitat conservation in this part of the world. In turn, we were able to share with our Mweka colleagues some of our knowledge of plants and insects, making the trip more rewarding for everyone.

Field work in Africa can be expensive and logistically difficult for scientists based far away and with limited knowledge of local resources. Organizing a class for undergraduates made available to us with support from both our own university and from Mweka, providing a convenient and low-cost way to travel. Both for us and for our students, the class was an opportunity to work in a part of the world that would otherwise have been very difficult for us to visit.

ACKNOWLEDGMENTS

We thank the College of African Wildlife Management and SUNY Oswego's Office of International Education and Programs for making our Tanzania course possible; and we thank Jim Seago and two anonymous reviewers for comments on an earlier version of this manuscript.

REFERENCES

Anderson, G. D., and L. M. Talbot. 1965. Soil factors affecting the distribution of the grassland types and their utilization by wild animals on the Serengeti Plains, Tanganyika. *The Journal of Ecology* 53: 33-56.

Anderson, G. D., and D. J. Herloacker. 1973. Soil factors affecting the distribution of the vegetation types and their utilization by wild animals in Ngorongoro Crater, Tanzania. *Journal of Ecology* 61: 627-651.

Briggs, P., and C. McIntyre. 2017. Northern Tanzania Safari Guide: Including Serengeti, Kilimanjaro, Zanzibar. Bradt Travel Guide Publication. Chalfont St. Peter, England.

Buzinde, C. N., J. M. Kalavar, and K. Melubo. 2014.Tourism and community well-being: The case of the Maasai in Tanzania. *Annals of Tourism Research* 44: 20-35.

Carr, D. J., N. M. Cruthers, R. M. Laing, and B. E. Niven. 2006. Selected mechanical properties of sisal aggregates (*Agava sisalana*). *Journal of Materials Science* I41: 511–515.

DeWalt, B. 1994. Using indigenous knowledge to improve agriculture and natural resource management. *Human Organization* 5: 123–131.

Fernandes, E. C. M., A. Oktingati, and J. Maghembe. 1985. The Chagga home gardens: A multi-storeyed agro-forestry cropping system on Mt. Kilimanjaro, Northern Tanzania. *Food and Nutrition Bulletin* 7: 1-8.

Gari, J. 2001. Biodiversity and indigenous agroecology in Amazonia: the indigenous people of Pastaza. *Etnoecologic* 5: 21-37.

Gebauer, J., K. El-Siddig, and G. Ebert. 2002. Baobab (*Adansonia digitata* L.): a review on a multipurpose tree with promising future in the Sudan. *Gartenbauwissenschaf*t 67: 155–160.

Greenway, P. J., and D. F. Vesey-Fitzgerald. 1969. The vegetation of Lake Manyara National Park. *Journal of Ecology* 57: 127–149.

Greenway, P. J., and D. F. Vesey-FitzGerald. 1972. Annotated check-list of plants occurring in Lake Manyara National Park. *Journal of the East Africa Natural History Society and National Museum* 28: 1–29.

Hemp, A. 2006. The banana forests of Kilimanjaro: Biodiversity and conservation of the Chagga home gardens. *Biodiversity and Conservation* 15: 1193–1217.

Hemp, A. 2008. The Chagga home gardens on Kilimanjaro: Diversity and refuge function for indigenous fauna and flora in anthropogenically influenced habitats in tropical regions under global change on Kilimanjaro, Tanzania. *International Human Dimensions Programme on Global Environmental Change* (IHDP) 2: 12-17.

Jackson, S. J., P. J. Houghton, A. Photiou, and S. Retsas. 1996. The isolation of a novel antineoplastic compound from a bioassay guided fractionation of stem bark and fruit extracts of *Kigelia pinnata* (Bignoniaceae). *British Journal of Cancer* 73: 68.

Kennedy, A. S. 2014. Birds of the Serengeti and Ngorongoro Conservation Area. Princeton University Press. Princeton, NJ.

Lind, E. M., and M. E. Morrison. 1974. East African Vegetation. Longman. London, UK.

Luke, Q., and H. Beentje. 2020. 100 Trees to see on Safari in East Africa. Penguin Random House. Johannesburg, South Africa.

Makunga, J. E. 2022. Field Guide of Tanzania Plants. White Falcon Publishing. Chandigarh, India.

McNaughton, S. J. 1983. Serengeti grassland ecology: The role of composite environmental factors and contingency in community organization. *Ecological Monographs* 53: 291-320.

Melubo, K., and B. Lovelock. 2019. Living inside a UNESCO World Heritage Site: The perspective of the Maasai community in Tanzania. *Tourism Planning & Development* 16: 197-216.

Ngondya, I. B., and L. K. Munishi. 2021. Impact of invasive alien plants *Gutenbergia cordifolia* and *Tagetes minuta* on native taxa in the Ngorongoro crater, Tanzania. *Scientific African* 13: e00946.

Niazi, F., M. Naseem, Z. Khurshid, M. S. Zafar, and K. Almas. 2016. Role of *Salvadora persica* chewing stick (miswak): A natural toothbrush for holistic oral health. *European Journal of Dentistry* 10: 301-308.

Picerno, P., G. Autore, S. Marzocco, M. Meloni, R. Sanogo, and R. Aquino. 2005. Anti-inflammatory activity of verminoside from *Kigelia Africana* and evaluation of cutaneous irritation in cell cultures and reconstituted human epidermis. *Journal of Natural Products* 68: 1610-1614.

Sanogo, R., M. P. Germanò, V. D'Angelo, A. M. Forestieri, S. Ragusa, and A. Rapisarda. 2001. *Trichilia roka Chiov.* (Meliaceae): pharmacognostic researches. *Farmaco* 56: 357-360.

Sinclair, A. R. E., K. L. Metzger, A. R. S. Mduma, and J. M. Fryxell. 2015. Serengeti IV: Sustaining Biodiversity in a Coupled Human-Natural System. Chicago University Press, Chicago, IL.

Trancă, S. D., R. Szabo, and M. Cociș. 2017. Acute poisoning due to ingestion of *Datura stramonium* - a case report. *Romanian Journal of Anaesthesia and Intensive Care* 24: 65-68.

United Republic of Tanzania. 2014. Report on the Implementation of the Convention on Biological Diversity. Website: https://www.cbd.int/doc/world/tz/tz-nr-05-en.pdf

United Republic of Tanzania. 2015. National Biodiversity Strategy and Action Plan 2015-2020. Website: https://www.fao.org/faolex/results/details/en/c/LEX-FAOC170299.

Venter, F., and J. A. Venter. 2007. Making the most of indigenous trees. Briza Publications, Singapore.

Williams, E. V., J. E. Ntandu, P. Ficinski, and M. Vorontsova. 2016. Checklist of Serengeti ecosystem grasses. *Biodiversity Data Journal* 4: e8286.

Winks, Q. 2009. Tanzania - Culture Smart! The Essential Guide to Customs & Culture. Kuperard, London.

Zemede, A. and N. Avele. 1995. Home-gardens in Ethiopia: characteristics and plant diversity. *Sinet, an Ethiopian Journal of Science* 18: 235-266.

MEMBERSHIP NEWS

Botany360 Event Recordings Now Available

Botany360 (https://botany.org/home/resources/botany360.html) is a series of programming that connects our botanical community during the 360 days outside of Botany Conferences. The Botany 360 event calendar is a tool to highlight those events. The goal of this program is to connect the botanical science community throughout the year with professional development, discussion sessions, and networking and social opportunities. To see the calendar, visit www.botany.org/calendar.

By Amelia Neely

BSA Membership & Communications Manager

E-mail: ANeely@botany.org

We are excited to now offer the following event recording from our Spring 2023 Botany360 events:

- **Making the most out of Botany 2023 - A Student Conference Guide** (May 26, 2023) [Available at: https://youtu.be/1CiRBSs45kw] Workshop presented by BSA Student Representatives, **Ioana Anghel** and **Eli Hartung**.

  Are you attending the Botany Conference for the first time this July? Or are you looking for tips on how to make the best of the conference as a student? This workshop goes over student-specific events, how to organize your time, how to make your trip as affordable as possible, and how to successfully network. It also goes over ways to make the best out of attending virtually. (Also see the student reps' article in this issue of the *PSB*.)

You can also find past recordings that can be accessed for free at https://botany.org/home/resources/botany360.html, including:

- **De-mystifying the MS submissions process: Before you submit (Part 1 & 2)**
- **Applying to Grad School - A Q&A Session**
- **Intro to Reviews and Meta-Analysis**
- **Webinar & Discussion #1: Learning to Write Your Story Well**

- **Webinar & Discussion #2: Getting Your Paper Published: An Editor's Perspective**

BSA LEGACY SOCIETY

Thank you to all of our Legacy Society members for supporting BSA by including the Society in your planned giving. We look forward to hosting you at this year's **Legacy Society Reception** at Botany 2023 in Boise, Idaho. If you are interested in joining the Legacy Society, you are welcome to come to the event and sign up in person or by filling out the form at https://crm.botany.org/civicrm/profile/create?gid=46&reset=1 at any time.

The intent of the **Botanical Society of America's Legacy Society** is to ensure a vibrant society for tomorrow's botanists, and to assist all members in providing wisely planned giving options. All that is asked is that you remember the BSA as a component in your legacy gifts. It's that simple—no minimum amount, just a simple promise to remember the Society. We hope this allows all BSA members to play a meaningful part in the Society's future. To learn more about the BSA Legacy Society, and how to join, please visit: https://botany.org/home/membership/the-bsa-legacy-society.html.

BSA SPOTLIGHT SERIES

The BSA Spotlight Series highlights **early career scientists** in the **BSA community** and shares both scientific goals and achievements, as well as personal interests of the botanical scientists, so you can get to know your BSA community better.

Here are the most recent Spotlights:

- **Mario Blanco-Sánchez**, Graduate Student, Universidad Rey Juan Carlos, Madrid, Spain Biología y Geología, Física y Química Inorgánica (https://botany.org/home/careers-jobs/careers-in-botany/bsa-spotlight-series/mario-blanco-sanchez.html)
- **Trinity Depatie,** Graduate Student, University of South Carolina, Biological Sciences (https://botany.org/home/careers-jobs/careers-in-botany/bsa-spotlight-series/trinity-depatie.html
- **Matias Köhler**, Postdoctoral Fellow, São Carlos University (UFSCar), São Paulo, Brazil Biology Department (https://botany.org/home/careers-jobs/careers-in-botany/bsa-spotlight-series/matias-koehler.html)
- **Kathryn Vanden Hoek**, Undergraduate Student, University of Missouri - Columbia Division of Biochemistry (https://botany.org/home/careers-jobs/careers-in-botany/bsa-spotlight-series/kathryn-vanden-hoek.html)

Would you like to nominate yourself or another early career scientist to be in the Spotlight Series? Fill out this form: https://forms.gle/vivajCaCaqQrDL648.

BSA PROFESSIONAL HIGHLIGHTS

New this year, we are including a **BSA Professional Member Highlights** section each month in the Membership Matters newsletter. If you would like to be highlighted, email me at aneely@botany.org.

Dr. Shannon Fehlberg, Conservation Biologist, Desert Botanical Garden

(Twitter: @sdfehlberg, Website: https://dbg.org/research-conservation-staff/shannon-fehlberg/)

Dr. Fehlberg works as the Conservation Biologist at the Desert Botanical Garden in Phoenix, Arizona. Her research uses phylogenetic and population genetic approaches, along with other data, to understand the evolution of rare plants and their closest relatives. She is particularly interested in resolving relationships among closely related species and understanding the influences of genome duplication (polyploidy), hybridization, geography, and ecology on species diversification. Recently, her work has focused on members of the cactus family, including several species complexes in the hedgehog genus, *Echinocereus*. Shannon is currently serving as a rotating program officer in the Systematics and Biodiversity Science Cluster at the National Science Foundation, an incredibly enriching and rewarding experience!

Wesley Knapp Chief Botanist NatureServ

(Twitter: @wmknapp, Websites: www.Wesley-Knapp.com and www.NatureServe.org)

Wesley Knapp is the Chief Botanist for NatureServe, a conservation nonprofit providing the authoritative source for biodiversity data on species and ecosystems throughout North America. Wes is an expert in numerous fields including plant identification, taxonomy, systematics, and extinct species. Wes's current research focuses on identifying and preventing plant extinction events and describing undescribed species. Wes has extensive field experience in his previous positions as a field botanist with the Maryland and North Carolina Natural Heritage Programs. Wes is currently a PhD student in Alan Weakley's lab at UNC-Chapel Hill.

Dr. Mason Heberling
Assistant Curator of Botany
Carnegie Museum of Natural History

(Twitter: @jmheberling, Websites: masonheberling.com, Blog: collectedonthisday.com)

Dr. Mason Heberling is an herbarium curator and plant ecologist studying the functional ecology of understory plant species in temperate forests, especially in the context of climate change and introduced species invasions. As a museum curator, he strives to facilitate and broaden the use of natural history collections by students, researchers, and the public. As a museum-based researcher, he uses herbarium specimens, field experiments, and observational data to understand basic plant function and complex ecological interactions.

Dr. Karolina Heyduk
Assistant Professor
University of Connecticut

(Twitter: @kheyduk, Website: www.kheyduk.net/)

Dr. Karolina Heyduk studies how plants have evolved adaptations to cope with abiotic stress, with a particular emphasis on understanding the evolution of CAM photosynthesis. Her research integrates plant physiology, genomics, and phylogenetics and focuses mostly on members of the Agavoideae (including agaves and yuccas). She is also Director of the George Safford Torrey herbarium at UConn.

BSA STUDENT CHAPTER UPDATE

BSA Student Chapters are a great way to network with peers within institutions of learning through engaging activities, as well as take advantage of special BSA discounts—including a **$10 Student Membership** and **discounted registration to Botany Conferences**.

Here are our current BSA Student Chapters:

- ***NEW*** - Bartoo Botanical Society - Tennessee Technological University - Student Chapter

- Bucknell University - Student Chapter
- ***NEW*** - Idaho State University Botany Club - Pocatello - Student Chapter
- IISER Bhopal Student Chapter
- L.H. Baileys Botany Bunch - Cornell University - Student Chapter
- Northwestern University - Student Chapter
- Oklahoma State University - Student Chapter
- ***NEW*** - Old Dominion University - Student Chapter
- Otterbein University - Student Chapter
- South Dakota State University - Student Chapter
- ***NEW*** - St. Louis Area - Student Chapter
- The Botany Club of Louisiana State University - Student Chapter
- University of Central Florida - Student Chapter
- University of Hawai'i at Mānoa - Student Chapter
- ***NEW*** - University of South Carolina - Student Chapter
- Weber State University - Student Chapter

Welcome to our New or Rejoining Student Chapters! If you want to start a BSA Student Chapter, contact me at aneely@botany.org.

BSA GIFT MEMBERSHIPS

This is a reminder that BSA Gift Memberships are a great way to introduce students and developing nations' colleagues to the BSA community. You can purchase one-year ($10) or three-year ($30) gift memberships by visiting: https://crm.botany.org and choosing "Give a Gift of Membership".

Don't have anyone specific for whom to purchase a gift membership? Not a problem! You can put your own name and email in the gift membership fields and we will **add that donation to a list of memberships that we offer to those who need financial assistance**. Questions about gift memberships, or other ways to donate? Email me at aneely@botany.org.

FROM THE *PSB* ARCHIVES

60 years ago

C. A. Price from Rutgers wrote to the editor to argue for greater training in math, chemistry, and physics for undergraduates in botany.

"To move freely along the highway of modern plant physiology, students need a solid understanding of physical chemistry. For the student who knows he is heading for graduate study in physiology or biochemistry, physical chemistry should obviously be taken as an undergraduate. But the principal problem lies in the advising of students only generally oriented toward botanical or biological sciences. In many otherwise reputable institutions a student may earn a B. A. or even an M. A. in botany without having a single course in college mathematics or physics. Such a student, wishing later to enter physiology, would require no less than three consecutive years making up undergraduate courses.

Price, C.A. 1963. Letter to the Editor. *PSB* 9(2): 7

50 years ago

An article by Beryl Simpson provides information on the status of women in botany.

"Let us now compare these figures with those of professional women in general. The first, and encouraging, datum, is that the percentage of women with a professional interest in botany is higher than the average of doctorates granted in the natural sciences as a whole (19% vs. 5.6%, or 7% vs. 5.6% if only the women with professional titles are considered). . . .

The decrease in women entering professions in the forties through the sixties is a general phenomenon. . . Although there is no data on the ages of the botanists in the Yearbook, it subjectively seems to me that there is a bimodality in the ages of women botanists, with few women botanists who would have received degrees during the period of 1940-1960. Many noted women botanists began their careers in the 20's and 30's, but few after World War II.. . .

To increase the percentages of women in the professions will require several things: the removal of the obvious hinderances of discrimination; a conscious effort to convince women that they are capable of pursuing a career without losing the qualities of' being a woman, and a generation during which we will hopefully dispose of our current conditioning of men and women. The next few years will be a transition period, but I have no doubt that the change will occur. The increase in interested individuals and new ideas that this change will cause could not help but advance a profession."

Simpson, Beryl 1973. Women in Botany *PSB* 19(2): 22-24

40 years ago

"The Center for Environmental Studies at Arizona State University is interested in publishing a newsletter dedicated to computer (particularly microcomputer) software and applications for the natural sciences. The newsletter would be published quarterly and would contain 1) a listing and short review of recent scientific software, with availability and compatibility specifications; 2) one or more articles on microcomputer techniques -- how to download software for different systems, how to choose between a minicomputer and a network of micros, etc.; 3) a form for advertising "custom" software -- a place where scientists who have written software for specialized modeling or applications (for microcomputers, minis, or main-frame) can list and describe programs for free use, exchange or sale."

Assistance Needed for Science Software Newsletter. 1983. *PSB* 28(5): 35.

[Note: The 1983 volumes 1-4 are missing from the digital archives. If you have a copy of these issues, please contact the BSA office.]

PlantingScience Updates!

Life has been busy for the PlantingScience team. We just closed out our Spring 2023 session, which served over 1300 students! Twelve of the projects they created received Star Project designation; please come take a look at them at plantingscience.org/starprojects/sp-recent. Many thanks to Jin Liao and Shan Wong, our coordinators, for helping to keep things running smoothly, and an additional big thank you to everyone who stepped up to mentor students or serve as leaders on the Master Plant Science Team.

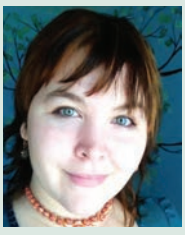
BSA 2022-2023 MASTER PLANT SCIENCE TEAM MEMBERS

Each year, the PlantingScience team reaches out to our society partners to ask them to sponsor members of our Master Plant Science Team. This leadership team mentors students like our other participants, but they also take on an advisory role with each teacher who works with us each session. As MPST members, they support communication between the teachers and the mentors working with student teams within a class. Each week they report in on any issues the group may be having, and they step in when scientist mentors cannot respond to student posts right away.

The BSA generously supports PlantingScience's Master Plant Science Team by sponsoring early career scientists interested in taking part. The 2022-2023 MPST members sponsored by BSA included:

- **Guadalupe Maldonado Andrade**
- **Israel Borokini**
- **Yanni Chen**
- **Ana Flores**
- **Nitin Gaikwad**
- **Waqar Hussain**
- **Devani Jolman**
- **Jacqueline Lemmon**
- **Allyssa Richards**
- **Juan Diego Rojas-Gutierrez**
- **Cierra Sullivan**
- **Jessica Szetela**

Please join us as we thank these amazing people for their contribution to our program. We could not do what we do without their help.



By Dr. Catrina Adams, *Education Director*

Jennifer Hartley, *Education Programs Supervisor*

PLANTINGSCIENCE NEEDS YOUR HELP!

PlantingScience's next round of efficacy research, *Digging Deeper F2,* kicks off in the coming Fall 2023 session. This session will include about sixty test classrooms in addition to the usual classes who participate. With this in mind, we are in desperate need of new mentors!

If you, your colleagues, or your students might be interested in working with a high school team this fall, **please consider registering for an account at plantingscience.org** and setting yourself available to mentor. Mentoring through PlantingScience is conducted entirely online through an asynchronous message board. The students' teachers handle instruction, so the mentors' role is simply to respond to student messages, answer their questions, and provide encouragement and advice. You'll also be encouraged to share a little about your own research and what life as a plant scientist is like. The experience is convenient and easy and takes at most an hour per week. For more information, visit plantingscience.org/getinvolved/mentor.

You can also apply to be a member of our Master Plant Science Team. MPST membership is available to early-career scientists who are interested in taking on a leadership role for one academic year (two sessions, fall and spring). This role involves more behind-the-scenes responsibilities that may require up to 2 hours of time per week during an active session, so our team members are sponsored by a partner society and receive membership discounts and other benefits. For more information on the MPST, visit plantingscience.org/getinvolved/mpst.

And of course, if you aren't in a position to participate directly, we would love your support in spreading the word! Please share this opportunity with other scientists in your community and encourage them to check it out.

SEE YOU IN BOISE!

Come visit our PlantingScience booth at Botany this summer! We have a fun booth planned in the exhibit hall, and we encourage everyone planning to attend the conference to drop by and check us out. If you're currently a mentor or MPST member, make sure to drop by to pick up an appreciation gift. We'll be found next to the BSA booth.

real plants real science real scientists

planting science

A student-teacher-scientist partnership promoting plant-based learning in 6-12+ grade classrooms

U.S. Department of the Interior
Bureau of Land Management

Plant Conservation & Restoration Program

Native plants are the true green infrastructure we rely on for healthy, resilient, biodiverse ecosystems. As wildfires and other climate-driven disasters continue to devastate the U.S., the BLM Plant Conservation & Restoration Program is implementing the National Seed Strategy and conserving and restoring the native plant communities that define America's iconic landscapes and provide wildlife habitat, ecosystem services, and recreational opportunities for all Americans to enjoy.

blm.gov/nativeplants
blm.gov/seedstrategy

Your Student Botany 2023 Conference Guide

The Botany Conference is coming up very soon. We are looking forward to seeing you in Boise or virtually! With six days of lectures, field trips, workshops, and socials, how can you get the most out of the conference? Don't worry, we've got you covered with some student-focused tips below. We discussed these conference tips and more at our Botany360 event on Friday, May 26th "Make the Most out of Botany 2023: A Student Conference Guide". See a recording of the event on the Botany360 page at: https://botany.org/home/resources/botany360.html

If you have any questions or need any help navigating Botany, please email us (Ioana: ianghel@ucla.edu, Eli: elishartung@gmail.com) or connect with us on Twitter (@ioana_anghel and @hartung_eli). Also follow the BSA social media accounts (Facebook: Botanical Society of America; Twitter: @Botanical_; Instagram: @botanicalsocietyofamerica) to get the latest updates on the conference and BSA activities.

By Ioana Anghel and Eli Hartung
BSA Student Representatives

CONFERENCE AT A GLANCE

- Here's a summary of the conference schedule: Friday 7/21 – Sunday 7/23: Field Trips
- Sunday 7/23: Workshops
- Monday 7/24 – Wednesday 7/26: Regular talks and events
- Wednesday 7/26 evening: Conference-wide party

STUDENT-CENTERED EVENTS

Join us for the many student-centered conference events including a workshop, a Careers in Botany Panel, two Student Socials, and a Student Chapter Meet-up:

Workshop: Writing your CV and translating it into public facing website

Sunday, July 23, 8:00 AM – 12:00 PM

Let's work together to create a comprehensive description of your career in a CV format and then create a website that will highlight those achievements for the world to see. We will first organize your skills and accomplishments

in a CV that you can use for job, funding, and nomination applications. Then we will use these highlights of your career history to design a website that can showcase your research, teaching, publications, speaking engagements, and service. At the end of this workshop, you will have the tools to write a well-developed CV and to create your own website. You will also leave with a working draft of a CV and a basic academic website that you will be able to build up further in the weeks to come.

In this workshop, you will:

1. Learn the basic structure of a CV and best practices for writing it
2. Receive feedback on your CV from peers and instructors
3. Learn the steps to create your own website
   - Why create a website? Define your audience and intentions for having a website
   - Discover possible content to include and see good examples
   - Create a structure for your personalized website content (using your CV as a starting point)
   - Work together to build a free website

This workshop is for students and early-career professionals. Please bring a draft of your current CV to edit in class, a computer, and any previous attempts at making a website.

This event costs $20 and has limited space - register today!

Undergraduate Student Social

Sunday, July 23, 5:30 – 7:00 PM

Join us before the Plenary Talk for a chance to meet fellow undergrads and make some new friends to explore the rest of the conference with.

Careers in Botany Luncheon

Monday, July 24, 12:00 – 1:45 PM

Come learn about career paths and experiences from professionals from a variety of academic disciplines and job titles. We will have rotating small-group discussions so that everyone has a chance to speak with our panelists. Check out the Careers in Botany Profiles from the 2022 conference (https://botany.org/home/careers-jobs/careers-in-botany/careers-in-botany-profiles-2022.html).

This event costs $10 for students, $25 for non-students with lunch included.

Student Social and Networking

Monday, July 24, 9:00 – 11:59 PM

After the full first day of the conference, please join us to wind down, network, and socialize with other students. This is another great opportunity to make friends that you can explore Botany and Boise with!

Registration is necessary and costs $10 for students, $25 for non-students with a drink and snacks included.

Student Chapter Meet-up

Date and time TBD

Come chat with other students about how to start a student chapter at your university or to connect with other student chapters at other schools. Look out for an announcement from us about the date and time for this event.

If you already registered, you can still sign up for events! Log into your registration and "Modify Registration" at https://2023.botanyconference.org.

GENERAL CONFERENCE TIPS

Here are some ideas to make the most of the conference:

- Plan out in advance the talks you want to see and make a schedule for your time. With so many events occurring during the conference, planning each day can be a challenge! The online Botany Conference App gives you the freedom to browse talks and events and create your own easily accessible schedule to stay on track. More information about where to download the App is coming soon! Be on the lookout for an e-mail and/or check the conference website for details.
- Don't overpack your schedule with too many talks to avoid burnout; plan time to meet people and to rest.
- Think about who you want to meet with in advance, and reach out to them to see if they'd be willing to grab a coffee or tea.
- If you are presenting, invite people you meet to come see your talk.

Share your experience on social media with the hashtags #BSAStudents and #Botany2023.

BUDGETING

Registration

- Register early for best price – early registration deadline 5/31, or before July 20
- Field trip reimbursements: Any graduate or undergraduate student that is a member of ASPT and/or BSA may apply to have one field trip fee reimbursed, up to $100.00. Reimbursements will be issued after the conference as a refund on your registration credit card. Sign up Here! https://forms.gle/M42jG2ujoRDvCzXbA

Volunteer at the conference

Did you know that you can earn your early registration fee back by volunteering your time at the conference? The conference would not be able to happen without the help of students who run the registration booth, help at ticketed events, and make sure that sessions run smoothly. Eight hours of service will cover your registration, with opportunities before and during the conference. For more information, be sure to check your email as well as the conference website.

Food

Find the included food events

- Continental breakfast each morning of the conference
- Coffee/Tea at coffee breaks

- Careers in Botany Luncheon – Mon 12:00 PM (lunch), registration necessary
- Student Social – Mon 9:00 PM (substantial snacks), registration necessary
- Undergraduate Student Social – Sun 5:30PM
- Celebrate! All-society celebration – Wed 7:30 PM (substantial snacks)
- Affinity group events; some require registration

Shop for food at the grocery store (TJs 2 blocks away from the conference center).

Conference center will have vegetarian, vegan, gluten-free, dairy-free, and kosher options, and the kitchen labels the food.

Accessibility

- All talks will be in one location at the conference center so there won't be any issue of running between buildings during the day.
- The hotels with room blocks surround the conference center, a very short walk away (most are less than 10 minutes away).

PRESENTING AT THE CONFERENCE?

- If giving a talk in person, you are encouraged to submit a recorded presentation for the virtual conference attendees or to have someone record your talk at the scheduled time and upload it.
- Virtual presenters must pre-record their presentations and upload them to the platform by July 23rd.

NETWORKING TIPS

Meeting new people is hard, especially if you are an introvert. A little planning in advance can make networking a little easier. Here are some ideas:

- Come up with a plan about how you will approach people.
- Remember that people love to talk about themselves, so asking questions can help start conversations.
- Talking to people is more valuable than attending talks.
- Use mutual connections to meet people. Ask your advisor to introduce you to people.
- Introduce others to people they might like to meet.
- Meet new people at affinity group events. This year the LGBTQ and Friends Mixer is planned for Tuesday (5:30–7:00 PM). In the past, we've had a Black, Indigenous, and People of Color gathering, a Bots with Tots gathering,

an Asian/Asian-American/Pacific Islander mixer, a Disabled and Allies mixer. Dates and times for additional planned meet-ups to come.

- Be ready with a pitch about you and your interests.
- Get contact info from people you meet (Twitter, email, etc.) and have a follow-up topic to keep the conversation going.

VIRTUAL CONFERENCING TIPS

- Treat it as if you were at the conference in person by giving it your undivided attention and by reaching out to people you would like to connect with.
- Avoid multitasking during talks.
- If presenting virtually, make sure to include your contact information in your presentation so people can get in touch with you.
- Use the chat features in the conference app to ask questions of the presenters and to connect with other attendees.
- Don't hesitate to reach out to people who are attending the conference in person.
- Be on the lookout for virtual specific events.

GETTING TO KNOW YOUR NEW STUDENT REPRESENTATIVE

We are excited to welcome our incoming BSA Student Rep, Josh Felton. Josh's term will begin the day after the Botany Conference and last for two years from 2023 to 2025. Get to know them in the interview below.

Josh Felton
Incoming Plant Biology PhD student at Cornell University

When did you join BSA and what motivated you to do so? Will you encourage other students to become members and participate in the Society as well?

In July 2021, I became a member of the BSA after taking part in the PLANTS program. It was my advisor at the time, Dr. Rachel Jabaily, who introduced me to both the program and the Society, and she spoke highly of the numerous benefits associated with being a member.

Since joining the BSA, my botanical journey has been enriched in countless ways. One of the most significant highlights has been attending the renowned Botany conference. This annual event serves as an invaluable platform for expanding my botanical knowledge. The conference offers a diverse range of sessions, workshops, and presentations that expose me to cutting-edge research, innovative methodologies, and emerging trends in the field. Each year, I eagerly anticipate this gathering of like-minded individuals who share a deep passion for botany.

Beyond the intellectual growth that Botany provides, the BSA has connected me with a vast network of professionals. I've had the privilege of interacting with esteemed botanists, researchers, and educators who have not only inspired me but also become valuable mentors in my journey.

In addition to the conference, I've been thoroughly enjoying attending Botany360 events. These immersive experiences have allowed me to delve deeper into specific areas of botany, and the comprehensive range of events that cater to diverse interests has ensured there is always something new to learn and explore.

From my initial exposure through the PLANTS program to my ongoing participation in the Botany conference and other BSA events, I have gained invaluable knowledge, formed meaningful connections, and expanded my passion for botany. The BSA has truly been a cornerstone of my botanical journey, providing a supportive community and invaluable resources that continue to fuel my curiosity and growth in this fascinating field.

What motivated you to run for the position of Student Representative to the Board of Directors and what do you plan to do as the student representative of BSA?

The motivation to run for the student representative position stemmed from my deep passion for building community and my desire to actively contribute and advocate for the needs and interests of fellow student members. As a passionate student in the field of botany, I have recognized the importance of providing a platform for students to have their voices heard and their perspectives considered within the society.

As the student representative, I aim to establish effective communication channels between students and the Board of Directors. I will actively engage with student members, soliciting their feedback, ideas, and concerns, and ensure that their voices are represented during decision-making processes.

Additionally, I intend to promote professional development opportunities specifically tailored to students. This includes organizing webinars, and workshops that focus on honing essential skills, providing guidance for career advancement, and facilitating networking opportunities within the botanical community.

Overall, my goal as the student representative is to ensure that the BSA remains a supportive and inclusive community for all students. By actively listening to any concerns and advocating for our interests I aim to empower

student members and strengthen their engagement within the BSA.

What's your research about and how did you discover your research interest?

My undergraduate research focused on studying the reproductive biology of Bromeliaceae (the pineapple family). As I looked ahead to my future research in graduate school, I discovered a new-found interest in mating systems. It was while working on my undergraduate thesis that I became fascinated by the intricate nature of plant reproduction. This sparked my desire to delve deeper into the study of mating system evolution.

Mating systems in plants are determined by a combination of morphological, developmental, and physiological traits of reproductive organs, which directly influence the union of gametes. Understanding the intricate interaction among these traits is crucial in determining how plants mate. While breeding system evolution has been broadly investigated across angiosperms and extensively studied in select model systems, there remains a significant knowledge gap regarding the phylogenetic distribution of breeding systems in some of the largest and most culturally and agriculturally important angiosperm families.

In graduate school, my aim is to address this knowledge gap and shed light on the breeding systems of Bromeliaceae. I will focus on exploring the evolutionary patterns of mating systems while incorporating aspects of natural history research.

Through this research, I hope to uncover important insights into the adaptive radiation and evolution of mating systems in Bromeliaceae. By expanding our understanding of breeding systems beyond model systems, we can gain a more comprehensive understanding of plant reproduction as a whole and its implications for both conservation and agricultural practices.

What hobbies do you have?

One of my biggest passions is playing guitar, which I've been playing off and on since I was young. Lately, I've been particularly interested in blues, indie folk, and bossa nova. I enjoy experimenting with different chords and melodies, and I find that playing music is a great way to relax and unwind after a long day.

I also love to get outside and explore the world around me. I'm an active person and I love to channel that energy through outdoor activities like ultimate frisbee and road biking. I love the rush of adrenaline that comes with chasing down a frisbee and making a great catch, and the feeling of freedom that comes with riding my bike down an open road.

Maybe my favorite hobby is botanizing. It's a great way to connect with nature and the feeling of finding a plant that you've never seen before is euphoric. Follow me on iNaturalist: Josh_felton!

ANNOUNCEMENTS

IN MEMORIAM

AJ Harris in the Xiang Lab at NCSU in 2005

AJ HARRIS 1979–2023

This year we lost another brilliant evolutionary biologist much too early! AJ Harris lost her battle with cervical cancer on January 15 at her home in Indiana at the young age of 44. AJ started her academic career at Alamance Community College in Graham, North Carolina where she earned her high school equivalency diploma in 2003, and was recognized as the Distinguished Alumna of the Year in 2016. She soon enrolled at North Carolina State University (NCSU) majoring in Religious Studies and minoring in Botany after taking PB403-Systematic Botany with Dr. Jenny Xiang. This curriculum sparked an interest in plants that would inspire her to not only to graduate with a minor in Botany for her undergraduate degree (2005), but also to complete a M.S. degree with Dr. Xiang on *Molecular and Morphological Inference of the Phylogeny, Origin, and Evolution of* Aesculus *L. in 2007* at NCSU. AJ published two peer-review papers from her M.S. degree (Harris et al., 2009; Harris and Xiang, 2009). In the process, she spearheaded a method to account for phylogenetic uncertainty in reconstructing ancestral ranges in biogeographic analysis with the DIVA method to serve her research on *Aesculus* and published the method in the second paper.

During this time, AJ began interacting with colleagues in China, which led to fruitful collaborations. Her keen understanding and interest in computational biology allowed AJ to contribute to the development of some excellent analytical tools in biogeographic inference such as *S-DIVA* (Yu et al., 2010) and *RASP* (Yu et al., 2015). AJ also had an insatiable appetite for the evolutionary history and diversification of plants, and she wanted to know more about the fossil record after taking Jim Mickle's PB545-Paleobotany class at NCSU during her M.S. degree. AJ pursued that passion from 2008 to late 2009 as a Ph.D. student with paleobotanist Dr. Ruth Stockey at the University of Alberta in Edmonton, Canada. AJ gained much insight from working with Ruth and was working on a manuscript describing fossil maple-like samaras with Drs. Steve Manchester and Kirk Johnson in the fall of 2022.

She enrolled in a Ph.D. program at Oklahoma State University, Stillwater in 2010 under the mentorship of Dr. Michael Palmer, and she graduated in 2015 with her dissertation: Evaluating Past and Present Plant Distributions using Biodiversity Informatics. During her Ph.D. studies, she received an East

Asia and Pacific Summer Institutes for U.S. Graduate Students (EAPSI) fellowship from NSF to work in Dr. Fu Chengxin's laboratory at Zhejiang University in Hangzhou, China in 2012. There AJ developed a passion for field work and interacted with many colleagues from all over China.

After her Ph.D. graduation AJ was awarded the prestigious Peter Buck Postdoctoral Fellowship to work with Dr. Jun Wen on 'The effects of time, speciation and extinction rates, and morphological traits on assembly of the woody flora of North America' (2016–2018) at the Department of Botany, Smithsonian Institution. She had a tremendous impact on undergraduate and high school interns and foreign visitors at the Wen lab, helping with analyses and the training of graduate students in computational biology. This collaboration resulted in a dozen peer-reviewed papers ranging in scope from historical biogeography and ecological characterization of Northern Hemisphere disjunct plants to sumac-gall aphid-plant co-evolution (Harris et al. 2016, 2017; Ren et al. 2017). Prior to her Peter Buck postdoctoral fellowship, AJ also did a 10-week Smithsonian graduate fellowship on 'Resolving taxonomic uncertainties in Billia Peyr. (Sapindaceae), tropical trees in a temperate subfamily' in the summer of 2014.

Always reinventing and fueling her passion, AJ applied and was awarded another postdoctoral fellowship in computational biology working with Dr. Aaron Goldman at Oberlin College in Oberlin, Ohio (2018–2020). In this position, AJ brought her expertise in phylogenetic analysis to a NASA-funded collaboration with origin of life researchers at the University of Southern California (USC) and the Jet Propulsion Laboratory. Her many contributions included the discovery of a new family of anciently duplicated genes (Harris and Goldman, 2018) and the reconstruction of ancient proteins responsible for targeting other proteins to cell membranes (Harris and Goldman, 2021). This research required AJ to learn an entirely new side of evolutionary biology. Although she continued to carry her botanical sampling equipment with her everywhere she went, AJ also approached

Yuan Xu, Yash Kalburgi, Jun Wen, AJ Harris, Liz Zimmer, Xiaodan Xu, Wei Zheng and Yousheng Chen at the National Museum of Natural History, the Smithsonian

these new topics in molecular evolution with the same enthusiasm and fearlessness that defined her approach to science.

She continued her passion for China and chose to work in China at the South China Botanical Garden (SCBG), Chinese Academy of Sciences, in Guangzhou, Guangdong, China as an associate professor in 2020. Unfortunately, due to the pandemic and travel bans, she was unable to fulfill her dream of living in China to pursue her academic career there, and worked at SCBG remotely during the COVID-19 pandemic. She was extremely productive in her position at SCBG, collaborating with many inspiring young students and colleagues. She did not only manage to mentor her own students at SCBG, but also extended her mentoring to several students of Huafeng Wang's lab at Hainan University.

It was in 2011 that I (S.I.B.) had the privilege to meet AJ at the XVII International Botanical Congress (IBC) in Melbourne, Australia, where she was an invited speaker on The Bayes–DIVA method and its application for testing biogeographic origins of inter-continental disjunct endemics. AJ first approached me in her self-assertive, exuberant way, "Hello, are you Dr. Ickert-Bond, I am AJ Harris, I am the co-developer of Bayes-DIVA and I would like to get your datasets…." Our meeting in Melbourne started a long period of exchanging thoughts on manuscripts, developing new projects and always having a laugh on one thing or another (Ickert-Bond et al., 2018). AJ was very generous with her time throughout her short career and helped many scientists from many different nations with their own research and career paths. AJ had an impactful career in the life sciences, publishing more than 66 peer-reviewed papers (see References), and she organized symposia both at the IBC in Shenzhen, China in 2017 as well as the BSA annual Botany meeting in Anchorage, Alaska in 2022. Her research was original, using her knowledge of systematics, biogeography, and computer sciences. I loved her voice, her smile, and her laugh. Her joyful spirit was contagious. She was amazing in her endeavors, forging ahead, breaking new ground analytically, and always posing challenging questions in seminars and at conferences. She was very humble and generous with her knowledge, eager to include you on her discoveries. We will miss you, AJ! She is survived by her parents, husband Andrew Dabbs, and many international colleagues and students that she supported in many ways.

REFERENCES

{The most complete listing of AJ's publications can be found at https://scholar.google.com/citations?user=xKlng-gAAAAJ&hl=en.}

Harris, AJ, and Q.-Y. Xiang. 2009. Estimating ancestral distributions of lineages with uncertain sister groups - A statistical approach to DIVA and a case using Aesculus L. (Sapindaceae) including fossils. *Journal of Systematics and Evolution* 47: 349-368.

Harris, AJ, Q.-Y. Xiang, and D. T. Thomas. 2009. Phylogeny, origin, and biogeographic history of Aesculus L. (Sapindales) - An update from combined analysis of DNA sequences, morphology, and fossils. *Taxon* 58: 1-19.

Harris, AJ. 2015. *Evaluating Past and Present Plant Distributions using Biodiversity Informatics.* Ph.D. Oklahoma State University, Stillwater, OK.

Harris, AJ, C. X. Fu, Q.-Y.(J.) Xiang, L. Holland, and J. Wen. 2016. Testing the monophyly of Aesculus L. and *Billia* Peyr., woody genera of tribe Hippocastaneae of the Sapindaceae. *Molecular Phylogenetics and Evolution* 102: 145-151.

Harris, AJ, P. T. Chen, X. W. Xu, J. Q. Zhang, X. Yang, and J. Wen. 2017. A molecular phylogeny of Staphyleaceae: Implications for generic delimitation and classical biogeographic disjunctions in the family. *Journal of Systematics and Evolution* 55: 124-141.

Harris, AJ, and A. D. Goldman. 2018. Phylogenetic reconstruction shows independent evolutionary origins of mitochondrial transcription factors from an ancient family of RNA methyltransferase proteins. *Journal of Molecular Evolution* 86: 277-282.

Harris, AJ, and A. D. Goldman. 2021. Very early evolution of protein translocation across membranes. *PLoS Computational Biology* 17: e1008623

Ickert-Bond, S. M., AJ Harris, S. Lutz, and J. Wen. 2018. A detailed study of leaf micromorphology and anatomy of New World *Vitis* L. subgenus *Vitis* within a phylogenetic and ecological framework reveals evolutionary convergence. *Journal of Systematics and Evolution* 56: 309-330.

Ren, Z. M., AJ Harris, R. B. Dikow, E. B. Ma, Y. Zhong, and J. Wen. 2017. Another look at the phylogenetic relationships and intercontinental biogeography of eastern Asian - North American *Rhus* gall aphids (Hemiptera: Aphididae: Eriosomatinae): Evidence from mitogenome sequences via genome skimming. *Molecular Phylogenetics and Evolution.* 117: 102-110.

Yu, Y., AJ Harris, and X. He. 2010. S-DIVA (Statistical Dispersal-Vicariance Analysis): a tool for inferring biogeographic histories. *Molecular Phylogenetics and Evolution* 56: 848-850.

Yu, Y., AJ Harris, and X. He. 2015. RASP (Reconstruct Ancestral State in Phylogenies): A tool for historical biogeography. *Molecular Phylogenetics and Evolution* 87: 46-49.

DONATE TO THE AJ HARRIS AWARD

To honor AJ, members of the botanical community seek to establish an award with the BSA to support graduate student research. In this way, her name will continue to resonate with botanists well into the future. BSA is collecting funds in memory of AJ Harris. $20,000 will allow a student award to be created in her name in perpetuity. If this goal is not met, the funds collected will be distributed to fund extra graduate student research awards in 2023 and 2024. Graduate student research awards are open to all students, including non-U.S. citizens. Your donation to this fundraising effort to the BSA is tax deductible and you will receive a tax donation receipt upon making your gift. Thank you for your contributions in honor of AJ Harris.

https://botany.org/aj-harris-memorial.html

IN MEMORIAM

Bob Wilbur collecting plants in Orange County, North Carolina in 2013. Photo by Mengchi Ho, used with permission

ROBERT L. WILBUR 1925–2022

Robert Lynch Wilbur, Professor Emeritus of Biology at Duke University died 31 October 2022 in Durham, North Carolina at the age of 97. He was a prominent teacher of plant taxonomy, productive botanical researcher and nomenclaturist, herbarium curator/proponent, and mentor to several generations of undergraduate and graduate students. He excelled in each of these endeavors throughout his botanical career. Born in Annapolis, Maryland, he and his family moved to Durham in 1933, where Bob Wilbur and Duke University began an association that lasted nearly 80 years. After obtaining his BS (1946) and MA (1947) degrees in botany at Duke, he went to the University of Hawaii and worked as a graduate assistant with Harold St. John. In 1948, Wilbur began studies at the University of Michigan for a Ph.D. under the direction of Rogers McVaugh—as the latter's third graduate student. He accompanied McVaugh on his professor's first trip to the Nueva Galicia region of west-central Mexico, and several months later, he and one of his brothers returned there to continue collecting. His doctoral dissertation, a detailed taxonomic account of the primarily North American genus *Sabatia* (Gentianaceae), was completed in 1953. Its publication (Wilbur, 1955) received the George R. Cooley Award in 1956 from the American Society of Plant Taxonomists for the "best published paper dealing with the flora of the southeastern U.S."

Wilbur's professional academic career began with a one-year stint as an assistant professor at the University of Georgia (1952-53). He relocated to North Carolina State College in Raleigh as assistant professor and herbarium curator (1953-57) before making his final move back to Durham, Duke, and the Department of Botany (later Biology) for the remainder of his career. He advanced to associate professor in 1963, to professor in 1970, departmental chair (1971-77), and professor emeritus (2007-22). Wilbur's signature course was a lecture/lab class on local flora and plant taxonomy. Half or more of both lecture and lab periods were spent roaming the Duke campus and Duke Forest, learning how to identify plants. In addition to his teaching duties, he curated and greatly expanded the university's herbarium (DUKE) and conducted/published research primarily on plants of the southeastern U.S. and

Central America. One of his early botanical contributions that remains in use today was a book on the family Fabaceae in North Carolina with keys, lengthy descriptions, distribution maps, and illustrations (Wilbur, 1963).

A trip to Costa Rica in 1968 with Duke colleague Donald E. Stone rekindled his interest in tropical botany, and thereafter Wilbur became an avid collector of plants in Central America. He and his students collected extensively in Costa Rica, and made trips to Belize, El Salvador, Mexico, Nicaragua, and Panama. His typical field protocol was early to rise, eat breakfast, get out in the field ASAP, collect until dark with no lunch break, return and eat dinner, and work until late at night writing up notes and rearranging plants from the field press into drying presses. His specimens tended to be ample (sometimes completely covering an herbarium sheet) and were occasionally referred to by others as "Wilbur sheets." After formally retiring, much of his time in the field was refocused on collecting again in North Carolina and other parts of the southeastern U.S.

In his floristic and monographic research, Wilbur was a flowering plant generalist with taxonomic publications on numerous families, including: Asteraceae, Annonaceae, Campanulaceae, Cistaceae, Clethraceae, Crassulaceae, Ericaceae, Euphorbiaceae, Fabaceae, Gentianaceae, Liliaceae, Myricaceae, and Rubiaceae. For 21 years, he served on the International Association for Plant Taxomomy's Committee for Spermatophyta, and his papers clarifying and revising botanical nomenclature include many additional families. Wilbur was a prolific plant collector who made more than 100,000 numbered collections. Largely as a result of his collections, those of his students, and exchange generated by duplicates of both, the number of specimens of vascular plants at DUKE grew from a teaching and reference collection of 134,000 to a major research collection of more than 400,000. Among his 103 (fide his numbered reprint collection) research publications, Wilbur described three new genera, *Calcaratolobelia* Wilbur (Campanulaceae), *Didonica* Luteyn & Wilbur (Ericaceae), and *Utleya* Wilbur and Luteyn (Ericaceae); he also described more than 60 new species. To date, 28 species have been named for him.

Beyond his productivity as a teacher, collector, and researcher, Dr. Wilbur was devoted to his family, students, university, and discipline of systematic botany. He was warm-hearted, friendly, and always approachable. Those who worked closely with him—colleagues, students, his long-time collections manager (Sherri Herndon)—got to know him as a caring family man with six children and a cadre of dogs; at least one of the latter often accompanied him to the herbarium and/or field. One of his great joys was the time he spent training, encouraging, and aiding the next generation of plant systematists. He took a personal interest in the lives and careers of his graduate students and those undergrads, like us, who demonstrated an interest in learning about plants. These efforts included taking students into the field, offering both fatherly and academic advice, and sharing his passions for local flora, tropical botany, and rigorous academic scholarship.

A tribute to Robert Wilbur, the man, scientist, and teacher, is to appear in a forthcoming issue of *Rhodora*, a journal in which his articles often appeared. It consists of a detailed biography, a bibliography, reminiscences by some of his former students, and a series of research papers produced in his honor.

REFERENCES

Wilbur, R. L. 1955. A revision of the North American genus Sabatia (Gentianaceae). *Rhodora* 57: 1-33, 43-71, 78-104.

Wilbur, R.L. 1963. The Leguminous Plants of North Carolina. *North Carolina Agricultural Experiment Station, Technical Bulletin* 151. Raleigh, North Carolina. 294 pp.

— Thomas F. Daniel, Curator Emeritus, Botany, California Academy of Sciences; and Layne Huiet.

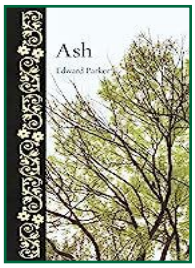
NANCY G. SLACK 1930–2022

Nancy Slack, botanist and historian of botany, passed away on December 21, 2022 after a short illness. She taught botany at Russell Sage College and then also became interested in the history of botany. She was an active member of the Botanical Society of America.

BOOK REVIEWS

Ash

Edward Parker
2021. ISBN: 978-1789143560
US$27 (Hardcover); 224pp.
Reaktion Books, London, U.K.



Years ago, I planted several ash trees in my yard in Ohio. Then sometime later, I learned that the emerald ash borer beetle had arrived in Ohio and that people all over town were cutting down these trees to stop the spread of infection from this harmful insect. It appeared that the massive death of ash trees would change the character of natural areas and cities as much as the Dutch Elm disease fungus did (Bukowski, 2019). Ash trees are casualties of this invasive insect that has killed hundreds of millions of these trees in the United States and Canada (Siegert et al., 2014).

This book, written for the general reader, is part of a series that integrates botanical work into a broader social and historical context. All books in the series have a single word title (e.g., apple, sunflower, oak, cherry) and are elegant hardcover volumes.

Chapter one provides the general botanical background on ash trees. Ash is in the genus *Fraxinus* with about 48 true species. Ash is one of the 24 genera in the olive and lilac family, the Oleaceae. These plants are widespread throughout much of North America, Europe, and Asia, and most of the species are medium-to-large, deciduous trees. These trees are generally 35 to 75 feet in height with a diameter of 1 to 2 feet. Most species of ash have compound leaves, and they provide a more open canopy than other trees so that there can be a rich under-story of small plants in the forest. Many lichens and mosses occur on the alkaline bark of ash trees. The oldest ash trees in the fossil record are from the Eocene epoch (55 to 34 million years ago).

The next chapter focuses on threats to ash trees, which are dying at an unprecedented rate throughout North America and Europe. In North America, the death is due to the introduction of a beetle known as the emerald ash borer, and in Europe, ash is perishing due to a fungal infection. The emerald ash borer was introduced from Asia where it is in balance with the ecosystem, but in North America this beetle has no known predators. Damage occurs when emerald ash borer larvae feed on the inner bark of trees, thus impeding transport within the phloem. Blue ash (*Fraxinus quadrangulate*) appears to be relatively resistant to the emerald ash borer, but damage caused by this insect is estimated to be $10 billion over a 10-year period (Herms and McCullough, 2014).

Mythology of ash throughout history and across the world is considered by the author. Mythologies about ash appear in a large number of cultures, including Native American, Scandinavian, Siberian, Asian, Middle Eastern, and Indian folklore. A common theme is to use a tree as a metaphor for the structure of the universe and to show the interconnectedness of everything.

Ash trees also have had tremendous economic importance throughout history. Ash timber has a number of qualities that make it very useful, such as its strength and flexibility. Ash wood was used for the wheels in carts and carriages for hundreds of years. This wood also was used in a number of weapons such as spears as well as bows and arrows. Ash also was used in construction and furnishing homes throughout the ages. One of the most interesting uses of ash woods is in musical instruments, including the classic violin and electric guitar bodies.

The final chapter considers the medicinal uses of ash trees. One of the first medicinal uses of ash was noted by ancient Greek physicians who found the leaves were useful for the treatment of snake bites. Ash plants contain important biochemicals including phenols, phenylethanoids, flavonoids, coumarins, and lignans. These compounds are useful as pharmaceutical since they have been shown to have properties such as antioxidant, anticancer, anti-inflammatory, antimicrobial, among others (Sarfraz et al., 2017).

The book is beautifully illustrated with many images of ash trees in natural settings along with interesting historical photographs. This book is reasonably priced and will be enjoyed by professional and amateur botanists as well as by horticulturalists and foresters.

REFERENCES

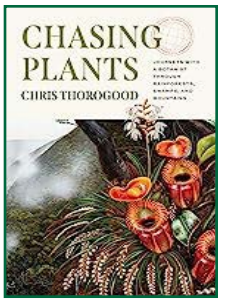
Bukowski, E. 2019. Using the commons to understand the Dutch elm disease epidemic in Syracuse, NY. Geographical Review 109: 180-198.

Herms D. A., and D. G. McCullough. 2014. Emerald ash borer invasion of North America: history, biology, ecology, impacts, and management. Annual Review of Entomology 59: 13-30.

Sarfraz, I., A. Rasul, F. Jabeen, T. Younis, M. K. Zahoor, M. Arshad, and M. Ali. 2017. Fraxinus: a plant with versatile pharmacological and biological activities. Evidence-Based Complementary and Alternative Medicine. https://doi.org/10.1155/2017/4269868

Siegert, N. W., D. G. McCullough, A. M. Liebhold, and F. W. Telewski. 2014. Dendrochronological reconstruction of the epicentre and early spread of emerald ash borer in North America. Diversity and Distributions 20: 847-858.

–John Z. Kiss, Department of Biology, UNC-Greensboro, Greensboro NC 27402



Chasing Plants: Journeys with a Botanist through Rainforests, Swamps, and Mountains

Chris Thorogood
2022. ISBN: 978-0226823539
US$27.50 (cloth); 224 pp.
University of Chicago Press

Chasing Plants really is a journey with botanist Chris Thorogood through rainforests, swamps, and mountains. The book is intended for a lay audience and the beautiful artwork throughout makes it worthy of any coffee table. The writing and stories are so enjoyable that non-botanists and seasoned researchers alike will thoroughly enjoy the book. While botanical knowledge is not a prerequisite for reading this book, having some background in botany does improve the reading experience. Overall, Thorogood has written an entertaining and informative book that takes you with him as he travels the world to satisfy his professional goals and fulfill his personal mission of experiencing as many plants as he can while they can still be found.

Right from the start, Thorogood's eagerness and passion for studying plants drives him to inspire a similar passion in his readers. His enthusiastic descriptions and narrated adventures immerse the reader in a secondhand experience of a day in the life of a botanist. Throughout his book, it's clear that Thorogood views botany as a communal effort as he strives to increase awareness of plants in communities in order to combat plant blindness. It's evident that part of Thorogood's mission in writing his book is to highlight the vulnerability of many plants, especially endemic species, which may soon disappear forever due to natural disasters and climate changes. One of his adventures highlights this danger, when he talks of a mudslide that wipes out many endemic species before he has the chance to return and study them. His race to discover, study, and raise awareness of as many plants as possible portrays Thorogood's belief that mankind must take part in a stewardship of nature. Part of this stewardship seems to involve a "conversation with the past" (p. 64). He's not only interested in studying plants in the present, but also in learning what plants can tell us about our heritage. In addition, Thorogood is very conscious of the fact that botany exists today as a result of the combined efforts of past scientists and explorers, such as Alexander von Humboldt and Walter Weston, whom he quotes multiple times. Through Thorogood's interweaving of history, conservation, theory, and science, the reader gleans a sense of the interdisciplinary nature of botany.

As Thorogood states, each geographic location is a "living library" of rare and endemic species, documenting evolutionary changes and relationships that contribute to the greater study of plant conservation (p. 57). He places himself within a long-existent tradition of plant documentation, originating as personal herbariums and sketches, by including the writings of early botanists, linking his own research into the continuous lineage of botanical study (pp. 53-54, 154-155). Thorogood's masterful paintings paired with his own meticulous study are perfect reflections of the structure of early botanical studies. The reader can see that Thorogood envisions himself as a perpetuator of and participant in a historically rich and ecologically critical heritage. By continuing research begun centuries previous, he constructs a promising future for the conservation and preservation of diverse plant communities across the globe.

The reader will notice that throughout his explorations, Thorogood never hesitates to credit his discoveries of rare plants to local guides and researchers. He subtly but artfully emphasizes that the science of plant taxonomy is only possible with the intimate, observational knowledge that local communities have of their unique flora. This becomes a key for his vision of plant conservation as a practice which needs the involvement of the average person as well as scientists. Thorogood crafts a definition of plant conservation as one part science, one part botanical tradition, one part personal interest, and one part community engagement (pp. 10-11, 144-146, 154, 264). As readers approach the final chapters, they cannot help but feel that Thorogood's mission is the most relatable, compelling, and accessible form of plant science they have encountered.

As a researcher, Thorogood provides powerful and yet simple explanations of the science underlying why plant taxonomy is important to our understanding of plant diversity. For example, Thorogood's explanation of species richness and the importance of collecting herbarium specimens (pp. 154, 155) and his allusion to the importance of DNA to confirm identifications (p. 120) remind us that the author always has his research goals in mind. In addition, Thorogood conveys how island endemism and rarity are products of evolution, further supporting his goal of increasing awareness of plant conservation without detracting from the overall narrative. The glimpses into the life a modern botanist are equally informative; descriptions of the harsh conditions, the fruitless searches and the successful ones are described in ways that make you feel like you are in the field too.

Chasing Plants incorporates an exciting mixture of art, science, history, and culture, which are all made accessible to the reader through vivid imagery and Thorogood's conversational tone. Thorogood's descriptions of the plants that he encounters engage all the senses and bring the plant to life in the reader's mind. Part of the life-like nature of Thorogood's descriptions comes from his creative ability to associate unfamiliar plants with images from everyday life. He'll compare plants to anything ranging from a "purple asparagus" to "a leafless ghoul" (pp. 21, 23). Add to these descriptions his dynamic artwork, and the reader feels as though they are seeing the plant with their own eyes. Our only complaint about the artwork is that there could be a larger variety of plants depicted and a more organized placement of the artwork throughout. Often the artwork displayed seems to have little to do with the page it's facing. However, the art itself is beautiful and creates an anticipation for whatever artwork might be displayed on the next page. Overall, Thorogood's *Chasing Plants* invites the reader to share in an educational, immersive, and exciting journey that helps reveal the history of plants and their relevance to our own lives.

–Elizabeth Wamsley, Carolyn W. Howell, and Christopher D. Heckel (checkel@hillsdale.edu), Hillsdale College, 33 E College St, Hillsdale, MI 49242

Mary Strong Clemens. A Botanical Pilgrimage

Nelda B. Ikenberry
2021. ISBN-13: 978-1889878638
Hardcover US$45; 462 pp.
Botanical Research Inst of Texas

Mary Strong Clemens, who lived from 1873 to 1968, was a botanical explorer and extensively collected plants in remote areas of the world including the Philippines, Borneo, New Guinea, and Australia. She was born in New York and died in Australia where she did extensive work in isolated areas.

In 1896, Mary married Joseph Clemens, who became a chaplain in the U.S. Army. This work brought Joseph and Mary to the Philippines from 1905 to 1907, and she started to make collections in remote areas. Later, Joseph worked with her, and they became notable botanical collectors. They made many trips in Southeast Asia, and during 1931–1934 in Borneo (a large, rugged island), they made the largest collections of plants from remote mountainous parts of that island.

In 1935, Mary and Joseph traveled to New Guinea, and Joseph died the next year (Merrill and Perry, 1948). Mary stayed to continue to collect plants but evacuated to Australia in 1941 due to World War II in the Pacific theater. For the next 20 years, she worked at the Queensland Herbarium in Brisbane, and she continued her botanical work as a collector. Mary did extensive botanical collections in Queensland and made major contributions to categorizing the flora of Australia. She worked in the Queensland Herbarium until the early 1960s and died in 1968.

This book used her diaries and letters as well as family and institutional archives to present the fascinating story of her dedication to collect plants from all around the world. She was considered in many ways an "amateur" botanist whose extensive collections were used by professional botanists throughout the world (Keeney, 1992). Sets of her plant collections in Queensland were sent to the Botanical Garden at the University of Michigan, which distributed them to other institutions. Thus, her specimens were sent to herbaria around the world including Berlin, Zurich, Munich, Singapore, Harvard, the United States Botanic Garden, New York Botanical Garden, and many other places.

The author takes a chronological approach, and the book includes many photographs (both half-tone and color) of Mary and Joseph Clemens, the exotic locations of their collections, and some of the plants they collected and catalogued. Amateur botanists have contributed greatly to the field, and we are fortunate to have so many people interested in plants and their remarkable diversity. Although we still have some amateurs who are very knowledgeable about plant taxonomy (Marcenò et al., 2021), few today will ever contribute to plant biology as much as Mary Strong Clemens.

REFERENCES

Keeney, E. 1992. *The botanizers: amateur scientists in nineteenth-century America*. University of North Carolina Press.

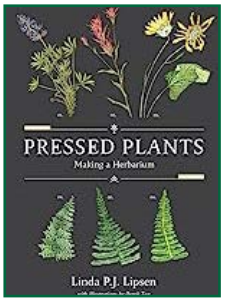
Marcenò, C., J. Padullés Cubino, M. Chytrý, E. Genduso, A. S. Gristina, A. La Rosa, D. Salemi, et al. 2021. Plant hunting: exploring the behaviour of amateur botanists in the field. *Biodiversity and Conservation* 30: 3265-3278.

Merrill, E. D., and L. M. Perry, L.M. 1948. Notes on some Papuan collections of Mary strong Clemens. *Journal of the Arnold Arboretum* 29: 152-168.

–John Z. Kiss, Department of Biology, University of North Carolina Greensboro, Greensboro NC 27412

Pressed Plants: Making a Herbarium

Linda P.J. Lipsen
With illustrations by Derek Tan
2023. ISBN 978-0772680563.
Paperback, US$19.95; 92 pp.
Royal BC Museum



People press plants for all sorts of reasons, from creative or artistic pursuits, to "amateur" documentation, to the use of specimens in more formal scientific endeavors. *Pressed Plants: Making a Herbarium* by Linda P.J. Lipsen (with illustrations by Derek Tan) guides readers through the entire process of pressing plants. Lipsen is the collections curator at the University of British Columbia Herbarium, part of the Beaty Biodiversity Museum, while Derek Tan is an illustrator and photographer with the museum. This book is divided into six main chapters that chronologically address the major steps in creating one's own herbarium.

The book starts with a brief introduction that explains why we press plants, and who presses them, followed by chapters that walk through the steps to making an herbarium. Chapter One deals with collection preparation, including a list and description of the necessary supplies as well as safety and ethical considerations to make before collecting. The second chapter focuses on the actual collection process, walking through the why, what, when, and how to carry out this important step of sampling plants in the field. The third chapter addresses how to press and dry plant specimens, and Chapter Four focuses on the mounting process. Now that individual specimens have been collected, pressed, and mounted, the author details the preservation and organization of the overall collection in Chapter Five. Chapter Six discusses how to identify specimens, pointing to both traditional field guides and online resources, while also describing key traits for some of the largest plant families along with illustrations and special tips on collecting or mounting plants from these groups. Finally, the References and Resources section directs readers to both useful publications and websites, organized thematically.

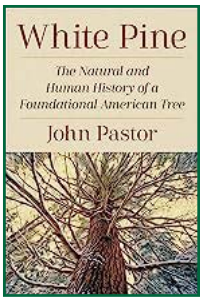
This concise book (92 pages) is a remarkable guide through each step of making an herbarium. Lipsen provides complete equipment lists for each step, including both expensive options and recommendations for supplies that are more affordable or accessible, with special notes on reusable or sustainable options in the margins denoted by a recycling symbol. Additional margin notes denoted with a "T" include tips and tricks, while checkmarks provide step-by-step checklists for important protocols. The black-and-white illustrations by Tan are beautiful and clean, giving clear depictions of all tools and supplies, plus set-ups for organizing and walking through the pressing and mounting processes. Gorgeous botanical illustrations also highlight important parts of the plants to preserve; labeled diagrams show key features of important plant groups.

This book is accessible to novices while simultaneously providing helpful reminders and tips for more experienced individuals. At each step in the process, Lipsen not only discusses what to do, but also why to do it, which reiterates the importance of the step and provides helpful context. It can therefore serve as a handy reference for non-experts, as a great introduction to students or new people working in collections, or as a reference for seasoned herbarium staff or curators. As a

professor who teaches Plant Systematics and co-curator of a small university herbarium, I will certainly be using many of the tips and tricks recommended in this book and will also be framing my teaching using some of these ideas and examples! Overall, this book is a thorough and accessible introduction and reference to plant collection and preservation in herbarium formats.

—Nora Mitchell, Department of Biology, University of Wisconsin – Eau Claire, Eau Claire, Wisconsin, USA

White Pine: The Natural and Human History of a Foundational American Tree



John Pastor
2023. ISBN-13: 9781642831412
US$30.00 (paperback); 276 pp.
Island Press, Washington, DC, USA

As children, we all learned about the history of America in increasing detail each year from kindergarten through our late high school or early college years. Our teachers imparted their knowledge of major events in American history, including the Boston Tea Party, Revolutionary War, and Franklin D. Roosevelt's New Deal but, sadly, not one teacher, in my experience, mentioned the critical role that white pine had on these and other historical events. *White Pine: The Natural and Human History of a Foundational American Tree* by Dr. John Pastor, an ecologist and Professor Emeritus at the University of Minnesota, fills in the gaps and regales readers with tales from American history through the lens of *Pinus strobus*, the tree species that built America. This captivating book is organized into 11 chapters, and includes a detailed introduction, afterword, and bibliography with additional notes for the history and forestry buffs who want more information and references for further reading.

The book starts with stories of Pastor's youth in the North Woods with old-growth eastern white pine stands and evolves into a summary of the history of white pine. Many of the chapters seem to include similar musings from Pastor about his lived experiences with white pine, preceding or following the science and history around the theme of the respective chapter. In the first chapter, Pastor begins by painting a vivid description of the sights, smells, and sounds of an old growth stand of eastern white pine in Minnesota and transitions to a story of how pine evolved, starting from the time of Pangaea and Laurasia with *Pinus mundayi*, through the many Ice Ages, and up to the present-day distribution and diversity of pine species in North America. This narrative eases the reader into the history of the relationships between humans and white pine that picks up speed in the second chapter, which includes a very brief history of Indigenous use (e.g., needles, roots, and bark used as base of many Algonquin medicines) and reverence/views (e.g., sign of unity for Haudenosaunee peoples) of white pine. The chapter includes citations from some powerhouse researchers in the field, but, unfortunately, does not directly or explicitly cite Indigenous elders and knowledge keepers as sources of the information. Pastor strongly contrasts Indigenous use and views of white pine with the more utilitarian and ownership-centric view of European colonists, who are the focus for the rest of the chapter. Notable events, such as the naming of white pine by Plukenet and Linnaeus, the development of the Pine Laws and King's Broad Arrow, and Pine Tree Riot, which led to the Boston Tea Party and Revolutionary War, are woven

together in the history presented in the second chapter.

The post-Revolutionary War era picks up in the third chapter, which focuses on the extreme shift in white pine logging and utilization that led to the rapid establishment and success of many timber companies (some of which still exist today) and rapid displacement of Indigenous peoples and downfall of white pine ecosystems throughout eastern North America. Henry David Thoreau's views on the destruction of these "legendary" white pine forests are outlined in the somewhat solemn fourth chapter, which details Thoreau's ecological perspective, "righteous" quest to understand the relationships between white pine and other forest-dwelling organisms, and determination to demonstrate the ecological value of white pine from cradle to grave and beyond. This focus on ecological benefits of white pine continues in the next chapter, "The Watershed," which focuses on diplomat and conservationist George Perkins Marsh and artist Sanford Gifford, the latter of which who was the godfather of Gifford Pinchot, the first head of the U.S. Forest Service. Collectively, the story of these three men speaks to the recognition that white pine commodification led to the demise of other species and the landscape, which segues to the sixth chapter focused on Pinchot's quest for sustainable forestry and the development of Spalding and Fernow's comprehensive study of white pine ecology, silvics, health, and management. Chapters seven through ten focus on the movement to restore white pine to the landscape, which ranged from imports of white pine (and the horrid white pine blister rust) from Europe to the development of the Civilian Conservation Corps (a.k.a., Roosevelt's Tree Army) as part of FDR's New Deal attack on economic stagnation during the Great Depression, and the development of modern-day ecological silviculture. The ninth chapter focuses on the shifting view of fire in the forest landscape, from Indigenous use of fire to promote berry-producing species to the early Smoky Bear era of fire prevention and the shift to understanding the importance of using fire to obtain and sustain diverse, healthy forest ecosystems. The last chapter brings the story back to climate and how pines have evolved over time, citing that, with climate change rapidly warming Earth's temperature, no one really knows what will happen with pines. Will they adapt to the warming climate? Contract their range? Go extinct? Pastor speculates what will happen, wrapping up the book with an emphasis on using what we have learned about the history of white pine to guide the future of this foundational species that helped shape America and the field of forestry.

This book contains the rich history of a foundational tree species that has helped sustain life and ecosystem health while shaping a nation. Pastor's discussion of the fine historical details, such as the Pine Tree Riots, how mean annual increment was created, how white pine blister rust was important for motivating Congress to pass the Plant Quarantine Act, and transition from Indigenous reverence to European exploitation and utilitarianism to modern conservation and sustainability, makes this a must-read for all forestry professionals, naturalists, and others receptive to the teachings of history in pursuit of conserving a legendary tree species and forest ecosystems.

– A.N. Schulz, Department of Forestry, Mississippi State University, Starkville, Mississippi, USA

Plant Science Bulletin

Botanical Society Of America

ISSN 0032-0919
Published 3 times a year by
Botanical Society of America, Inc.
4475 Castleman Avenue
St. Louis, MO 63166-0299

Periodicals postage is paid at
St. Louis, MO & additional
mailing offices.
POSTMASTER:
Send address changes to:
Botanical Society of America
Business Office
P.O. Box 299
St. Louis, MO 63166-0299
bsa-manager@botany.org

The yearly subscription rate
of $15 is included
in the membership
Address Editorial Matters (only) to:
Mackenzie Taylor, Editor
Department of Biology
Creighton University
2500 California Plaza
Omaha, NE 68178
Phone 402-280-2157
psb@botany.org

The Botanical Society of America is a membership society whose mission is to: promote botany, the field of basic science dealing with the study & inquiry into the form, function, development, diversity, reproduction, evolution, & uses of plants & their interactions within the biosphere.

Plant Science Bulletin

Have you registered yet?
Come home to Botany 2023
at the beautiful
Boise Centre, Boise, Idaho

Connect, Collaborate & Learn
with Colleagues from Around the Globe

A NOTE FROM VISIT BOISE
https://bit.ly/3mXx7Jm

WHY BOISE?
https://bit.ly/3AjUZd4

Over 900 Scientific Presentations
Including Symposia - Colloquia - Poster Session
Social Events - Field Trips - Wildflower Walks
Workshops - Exhibits
Special Lectures by Prominent Scientists

AN INVITATION FROM A MEMBER
https://bit.ly/41uM70n

Register now - www.botanyconference.org

Measuring photosynthesis? Chlorophyll fluorescence?

Don't let its compact size fool you. The highly accurate CIRAS-4 Portable Photosynthesis System is the lightning-fast portable powerhouse that will elevate your research. Its advanced software is exceptionally intuitive, customizable, and all managed from the touchscreen. It's so easy to use that you can begin taking measurements right out of the box.

- **Designed for high-level field research**
  Lightweight, compact & up to 16 hours of continuous use
- **Measure rapid A/C_i in real time without post processing**
  The Single-Step CO_2 Response ($SSCO_2R^{™}$) Method is the fastest, most accurate, streamlined method available
- **Only system to feature far-red LEDs**
  Allows for control of far-red light up to 30% of PAR
- **Fully automatic & programmable environmental control**
  Full control of CO_2, H_2O, temperature & light (RGBW-FR)
- **Measure leaf gas exchange & chlorophyll fluorescence simultaneously**
  Plus dark & light-adapted fluorescence measurement parameters & OJIP fast induction kinetics

Learn more about the fastest, most accurate portable leaf gas exchange system available.

PP SYSTEMS

Elevate your research

Amesbury, MA 01913 U.S.A. | +1 978-834-0505 | sales@ppsystems.com