



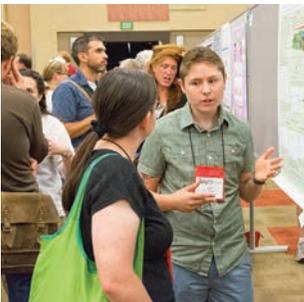
PLANT SCIENCE BULLETIN

FALL 2014 VOLUME 60 NUMBER 3



SCIENTISTS PROUDLY STATE THEIR PROFESSION!

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FROM THE EDITOR

Reclaim the name: #Iamabotanist is the latest sensation on the internet! Well, perhaps this is a bit of an overstatement, but for those of us in the discipline, it is a real ego boost and a bit of ground truthing. We do identify with our specialties and subdisciplines, but the overarching truth that we have in common is that we are botanists! It is especially timely that in this issue we publish two articles directly relevant to reclaiming the name. “Reclaim” suggests that there was something very special in the past that perhaps has lost its luster and value. A century ago botany was a premier scientific discipline in the life sciences. It was taught in all the high schools and most colleges and universities. Leaders of the BSA were national leaders in science and many of them had their botanical roots in Cornell University, as well documented by Ed Cobb in his article “Cornell University Celebrates its Botanical Roots.” While Cornell is exemplary, many institutions throughout the country, and especially in the Midwest, were leading botany to a position of distinction in the development of U.S. science.

Beginning in the late 1930s and early 1940s a serious disease began to appear in the U.S. that was only diagnosed in 1998—PLANT BLINDNESS! In hindsight, this serious disease was a major factor in the steady erosion of botany and the status of botanists. How can we overcome this epidemic to help “reclaim the name”? Strong doses of local treatment are indicated, and Lena Struwe and her collaborators provide a good example of opening students’ eyes in their article, “The Making of a Student-Driven Online Campus Flora: An example from Rutgers University.” Student engagement, hands-on with plants, should provide the stimulus for redeveloping plant sightedness—and a greater appreciation for botany both within the scientific community and with the public at large.

I’m sure that many of you have additional examples demonstrating effective treatment of the insidious disease, Plant Blindness. I encourage you to share your results by submitting a manuscript to PSB.



-Marsh

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Botany 2015

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BOTANY 2014 CONFERENCE A SUCCESS

BOTANY 2014 in Boise was an amazing success, with 1056 botanists from 49 states and 39 countries in attendance. (From the United States, only Delaware was missing!) The conference welcomed a large international contingent, from China, Bhutan, New Zealand, Nigeria, Vietnam, and more.

Boise rolled out the red carpet for the conference, with stores displaying “Welcome Botany” signs in windows throughout the city, and attendees were enthusiastic about the cities welcoming ambiance, safe and walkable venues, delicious and affordable restaurants. The Boise Center and host hotel, The Grove, provided not only great meeting sites, but the important places for impromptu and planned locations for the attendees to meet with each other.

One attendee described the conference as “an explosion of science,” and another as the “single week that keeps me excited and challenged throughout the year.”



As always, the Exhibit Hall was popular, with 32 exhibitors on hand to bring some of the newest industry information to conference attendees. And the Poster Session was a wealth of information from some of the up-and-coming young scientists ready to present during the week-long conference.

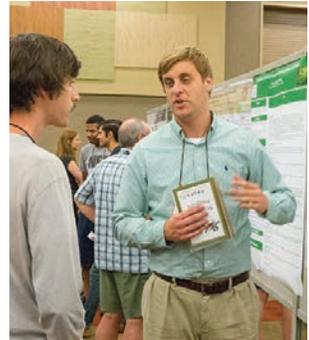
The week started out with the traditional Botany in Action service project—approximately 30 botanists put their backs into the work of weeding, pruning and generally buffing up for “Firewise!”---the program designed to teach citizens how to design, plant, and care for their property so it survives a wildfire.

That field trip, along with others, was well-attended and popular. While some attendees went out to enjoy Idaho’s spectacular weather, others stayed in for an array of workshops designed to hone professional skills.

This year, awards were given in a new format called “Celebrate!” featuring a reception and an informal ceremony, which replaced the banquet from previous years. The mixer furthered the meeting’s reputation for opportunities to meet and network.



...The week is an an explosion of science....





The 2014 Conference sets the stage for Botany 2015, July 25-29 in Edmonton, Alberta, with the theme "Science and Plants for People." The conference site <http://www.botanyconference.org/> is now open for symposia proposals.

CONFERENCE ATTENDEES GIVE BACK TO BOISE WITH “BOTANY IN ACTION” SERVICE PROJECT

Most scientific conferences feature lectures and posters, but attendees rarely get a chance to actually give back to the host city--but then, Botany Conferences have always stood out for offering above-and-beyond experiences.

At Botany 2014 in Boise, more than 30 botanists put their backs to work spiffing up the two-acre Firewise Demonstration Garden during the Botany in Action field trip. They descended on the flower beds to weed, prune, and deadhead as well as climb over the massive hill to remove the invading weeds to once again render the hills fireproof. The Garden—a cooperative project between the Bureau of Land Management (BLM), the college of Western Idaho Horticulture program, and the Idaho Botanical Garden—is used to show the public an example of how plantings can be used to protect homes and property in the area.

The “before and after” was evident as the group put their expertise to work, with the organizers of the trip noting the difference between the “botany volunteers” and some other groups, in terms of their unwavering energy for the task.

It may have been more than energy, one volunteer said. “We just know what we are looking at with the plants. We know what to prune and where, how to deadhead, what is a weed and what is a plant. That makes the work fun for us. And we are learning here too.”

The project, located adjacent to the Idaho Botanical Garden, includes more than 350 native and domestic species, all being evaluated for performance and fire resistance in the Idaho climate. The plants are watered in a drip system.

The Firewise project also focuses on teaching residents about plant choice, maintenance, and



spacing, as well as how to plant in zones so that structures do not burn. The concept of “defensible space” is taught so that owners learn about planting the right plants in the right place.

Roger Rosentreter, a botanist now retired from the BLM and Boise State University who started the Firewise project, coordinated the 2014 Botany in Action for the Botany Conference. He explained that today, perhaps with the onslaught of many forest fires throughout the West, the idea of the program is spreading. He says there is support from the environmental community as well as the public.

“Landscaping and roofing materials will literally determine if your house will burn,” Rosentreter said. “What the public cares about is their houses.”

---Janice Dahl, *Great Story!*



A (MUCH) YOUNGER CROWD AT BOTANY 2014

Botany 2014 attendees may have noticed a few younger-than-usual botanists in the mix this year. Here are two stories of how the conference can affect those whose interest in botany has started early in life.

YOUNGEST-EVER PRESENTERS WIN PHYSIOLOGICAL SECTION AWARD

High school students Eli Echt-Wilson and Albert Zuo were excited to be accepted to present their poster at Botany 2014--but they never dreamed they would win the award for the best poster presentation in the Physiological Section.

They developed their project, "Detailed Computational Model of Tree Growth," working with mentor and post-doc Sean Hammond and spurred to achieve more by their high school science teacher, Jason DeWitte. DeWitte connected the students with Hammond, who started the tree modeling work. The two students did the work as juniors at La Cueva High School in Albuquerque, New Mexico.

"Mr. Hammond told us about the Botany conference," said Eli. "It is very exciting to be here," chimed in Albert. "People have been friendly and open to come up to our poster to talk about it."

"The project started out as fun thing, a local challenge, but it snowballed and became something really good," Albert explained. "We just went with the flow!"

The young scientists entered their work earlier in the year in the Intel Science Fair and were delighted to see one of the judges at the Botany conference. They found their own excitement growing at the opportunity to attend presentations by scientists from all over the world.

With such a stellar performance, where do these young men plan to head in their careers? Both are interested in computer sciences and how those are applied to other fields. Botany is definitely still in the mix.

"I always wanted to be a scientist," Eli said. "If I can apply com sci to botany or biology, it would be of interest to me."

"I would definitely come back," said Albert with a smile, his fellow scientist adding, "We're already thinking about our next project."



Eli Echt-Wilson and Albert Zuo, in the middle of filming a video presentation of their award-winning Physiological Section poster.

THE MAKING OF A BOTANIST

Although Botany conference organizers are proud to have a large representation of students, it's rare when one of those students hasn't even entered high school. When 11-year-old Eagan Brandenberger signed up for a Botany Conference field trip, he and his mother Sarah Brandenberger didn't know quite what to expect---so perhaps they were surprised to see world-renowned botanists open their arms to someone so young.

Eagan talked about the many botanists on the "Fossil floras associated with the Middle Miocene Columbia River Basalts of Northern Idaho" field trip who were eager to share their help, showing him the plants and fossils. He saw the professional botanists keeping drawings and journal entries, and he kept his own journal during the field trips. His mother said he started out by drawing flowers, emulating the botanists he saw doing the same, and then making notes about what he saw. It's something a bit unusual for 11-year-olds, but maybe not for those headed so intently for a career they've fallen in love with at such a young age.

"The experience was amazing," Eagan said, talking about 50-million-year-old fossils he unearthed on the three-day trip led by Dr. Steve Manchester. Big leaves, little leaves, all different leaves clustered on a rock just "this big," he gestured in excitedly explaining his discovery of fractured bald Cyprus. "I was really looking for an avocado...but I didn't find it," he added with the exasperation reserved for pre-teens.

During the trip, they learned about geography, stopping at Whitebird to discover fossils right at the side of the road. Side by side with botanists, Eagan learned how to split the rock, looking at each find with fascination as each fossil was identified. The scientists taught Eagan how to split the fossils from the rock so that the entire rock doesn't have to be carried to preserve the fossil.

"(Field trip coordinator) Bill (Rember) was showing me the leaf and I realized it wasn't yet rock or simply impression---but an actual organic leaf," Sarah said. Later, some of the participants invited Eagan to "botanize" the wet lands, so they went and checked out the flora of the wetlands and "freed" some fossils from the dig. The botanists worked with Eagan, Sarah said, showing him different



Eagan Brandenberger, 11, learning about plant fossil identification during a Botany 2014 field trip.

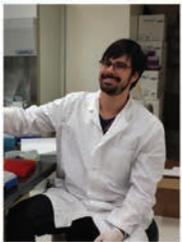
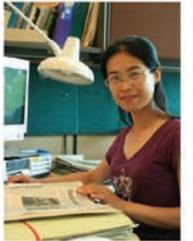
techniques for lifting the leaves from the rock.

"I grew up with my father being a scientist in Los Alamos, a town of scientists, and was able to feel the excitement my father had for discovery and science," Sarah said of the Botany Conference experience. "Eagan was able to pick up on that and feel it himself. That was the best/most a mother could have hoped for and was not disappointed."

Sarah said Eagan began collecting unusual plants at age 4 with bromeliads, figuring out on his own what that was. This year, he made several flower gardens for his mother on Mother's Day and has created window gardens in every available space. Already, Eagan has shown an interest in the loss of plant diversity on the planet, though his mother says he is not a prodigy botanist.

Sarah said she has worked to get her son interested in other things, to make him better-rounded. But his fascination with plants remains. And perhaps, at the center of this ongoing discover, the Botanical Society of America will help lead the way.

---Janice Dahl, Great Story!



BOTANY 2014 AWARDS

ISABEL COOKSON
AWARD (PALEOBOTANICAL SECTION)

Established in 1976, the Isabel Cookson Award recognizes the best student paper presented in the Paleobotanical Section.

Kelly K.S. Matsunaga from Humboldt State University, for the paper, “*A whole-plant concept for an Early Devonian (Lochkovian-Pragian) lycophyte from the Beartooth Butte Formation (Wyoming)*” Co-author: Alexandru M.F. Tomescu.

KATHERINE ESAU AWARD
(DEVELOPMENTAL AND STRUCTURAL SECTION)

This award was established in 1985 with a gift from Dr. Esau and is augmented by ongoing contributions from Section members. It is given to the graduate student who presents the outstanding paper in developmental and structural botany at the annual meeting.

This year’s award goes to **Rebecca Povilus**, from Arnold Arboretum of Harvard University, for the paper “*Pre-fertilization reproductive development and floral biology in the remarkable water lily, Nymphaea thermarum.*” Co-authors: Juan M. Losada and William E. Friedman.

PHYSIOLOGICAL SECTION
LI-COR PRIZE

Christina Hilt, Fort Hays State University-Advisor, Dr. Brian Maricle, for the poster “*Physiological responses of grasses to drought and flooding treatments*” Co-author: Brian Maricle

MAYNARD MOSELEY AWARD
(DEVELOPMENTAL & STRUCTURAL AND PALEOBOTANICAL SECTIONS)

The Maynard Moseley Award was established in 1995 to honor a career of dedicated teaching, scholarship, and service to the furtherance of the botanical sciences. Dr. Moseley, known to his students as “Dr. Mo”, died Jan. 16, 2003 in Santa Barbara, CA, where he had been a professor since 1949. He was widely recognized for his enthusiasm for and dedication to teaching and his students, as well as for his research using floral and wood anatomy to understand the systematics and evolution of angiosperm taxa, especially waterlilies (PSB, Spring, 2003). The award is given to the best student paper, presented in either the Paleobotanical or Developmental and Structural

sessions, that advances our understanding of plant structure in an evolutionary context.

Fabiany Herrera, from the University of Florida, Florida Museum of Natural History, for the paper “*Revealing the Floristic and Biogeographic Composition of Paleocene to Miocene Neotropical Forests*” Co-authors: Steven Manchester and Carlos Jaramillo

DEVELOPMENTAL & STRUCTURAL SECTION
BEST STUDENT PRESENTATION AWARDS

Kelsey Galimba, University of Washington, for the poster “*Gene duplication and neo-functionalization in the APETALA3 lineage of floral organ identity genes in a non-core eudicot*” Co-author: Jesus Martinez-Gomez and Veronica S Di Stilio

ECOLOGY SECTION STUDENT PRESENTATION AWARDS

Rachel M. Germain (Graduate Student), University of Toronto, for the paper “*Hidden responses to environmental variation: maternal effects reveal species niche dimensions*” Co-author: Benjamin Gilbert

Clayton J. Visger (Graduate Student), University of Florida, Florida Museum of Natural History, for the paper “*Niche Divergence in Tolmiea (Saxifragaceae): using Ecological Niche Modeling to develop a testable hypothesis for a diploid-autotetraploid species pair*” Co-authors: Charlotte Germain-Aubrey, Pamela S. Soltis, and Douglas E. Soltis

Takashi Yamamoto, Chiba University, for the best Graduate Student poster “*Refugia might affect the genetic structure of a sea-dispersal plants: Vigna marina*” Co-authors: Koji Takayama, Reiko Nagashima, Yoichi Tateishi, and Tadashi Kajita

Ignacio Vera, for the best Undergraduate Student poster “*Comparing Seed Viability and Harvest Consistency Across Sites and Years for the Federally Endangered Plant Eriastrum densifolium spp. sanctorum*”

Davis Blasini, Chicago Botanic Garden, for the best Undergraduate Student poster “*Introduction of Echinacea pallida in the Prairies of Western Minnesota and its Possible Effects on Native Echinacea angustifolia*” Co-author: Stuart Wagenius

GENETICS SECTION STUDENT PRESENTATION AWARD

Morgan Roche, Bucknell University, for the poster “*When dioecy doesn’t pay: Population genetic comparisons across three breeding systems and five species in Australia Solanum*” Co-authors: Ingrid Jordon-Thaden and Chris Martine

PHYSIOLOGICAL SECTION STUDENT PRESENTATION AWARDS

Eli Echt-Wilson and **Albert Zuo**, La Cueva High School - Advisor, Jason DeWitte, for the paper “*A Detailed Computational Model of Tree Growth*” Co-authors: Sean Hammond, David Hanson and Jason DeWitte

Keri Caudle, Fort Hays State University - Advisor, Dr. Brian Maricle, for the poster “*Pigment variation among ecotypes of big bluestem (Andropogon gerardii) across a precipitation gradient*” Co-authors: Christina Hilt, Cera Smart, Diedre Kramer, Sana Cheema, Loretta Johnson, Sara Baer and Brian Maricle

SOUTHEASTERN SECTION - ASSOCIATION OF SOUTHEASTERN BIOLOGISTS, POSTER/PAPER AWARDS

Titian Ghandforoush, Wake Forest University - for the ASB 2014 presentation: “*Phylogenetic reconstruction of relationships I the paleotropical Vaccinieae (Ericaceae) based on DNA sequence data*” Co-author Kathleen Kron

Kristin Emery, University of North Carolina at Asheville - for the ASB 2014 poster: “*Effects of open pollination, selfing, inbreeding and outbreeding treatments on seed set and viability in Spiraea virginiana, an endangered rose*” Co-authors Jennifer Rhode Ward and H. David Clarke

DEVELOPMENTAL & STRUCTURAL SECTION STUDENT TRAVEL AWARDS

Italo Antonio Cotta Coutinho, Universidade Federal de Vicosa - Advisor, Renata Maria Strozi Alves Meira - for the Botany 2014 presentation: “*Diversity of secretory structures in Urena lobata L.: ontogenesis, anatomy and biology of the secretion*” Co-authors: Sara Akemi Ponce Otuki, Valéria Ferreira Fernandes, Renata Maria Strozi Alves Meira

Roux Florian, INRA - Advisor, Jana Dlouhá - for the Botany 2014 presentation: “*Flexible juveniles or why trees produce ‘low quality’ wood?*” Co-authors: Jana Dlouhá, Tancrede Almeras, Meriem Fournier

Rebecca Povilus, Harvard University - Advisor, William E. Friedman - for the Botany 2014 presentation: “*Pre-fertilization reproductive development and floral biology in the remarkable water lily, Nymphaea thermarum*” Co-authors: Juan M. Losada, William E. Friedman

Beck Powers, University of Vermont - Advisor, Jill Preston - for the Botany 2014 presentation: “*Evolution of asterid HANABA TARANU-like genes and their role in petal fusion*” Co-author: Jill Preston

ECOLOGY SECTION STUDENT TRAVEL AWARDS

Rachel Germain, University of Toronto - Advisor, Dr. Benjamin Gilbert - for the Botany 2014 presentation: “*Hidden responses to environmental variation: maternal effects reveal species niche dimensions*” Co-author: Benjamin Gilbert

Jessica Peebles Spencer, Miami University - Advisor, Dr. David L. Gorchov - for the Botany 2014 presentation: “*Effects of the Invasive Shrub, Lonicera maackii, and a Generalist Herbivore, White-tailed Deer, on Forest Floor Plant Community Composition*” Co-author: David L. Gorchov

ECONOMIC BOTANY SECTION STUDENT TRAVEL AWARDS

Lauren J. Frazee, Rutgers University - Advisor, Lena Struwe - for the Botany 2014 presentation: “*Urban Environmental Education and Outreach using Edible, Wild, and Weedy Plants*” Co-authors: Sara Morris-Marano and Lena Struwe

Jacob Wasburn, University of Missouri - Advisor, J. Chris Pires - for the Botany 2014 presentation: “*Photosynthetic evolution in the grass tribe Paniceae*” Co-authors: James Schnable, Gavin Conant and J. Chris Pires

GENETICS SECTION STUDENT TRAVEL AWARDS

Heather Dame, University of Ottawa - for the Botany 2014 presentation: “*Phylogeny of the paraphyletic Fuireneae (Cyperaceae)*” Co-authors: Anna K. Monfils, Derek R. Shiels, Julian Starr, David Pozo, Adriane L. Shorkey and Elizabeth R. Schick

Robert Massatti, University of Michigan - for the Botany 2014 presentation: “*Microhabitat differences impact phylogeographic concordance of co-distributed species: genomic evidence in montane sedges (Carex L.) from the Rocky Mountains*” Co-author: Lacey Knowles

Rosa Rodriguez, Florida International University - for the Botany 2014 presentation: "*Genetic structure, diversity, and differentiation of Pseudophoenix (Arecaceae) in Hispaniola*" Co-authors: Brett Jestrow, Teodoro Clase, Francisco Jimenez, Alan Meerow, Eugenio Valentin Santiago, Jose Sustache, Patrick Griffith and Javier Francisco-Ortega

PTERIDOLOGICAL SECTION &
AMERICAN FERN SOCIETY STUDENT
TRAVEL AWARDS

Alyssa Cochran, University of North Carolina, Wilmington - Advisor, Dr. Eric Schuettpelez - for the Botany 2014 presentation: "*Tryonia, a new taenitidoid fern genus segregated from Jamesonia and Eriosorus (Pteridaceae)*" Co-authors: Jefferson Prado and Eric Schuettpelez

Jordan Metzgar, University of Alaska, Fairbanks - Advisor, Dr. Stefanie Ickert-Bond - for the Botany 2014 presentation: "*From eastern Asia to North America: historical biogeography of the parsley ferns (Cryptogramma)*" Co-author: Stefanie Ickert-Bond

Jerald Pinson, University of North Carolina, Wilmington - Advisor, Dr. Eric Schuettpelez - for the Botany 2014 presentation: "*Origin of Vittaria appalachiana, the "Appalachian gametophyte"*" Co-author: Eric Schuettpelez

Sally Stevens, Purdue University - Advisor, Dr. Nancy C. Emery - for the Botany 2014 presentation: "*Home is Where the Heat Is? Temperature and Humidity Responses in a Fern Gametophyte*" Co-author: Nancy C. Emery

SPECIAL AWARDS:

DR. ELIZABETH KELLOGG
OUT-GOING BSA PAST-PRESIDENT,
DANFORTH CENTER

The Botanical Society of America presents a special award to Dr. Kellogg expressing gratitude and appreciation for outstanding contributions and support for the Society. Toby has provided exemplary contributions to the Society in terms of leadership, time, and effort.

DR. DAVID SPOONER
OUT-GOING PROGRAM DIRECTOR,
UNIVERSITY OF WISCONSIN

The Botanical Society of America presents a special award to Dr. Spooner expressing gratitude and appreciation for outstanding contributions and support for the Society. David has provided exemplary contributions to the Society in terms of leadership, time, and effort.

DR. LINDA GRAHAM
OUT-GOING DIRECTOR-AT-LARGE
FOR DEVELOPMENT, UNIVERSITY OF
WISCONSIN

The Botanical Society of America presents a special award to Dr. Graham expressing gratitude and appreciation for outstanding contributions and support for the Society. Linda has provided exemplary contributions to the Society in terms of leadership, time, and effort.

MORGAN GOSTEL
BSA STUDENT REPRESENTATIVE TO THE
BOARD, GEORGE MASON UNIVERSITY

The Botanical Society of America presents a special award to Morgan expressing gratitude and appreciation for outstanding contributions and support for the Society.

"CROWDFUND" YOUR RESEARCH

What do you do when you have a great research idea but can't afford to pay for it?

One option is to "crowdfund" your idea using Experiment.com, a small private company based in the venture capital of the world, San Francisco. From an office in the living room of a shared apartment in the Mission District, the staff at Experiment.com invited me to sit on a beanbag chair on their deck and talk about my research. We used Skype to bring Tommy Stoughton, my field partner, into the discussion from the other side of the state nearer Los Angeles. We focused on the differences between a crowdfunding campaign and a grant proposal, and the psychology of potential donors. Following this conversation, we hashed out a schedule and planned for the launch of our crowdfunding campaign involving alpine plant research.

It isn't necessary that you make a personal visit to establish a connection with the staff at Experiment.com, but since I was in town, I wanted to meet these folks in their element. The bare-essentials living room had a large table with chairs around and was crowded with computer equipment -- they all slept in the apartment. Their job, and why we hire them, is to help promote and manage your social web-based presence to the World Wide Web via Social Media in this new age of technology and connectedness. They also manage the collection of individual donations that are made to your campaign, spending plenty of time encouraging principle investigators (like us) to get out there and find more backers.

Experiment.com is creating a different kind of community of public involvement in the Scientific Community. What most people ask is, "It is like Kickstarter.com, but for science, right?" That is exactly right. In the fall of 2013, Tommy Stoughton launched his own all-or-nothing \$20,000 campaign on Experiment.com, but he ultimately received nothing when his fundraising efforts fell short by about \$13,000. After great consideration regarding how or why Tommy had failed, we received encouragement to try again with a more realistic goal. Tommy's first attempt was designed to fund an entire Ph.D. dissertation, not a small paper or individual chapter. We decided to combine forces and launch the campaign together as a team, taking advantage of mostly non-overlapping social network outlets. While this strategy might work



Ingrid Jordon-Thaden and Thomas Stoughton in the Ruby Mountains, Humboldt National Forest, Nevada.

well for increasing the number of potential donors for one campaign, Experiment.com is structured for a single principal investigator to launch a campaign. This is something they are actively working to change as numerous researchers have requested for group campaign options.

If you already have a polished grant proposal, this is a good place to start. You will have to modify it, though, dividing it into smaller sections and removing ALL undefined technical language. This will enable the public, particularly your friends and family, to comprehend the importance of your campaign and be motivated to contribute to your science. A highlight of this alternative 'open source' research is that the backers (e.g. donors) receive updates from you as your campaign progresses and as your successfully funded project generates new data. These updates are posted by the researcher, and the website automatically sends an email to donors saying that something has been posted that they might be interested in. As with any company, though, the backers agree to be part of this community after they contribute until they remove their email from the Experiment.com database. Donors will continue to get notifications from Experiment.com when other projects they might be interested have been launched or are close to being funded. In addition, researchers using Experiment.com must agree to publish their research in an open access journal.

The staff at Experiment.com will review your campaign page multiple times until you and they

are confident that the public will understand your goals and descriptions. It helps to make a video of your research, your field trips, or even a small dialogue of you talking about your goals. You can repost this video on YouTube, for example, providing information to link the video to your campaign page. I posted our video before the launch in order to prepare our network of friends for the 30-day campaign.

When it really comes down to it, there were three major sources of backers for our project: (1) our contacts and posts on Facebook, (2) the Twitter network, and (3) old-fashioned email, phone, and personal communications. Immediately upon launching the project, we sent individual emails to friends, family and colleagues, asking them to support our research. A high percentage of our backers were people we already knew. In order to entice an unknown science enthusiast, it's best to prepare interviews with journalists or bloggers in advance, to promote your campaign before it even begins. I was a bit late in that aspect, but did arrange to have an article in my hometown newspaper (*The Omaha World-Herald*) a few days before our campaign ended. This did find a few people who knew me as a child and reached out to help. I can say that I spent approximately 10 hours a week in a 30-day period using my communication outlets to encourage people to donate. Tommy spent an equivalent amount of time blogging and communicating with friends, family, and others. Even though Experiment.com helps with this aspect, they do not have access to your personal contacts, and responsibility of promoting your project lies almost entirely on you. Reflecting again on Tommy's first attempt to raise funds on Experiment.com, having a slew of project backers before the launch may be the quintessential key to a successful crowdfunding effort. Project backers attract more project backers as momentum builds toward a 100% funded campaign.

We raised \$7,170 in pledges. After a couple of backers' declined credit card attempts, and Experiment.com's 8% commission, we came away with \$6,593.80. This will cover our two field trips this summer to the mountains of western Montana, central Idaho, and the Yukon, Canada. Any remaining funds will be used in the lab on our newly acquired samples. We are already planning a second campaign to fund the lab work we have proposed for newly collected samples. We will likely set a higher goal of \$10,000 for this campaign, but

that number is not seen by the public right away. If you are 100% funded before your campaign time ends (set by the researcher to 30, 60, or 90 days), this higher goal will be shown on your page as an 'extension' goal. Once a project has reached greater than 100%, more members of the general public are likely to chip in. We were funded 103%, but there have been numerous successful projects that were funded over 150%.

Overall, it has been a very positive experience working with the team at Experiment.com. Crowdfunding won't replace grant-writing—you can't depend on the public and your family/friends to continue funding your research—but it can work once or twice as an excellent method for generating preliminary data for larger grant proposals. Crowd-source funding takes advantage of the natural tendency of people to get excited about scientific research. When a project is 85% funded, for example, and you let people know that you are progressing towards your goal, the momentum can REALLY build. People talk about your project, other backers chip in, the goal is met. It is like an old-fashioned fundraiser at your school or church, but with more technology and fewer chocolate chip cookies... unless you want to try your luck at Kickstarter.com and promise a rewards like oatmeal raisin or external hard drives with all the raw data.

---by Ingrid Jordan-Thaden, Bucknell University



BSA SCIENCE EDUCATION NEWS AND NOTES



BSA Science Education News and Notes is a quarterly update about the BSA's education efforts and the broader education scene. We invite you to submit news items or ideas for future features. Contact: Catrina Adams, Acting Director of Education, at CAdams@botany.org or Marshall Sundberg, *PSB* Editor, at psb@botany.org.

NEW AND ONGOING SOCIETY EFFORTS

PLANTINGSCIENCE LAUNCHES 17TH SESSION, WELCOMES NEW TEACHERS AND MENTORS

PlantingScience, the online mentoring program started by the BSA in 2005, continues to reach hundreds of students each session. Through PlantingScience, plant scientists take advantage of the opportunity to conduct K-12 outreach from their own offices. They inspire middle- and high-school student teams to do real science investigations, to see themselves as scientists, and to open students' eyes to plants in their world.

We'd like to welcome the 30 new mentors who have registered with PlantingScience since last spring, and the 11 teachers who will use PlantingScience in their classrooms for the first time this fall. We also welcome back our dedicated mentoring team, many of whom have been mentoring for over 5 years.

We expect about 250 teams at 27 schools to participate this fall, from 12 states in the USA as well as from The Netherlands, Nigeria, and Indonesia. By the end of the fall's session we will have reached well over 14,000 students with the program.

If you aren't familiar with PlantingScience, please stop by the website this session to see how the teams are doing. We feature teams each week on the homepage, www.plantingscience.org. If you are interested in becoming a scientist mentor, please apply! The time commitment is small, and you can really make a difference in the students' lives. We are recruiting now for the upcoming spring session, which will run from mid-February through mid-April.

BSA is pleased to sponsor the following BSA graduate students and post-docs as part of our Master Plant Science Team this year: **Jesse W. Adams, Katie Becklin, Alan Bowsher, Riva Bruenn, Steven Callen, Elizabeth Georgian, Tara Caton, Julia Chapman, Taylor Crow, Cameron Douglass, Rachel Hackett, Julie Herman, Cody Hinchliff, Ingrid Jordon-Thaden, Irene Liao, Daniel Blaine Marchant, Angela McDonnell, Nora Mitchel, Mischa Olson, Rhiannon Peery, Megan Philpott, Jerald Pinson, Adam Ramsey, Amanda Tracey, Maria Vasquez, Evelyn Williams, and Bethany Zumwalde.**

Fundraising efforts continue as we strive to expand and provide long-term support for this successful program. A crowdfunding campaign through the website www.Indiegogo.com is planned for mid-September. Sales of the ebook *Inquiring About Plants: A Practical Guide to Engaging Science Practices* are going well. If you have not gotten your copy of the e-book yet, you can learn more and purchase a copy at www.plantingscience.org. All proceeds support the PlantingScience program.

JOIN US AT THE LIFE DISCOVERY – DOING SCIENCE CONFERENCE IN SAN JOSE, CALIFORNIA, OCTOBER 3-4

The theme for this year's Life Discovery Conference (LDC) is "Realizing Vision & Change, Preparing for Next Generation Biology."

Designed as a "working conference," the LDC is organized to maximize interaction and exchange among participants. The conference features 2 keynote speakers, 30 short presentations of best practices in Biology education, 9 workshops and more than 30 Education Share Fair Roundtable discussions over the 2 days of the conference. Additionally, there will be time for discussion and networking by special interest groups. All are welcome to bring your ideas and solutions to advance Biology education in the 21st century.

Learn more and register here: <http://www.esa.org/ldc/2014-ldc-conference/information/>

APPLY NOW FOR UPCOMING GORDON RESEARCH CONFERENCE ON
UNDERGRADUATE BIOLOGY EDUCATION RESEARCH (UBER) - JULY 12-17, 2015, BATES
COLLEGE, MAINE

Join a stellar group of colleagues from across the nation to advance our understanding of what it takes to change undergraduate biology programs systemically and to catalyze novel directions for future research at this new Gordon Research Conference.

The specific goals of the conference are to:

- Bring together a diverse community of biologists, biology education scholars, disciplinary society leaders, and others to discuss current issues, drivers, trends and future directions in undergraduate biology education research.
- Exchange information and ideas about best practices and their implementation.
- Foster development of new research ideas and collaborations among attendees.
- Develop a longer-term vision for regular UBER GRC meetings.

Applications for this meeting are currently available at: <http://www.grc.org/programs.aspx?id=16908>



WWW.PLANTINGSCIENCE.ORG



EDITOR'S CHOICE



The Plant Sciences Education issue of *CBE-Life Sciences Education* [13(3)] is live at <http://www.lifescied.org/content/current>! *CBE-Life Sciences Education* is online and open access, and this issue features an essay on Plant Behavior, by Dennis W.C. Liu of the Howard Hughes Medical Institute; a book review of the children's book, *My Life as A Plant*, published by ASPB; and seven research articles all linked by a pithy editorial by Diane Ebert-May and BSA member Emily Holt titled "Seeing the Forest and the Trees: Research on Plant Science Teaching and Learning."

Three of the articles report on original inquiry-based instructional materials. "Connections between Student Explanations and Arguments from Evidence about Plant Growth," by Jenny Dauer, Jennifer Doherty, Allison Freed, and Charles Anderson, focuses on understanding matter and energy transformations during growth. Although the study examines middle and high school students, the results and suggestions are clearly applicable to college freshman courses.

In "Beyond Punnett Squares: Student Word Association and Explanations of Phenotypic Variation through an Integrative Quantitative Genetics Unit Investigating Anthocyanin Inheritance and Expression in *Brassica rapa* Fast Plants," Janet Batzli, Amber Smith, Paul Williams, Seth McGee, Katalin Dosa, and Jesse Pfammater describe a 4-week inquiry focusing first on quantitative inheritance and then effectively integrating Mendelian genetics.

"Optimizing Learning of Scientific Category Knowledge in the Classroom: The Case of Plant Identification" by Bruce Kirchoff, Peter Delaney, Meg Horton, and Rebecca Dellinger-Johnston, describes the application of computer software in an active-learning format to improve sight recognition of plants. The experimental design provides proof of concept of the tools Bruce has developed and demonstrated at BSA workshops for the past several years.

Two of the articles explore "plant blindness," the concept developed by the late BSA member Jim Wandersee to describe the public's failure to notice or appreciate plants. In "Attention 'Blinks' Differently for Plants and Animals," Benjamin Balas and Jennifer L. Momsen demonstrate that there is, in fact, a fundamental difference in how the visual systems of college students process plant images versus animal images. They suggest several useful strategies for overcoming zoocentrism.

Janice L. Anderson, Jane P. Ellis, and Alan M. Jones use drawings of plant structures to examine plant blindness in school students. In "Understanding Early Elementary Children's Conceptual Knowledge of Plant Structure and Function through Drawings," the authors demonstrate that young children have a basic knowledge of plant structure and some functions, but also identify some common misconceptions. They conclude that drawings are a very useful tool for assessing student understanding at this level.

In "An Evaluation of Two Hands-On Lab Styles for Plant Biodiversity in Undergraduate Biology," John M. Basey, Anastasia P. Maines, Clinton D. Francis, and Brett Melbourne describe two very basic modifications to incorporate more student-active learning into a traditional biodiversity course. Finally, Jennifer Rhode Ward, H. David Clarke, and Jonathan L. Horton, in "Effects of a Research-Infused Botanical Curriculum on Undergraduates' Content Knowledge, SEM Competencies, and Attitudes toward Plant Sciences," describe the benefits of incorporating plant-based field and laboratory research throughout the undergraduate curriculum at their institution, a public liberal arts college, beginning with the introductory sophomore level course and extending throughout the curriculum. They provide some useful suggestions for keeping the time demand manageable for faculty members.



ANNOUNCEMENTS



PERSONALIA

THE AMERICAN SOCIETY OF PLANT TAXONOMISTS HONORED BSA MEMBER CHRIS MARTINE FOR HIS EMPHATIC TEACHING AND SOCIAL MEDIA OUTREACH

Teaching is like planting seeds. Lessons take root, understanding grows and knowledge branches out to new ground. Professor of Biology Chris Martine has been planting seeds at Bucknell for two years, and was recently honored for his efforts in disseminating knowledge of the plant sciences far and wide. The budding scientists he has nurtured here too have garnered recognition for their own research.

In May, Martine was honored by the American Society of Plant Taxonomists with its Innovations in Plant Systematics Education prize. The society lauded Martine not only for his “contagiously positive and fact-based way of enhancing botanical learning especially among college undergraduates,” but also for his efforts to reach a broader audience through new and social media. Martine has more than 1,600 Twitter followers (@MartineBotany); blogs about plants, science and teaching for the Huffington Post; and writes, produces and stars in an educational YouTube series, “Plants are Cool, Too!”

“People are using social media; people are watching things on YouTube; people are reading the Huffington Post,” Martine said. “I try to place content where people are already spending time watching things and reading things.”

Martine, the David Burpee Chair in Plant Genetics and Research, said there’s a serious motive underlying the entertaining, sometimes playful content he posts.

“I’m really concerned about people recognizing not only that biodiversity is declining on Earth, but also that there is a lot of unknown biodiversity on Earth that we still have a chance to discover,” he said. “As a botanist, I try to use plants to help people develop a greater appreciation for biodiversity, nature and this sense of discovery that we still can embrace. One of the things that makes plants an ideal model for that sort of outreach is that they’re everywhere—they’re really easy to find and they don’t move.”

He also incorporates his online persona in the classroom, whether by assigning his videos or blog posts as homework, or casually suggesting his students check out what he’s done next time they’re hanging out in one of those virtual spaces.

The seeds of curiosity Martine has planted in the minds of his students have clearly taken root. For the second year in a row, three of Martine’s students (Alice Butler, Ian Gilman and Morgan Roche) were selected to receive Undergraduate Research Awards by the Botanical Society of America (BSA), the foremost group promoting plant sciences in the United States. Last year the society parsed out only six such grants to undergraduates, with Bucknellians receiving half; this year it awarded seven, with Bucknell students again earning three grants. Three members of the Class of 2014—Gemma Dugan, Anna Freundlich and Vince Fasanello — were also honored with Young Botanist of the Year awards, which recognize the cumulative



accomplishments made by undergraduates during their collegiate years.

“I get emails from [Chris] all the time saying, ‘I heard about this; you should apply;’ and it’s always something specific to my interests,” Dugan said. “He pays a lot of attention to helping us as individuals get what we want from our careers; he doesn’t just forward everyone the same email. To have someone who pushes you to apply for grants and scholarships has been super helpful, and I think that’s why this lab has been so successful.”

Martine is quick to note, however, that the students wrote their own grant and scholarship applications, and deserve final credit for their accomplishments. He marked two additional accolades garnered this year by his students as particularly impressive. Gilman received an Undergraduate and Graduate Student Training Fellowship from the Torrey Botanical Society, which he will use to attend a field course in the Rocky Mountains through the University of Idaho.

“It’s an award that both graduate students and undergraduates are eligible for,” Martine said. “It’s hard to know what the pool was, but he likely went up against graduate students as well as undergraduates, and was chosen.”

Martine hopes his students and those he inspires online will continue to nurture an interest in botany as they move on. As they do, Martine will keep on planting seeds, wherever he can.

“Everybody can find a plant,” he said. “Everybody can learn something about one plant. That’s such an easy jumping off point to help people develop an understanding about nature, biodiversity and non-human organisms.”

--*Matt Hughes*

AIBS RELEASES NEW SCIENCE ADVOCACY TOOLKIT

The American Institute of Biological Sciences (AIBS) has launched a new website to help researchers participate in the development of the nation’s science policy. This free online resource is available at policy.aibs.org.

“AIBS has been a leader in its efforts to engage scientists in public policy,” said AIBS President Dr. Joseph Travis. “This new website continues this important work by making it easier than ever for researchers to be involved in the decision-making process.”

The Legislative Action Center is a one-stop shop for learning about and influencing science policy. Through the website, users can contact elected officials and sign up to interact with lawmakers.

The website offers tools and resources to inform researchers about recent policy developments. The site also announces opportunities to serve on federal advisory boards and to comment on federal regulations.

The Legislative Action Center is supported by AIBS, the Society for the Study of Evolution, the Botanical Society of American, and the Association for the Sciences of Limnology and Oceanography.

THE NATIONAL CLEARED LEAF COLLECTION-HICKEY PUBLISHED ELECTRONICALLY

The Division of Paleobotany at the Peabody Museum of Natural History is delighted to announce the electronic publication of the National Cleared Leaf Collection-Hickey (NCLC-H). The NCLC-H consists of over 7,000 cleared, stained and mounted extant leaves. It stands as the major community resource in the area of foliar morphology for plant systematists and paleobotanists around the world. While at the Smithsonian Institution, Leo J. Hickey began NCLC-H in 1969 as part of his research on the systematic distribution of the leaf characters of the flowering plants in relation to the evolution of a group. The NCLC-H was moved to Yale Peabody Museum on a long-term loan agreement when Leo Hickey came to the Peabody Museum of Natural History as Director in 1982. Sadly, Dr. Leo Hickey passed away in February 2013. The NCLC-H was returned to Smithsonian National Museum of Natural History in May, 2014.

The NCLC-H is currently arranged alphabetically

by family, then by genus and species. There are approximately 321 families and 1,300 genera, including herbaceous, parasitic, Arctic, alpine and derived groups such as the Asteridae, in an effort to elucidate the full range of dicotyledonous leaf morphological patterns. Also, there are a significant number of extinct and endangered species, such as *Canacomyrica monticola* from New Caledonia. The collection presently covers floras from South America, North Central America, Oceania and Asia. Most of the leaves have been taken from herbarium collections, with some prepared using fresh or fluid-preserved specimens. Each specimen is vouchered to an authoritatively identified herbarium sheet. The size, scope, documentation, and the quality of the mounts make the NCLC-H the most important database of leaf architecture in the world. At the present time, the NCLC-H provides the main source of documentation for the systematic description of leaf architectural variation among the dicotyledons and has been the basis for the current system of leaf architectural classification, fossil and modern plant identifications, ecological and paleoecological studies, as well as ongoing studies into the ontogeny of leaf venation.

The electronic publishing of NCLC-H makes researchers and the public easy access to the database. The NCLC-H is available free at <http://peabody.research.yale.edu/nclc/>.

---By Shusheng Hu, Division of Paleobotany, Peabody Museum of Natural History, Yale University

FUNDING OPPORTUNITIES

HARVARD UNIVERSITY BULLARD FELLOWSHIPS IN FOREST RESEARCH

Each year Harvard University awards a limited number of Bullard Fellowships to individuals in biological, social, physical and political sciences to promote advanced study, research or integration of subjects pertaining to forested ecosystems. The fellowships, which include stipends up to \$40,000, are intended to provide individuals in mid-career with an opportunity to utilize the resources and to interact with personnel in any department within Harvard University in order to develop their own scientific and professional growth. In recent years Bullard Fellows have been associated with the Harvard Forest, Department of Organismic and Evolutionary Biology and the J. F. Kennedy School of Government and have worked in areas of ecology, forest management, policy and conservation.

Fellowships are available for periods ranging from six months to one year after September 1. Applications from international scientists, women and minorities are encouraged. Fellowships are not intended for graduate students or recent post-doctoral candidates. Information and application instructions are available on the Harvard Forest website (<http://harvardforest.fas.harvard.edu>). Annual deadline for applications is February 1.

AMERICAN PHILOSOPHICAL SOCIETY ANNOUNCES RESEARCH PROGRAMS

Information and application instructions for all of the Society's programs can be accessed at <http://www.amphilosc.org>. Click on the "Grants" tab at the top of the homepage.

BRIEF INFORMATION ABOUT INDIVIDUAL PROGRAMS

FRANKLIN RESEARCH GRANTS

Scope: This program of small grants to scholars is intended to support the cost of research leading to publication in all areas of knowledge. The Franklin program is particularly designed to help meet the cost of travel to libraries and archives for research purposes; the purchase of microfilm, photocopies or equivalent research materials; the costs associated with fieldwork; or laboratory research expenses.

Eligibility: Applicants are expected to have a doctorate or to have published work of doctoral character and quality. Ph.D. candidates are not eligible to apply, but the Society is especially interested in supporting the work of young scholars who have recently received the doctorate.

Award: From \$1000 to \$6000.

Deadlines: October 1, December 1; notification in January and March.

LEWIS AND CLARK FUND FOR EXPLORATION AND FIELD RESEARCH

Scope: The Lewis and Clark Fund encourages exploratory field studies for the collection of specimens and data and to provide the imaginative stimulus that accompanies direct observation. Applications are invited from disciplines with a large dependence on field studies, such as archeology, anthropology, biology, ecology, geography, geology, linguistics, and paleontology, but grants will not be restricted to these fields.

Eligibility: Grants will be available to doctoral students who wish to participate in field studies for

their dissertations or for other purposes. Master's candidates, undergraduates, and postdoctoral fellows are not eligible.

Award: Grants will depend on travel costs but will ordinarily be in the range of several hundred dollars to about \$5000.

Deadline: February 1; notification in May.

INFORMATION ABOUT ALL PROGRAMS

Awards are made for noncommercial research only. The Society makes no grants for academic study or classroom presentation, for travel to conferences, for non-scholarly projects, for assistance with translation, or for the preparation of materials for use by students. The Society does not pay overhead or indirect costs to any institution or costs of publication.

Eligibility: Applicants may be citizens or residents of the United States or American citizens resident abroad. Foreign nationals whose research can only be carried out in the United States are eligible, although applicants to the Lewis and Clark Fund for Exploration and Field Research in Astrobiology must be U.S. citizens, U.S. residents, or foreign nationals formally affiliated with a U.S. institution. Grants are made to individuals; institutions are not eligible to apply. Requirements for each program vary.

Questions concerning the Franklin and Lewis and Clark programs should be directed to Linda Musumeci, Director of Grants and Fellowships, at LMusumeci@amphilsoc.org or 215-440-3429.

MISSOURI BOTANICAL GARDEN HOSTS MEETING OF ECOLOGICAL RESTORATION ALLIANCE

(ST. LOUIS): Conservation experts from the world's leading botanical gardens met in St. Louis in July and called for a renewed effort to link ecological restoration with the elimination of poverty in natural resource-dependent communities. In Madagascar, for example, the Missouri Botanical Garden provides training and jobs to local people who in turn assist with ecological restoration. All too often, there are no viable economic alternatives to the degradation of biodiverse ecosystems. Member gardens are committed to offering alternatives that restore damaged land while providing income for those living in these areas.

Botanical Gardens are uniquely qualified to conduct ecological restoration given their expertise in horticulture and their capacity to document the source and genetics of plants. A garden's reference plant collection provides documentation of a species even in areas with no remaining vegetation so that ecosystems can be restored in a historically accurate manner. Accurate species composition is necessary to revitalize normal function and regenerate ecosystem services such as watershed protection and nutrient cycling.

The Ecological Restoration Alliance consists of 18 member gardens from 10 countries. It was formed in response to the United Nation's Global Strategy for Plant Conservation goal of restoring 15 percent of the world's damaged ecosystems by 2020. The Alliance is currently working to restore more than 100 degraded, damaged or destroyed ecosystems by 2020 including tropical rainforests, temperate woodlands, grasslands, beaches, wetlands and more through partnerships with academic groups, industry and government. Among those 100 projects are two managed by the Missouri Botanical Garden: Restoring diversity in the St. Louis Region and Preserving and Restoring a Rich and Diverse Flora in Madagascar.

IN MEMORIAM

MATTHEW H. HILS
1955-2014

Matt Hils, Professor of Biology, Director of J.H. Barrow Field Station, and Director of the Center for the Study of Nature and Society at Hiram College, passed away June 10, 2014 at his residence. Matt received his B.A. in Biology from Thomas More College, his M.S. from Miami University (OH), and Ph.D. at University of Florida in Gainesville before arriving at Hiram College in 1984.

Although Matt has made contributions to the systematics of several flowering plant groups (Saxifragaceae, Rosaceae, and Melastomataceae, to name a few), he will be remembered best for his legacy as a teacher, mentor, and friend to every student who entered his class. In a time when a love for Botany is waning in students, Matt's unwavering enthusiasm sparked a love for plants among so many budding biologists. Matt was at his best in the field, hand lens to one eye and mindful of his students with the other. He taught many field courses including Systematics of Vascular Plants in the Smoky Mountains, Non-Vascular Plants on the trails of the James H. Barrow Field Station, Field Botany in the Upper Peninsula of Michigan, A Natural History of the Caribbean in Trinidad and Tobago, and Natural History in the 21st Century in the Galapagos Islands. Even on campus he taught courses to inspire a sense of awe and wonder in

our inner naturalist, such as Ethnobotany and his seminar *On the Origin of Species*.

Beyond his courses, Matt was a central member of the Hiram College community. He served as a faculty advisor for many in the Biology department, and went above and beyond to know each student in class. As a mentor, it was not uncommon to see him at a sporting event cheering on his students, or checking in with a student (former or present) that he ran into on campus. As a friend, he transcended academia in his availability to listen, help, and laugh. His dedication to these roles was authentic and transparent to all. Many of his students came to him for guidance in coursework, life, and careers regardless of their focus of study, and he gladly made an effort to guide them toward their goals. An avid cyclist, basketball enthusiast, and volleyball fan, one could expect to see Matt around campus and town any day, and he was always happy to see you.

Thank you Matt, you will be missed but your lessons and love will live on.

In lieu of flowers, memorial gifts can be made in Professor Hils' honor to the James H. Barrow Field Station or Hiram College.

OTTO LUDWIG STEIN
1925 - 2014

Otto Stein was born Jan. 14, 1925, in Augsburg, Germany, and moved to Berlin when he was 8 years old. He and his parents were protected by a local policeman on Kristallnacht, Nov. 9-10, 1938, and the family moved to the United States in January, 1940. He enlisted in the U.S. Army in September 1944 and after the war, he served as an interpreter for the United Nations War Crimes Commission and for the first four U.S. War Crimes Tribunals at the former Dachau Concentration Camp.

Upon returning to the United States, Otto attended the University of Minnesota through the G.I. bill, obtaining a doctorate in botany under Ernst Abbe. He completed a post-doctoral fellowship at Brookhaven National Laboratory and joined the botany department at the University of Montana at Missoula.

Coming from Indiana, I first met Otto as a beginning graduate student at Montana. Otto was never shy or timid about anything, but he had a compassion for seeing that everyone did their best.

You had to know this to understand Otto and I relate some examples. While a first-year graduate student, I was learning how to use the microtome for a research project. At one point Otto yelled at me because I was not doing something right. He saw my startled and astonished expression and then sat down beside me to explain his yelling. He said, "I will tell you twice about something, but the third time I yell." I responded that he yelled at me the first time and he replied, "I am getting older and don't have time for the first two, so I go straight to the third time." That was Otto.

After my microtome experience, I entered his office and indicated I would like to do my graduate studies under his advisement. He said, "I don't take graduate students I know nothing about." He plopped a book on his desk that was Edmond Sinnott's *Plant Morphogenesis* and said I should read it and then come see him. I took the book and in 3 days had read it from cover to cover. Returning it to him on the third day, he asked if I had read it. I said yes, all of it. Unsure I had done that, he asked what was on page 100? I responded that it showed the experiment by Vochting on polarity of root/shoot formation in willow twigs. He looked astonishingly at page 100 (which had that description) and said, "That's it. You can be my graduate student." I knew what was on page 100 because, in those days, libraries stamped their seal on page 100 of books. I never told him why I knew what was on page 100.

Sometimes it was difficult to predict what Otto would say or do. While I was taking an exam in Plant Systematics, he tapped on the door window and called me out to say he was leaving the University of Montana for the University of Massachusetts and I could either finish my degree at Montana or transfer to Massachusetts and to let him know my decision the next morning. After lamenting all night about what to do, I entered his office bleary eyed and declared I had decided to transfer to UMass. He responded by asking me to give him nine reasons I wanted to transfer! Unprepared for that question, I fumbled around for nine reasons and evidently satisfied him. Thus our relationship continued through the years at UMass.

Otto had a compassion that endeared me to him. In my Masters research I had done an experiment involving effects of heavy water (D_2O) on the growth of corn seedlings. The experiment involved making growth measurements every 2 hours for 48 hours. I slept in the lab for 2 days. After serial



sectioning 96 corn seedlings, I had the disastrous experience of seeing all my serial sections float off the slides because of defective Haupt's adhesive. I was devastated. After repeating the experiment, Otto's compassion exuded as he helped me section another 96 seedlings. That was Otto.

In Otto's lab, my graduate student colleague, Elisabeth Baker Fosket (wife of Don Fosket) and I constantly would hear Otto expressing his displeasure with someone, male or female, by stating "I'm going to castrate you with a *dull spoon!*" So Betsy Fosket and I made a beautiful plaque with a large wooden spoon and a shiny brass label entitled "*THE DULL SPOON.*" We wrapped it up and interrupted his botany lecture and presented it to him in front of 200 students. Some immediately asked what does it say and what does it mean? He unabashedly told them, and said that he would use the spoon on these two graduate students after the lecture! The plaque still hangs above his office at UMass.

For me and others, Otto was a superb analyst and critic with compassion to urge everyone to do their best. He was a great mentor to me and any success I have had as an educator and researcher, I owe to Otto. I cherish the long friendship and close relationship we maintained through the past 50 years. We all continue to celebrate his contributions to botany and humanity.

—David Dobbins, Professor Emeritus, Millersville University of Pennsylvania.

American Journal of Botany

Celebrating 100 years  1914–2014

THE AMERICAN JOURNAL OF BOTANY CENTENNIAL CELEBRATION CONTINUES THROUGH OUT 2014

The celebration of the first 100 years of the *American Journal of Botany* continues! The first two issues of the PSB this year have featured interviews with some of the *AJB*'s most prolific authors over the years, and this issue features interviews with more members of this elite group, as the following pages show.

The *AJB* has been promoting its anniversary with the special Centennial Review papers, which have appeared every month this year. These papers take a look at key research from the *AJB*'s past and re-examines and updates the research to find where the field stands now and into the future. The following *AJB* Centennial Review articles are already available and can be accessed for free:

- **“The relative and absolute frequencies of angiosperm sexual systems: Dioecy, monoecy, gynodioecy, and an updated online database”** by Susanne S. Renner [101(10):1588, 2014]
- **“Phloem development: Current knowledge and future perspectives”** by Jung-ok Heo, Pawel Roszak, Kaori M. Furuta, and Ykä Helariutta [101(9):1393, 2014]
- **“The role of homoploid hybridization in evolution: A century of studies synthesizing genetics and ecology”** by Sarah B. Yakimowski and Loren H. Rieseberg [101(8):1247, 2014]
- **“The polyploidy revolution then...and now: Stebbins revisited”** by Douglas E. Soltis, Clayton J. Visger, and Pamela S. Soltis [101(7):1057, 2014]
- **“Plant evolution at the interface of paleontology and developmental biology: An organism-centered paradigm”** by Gar W. Rothwell, Sarah E. Wyatt, and Alexandru M. F. Tomescu [101(6):899, 2014]
- **“Is gene flow the most important evolutionary force in plants?”** by Norman C. Ellstrand [101(5):757, 2014]
- **“Repeated evolution of tricellular (and bicellular) pollen”** by Joseph H. Williams, Mackenzie L. Taylor, and Brian C. O’Meara [101(4):559, 2014]
- **“The voice of American botanists: The founding and establishment of the *American Journal of Botany*, ‘American botany,’ and the Great War (1906-1935)”** by Vassiliki Betty Smocovitis [101(3):389, 2014]
- **“The nature of serpentine endemism”** by Brian L. Anacker [101(2):219, 2014]
- **“The evolutionary-developmental origins of multicellularity”** by Karl J. Niklas [101(1):6, 2014]
- **“The *American Journal of Botany*: Into the Second Century of Publication”** by Judy Jernstedt [101(1):1, 2014]

These articles are also hosted at www.botany.org/ajb100, and the site also hosts other free content---nearly 1000 articles from the history of the *AJB*, as written by the journal’s top 25 contributors! The *AJB* is one of the few surviving plant science publications published by a non-profit scientific society. The journal, and its authors, reviewers, editors, readers, and subscribers, are at the heart of the Botanical Society of America, and the strength of this connection makes the *AJB* stand out from many other journals.

RAY EVERT

Ray Evert joined the BSA in 1955---nearly 60 years ago!---and served as the Society President in 1986. He also won the the Society's most prestigious award, the BSA Merit Award, in 1982. Ray went on to publish 39 articles in the American Journal of Botany, and he recently took time to discuss his career and some of his key AJB research.

My first article published in *AJB* was "Some aspects of cambial development in *Pyrus communis*" in 1961. My principal research interest at the time was the vascular cambium and seasonal development of the secondary phloem in trees. Katherine Esau was my major professor, and my Ph.D. thesis (Phloem structure in *Pyrus communis* and its seasonal changes. Univ. Calif. Publ. Bot. 1960.32, 127-194) was patterned after her similar study on the grapevine.

Two articles (my latest) were published in *AJB* in 1994 and dealt with vastly different topics ("Ontogeny of the vascular bundles and contiguous tissues in the maize leaf blade" by A.M. Bosabalidis, R.F. Evert, and W.A. Russin; the other, "Development and ultrastructure of the primary phloem in the shoot of *Ephedra viridis* (Ephedraceae)" by R.A. Cresson and R.F. Evert.

As indicated, my early research was on the vascular cambium and seasonal development of the secondary phloem in trees (eudicots and conifers). With the advent of electron microscopy, I began ultrastructural studies on the phloem of woody and herbaceous eudicots, monocots, and gymnosperms. This was followed by extensive studies on the comparative ultrastructure of seedless vascular plants, ranging from Psilotum to a broad array of ferns. In 1978, my research shifted to studies on the development and structure of leaves of selected C3 and C4 plants, utilizing bright-field and electron microscopy and a variety of experimental procedures to gain a greater understanding of structure-function relationships in leaves. Among the plants studied were several economically important crop plants: barley, maize, sugarcane, sugar beet, and potato. Finally, my group concentrated on developmental and structural changes accompanying the transition of maize and barley leaves from importers to exporters of photoassimilates, a process commonly referred to as sink-to-source transition. I emphasize "group," because without my graduate students (25 PhDs, 23 MS) with their energy, enthusiasm, intelligence,



Ray Evert and Katherine Esau, April 1968, in Madison, WI.

and innovativeness, I would have achieved far less of my research goals.

My research interests never strayed far from the phloem. It was during a seminar in 1953, while working for the MS in Botany at Penn State, that I became interested in phloem. There and then I decided to pursue a PhD, with some aspect of the phloem as my thesis topic. When I told this to my MS mentor, Dr. David Kribs, he told me that I must go to UC-Davis to work with Katherine Esau. Shortly after my conversation with Dr. Kribs I received a letter from Dr. Esau informing me that Dr. Kribs had written to her on my behalf, and that she would be happy to accept me as one of her graduate students; moreover, she had a teaching assistantship for me. I became her "phloem ray."

Electron microscopy was in its infancy in the early 1960s, so I could not have foreseen the ultrastructural research undertaken by my students and me. Nor could I have foreseen the splendid collaborative research undertaken on aspects of leaf structure and function with Walter Eschrich (University of Gottingen, Germany) and C.E.J. Botha (Rhodes University, South Africa).

It is difficult to choose one or two of my articles published in *AJB* that stand out above the others. One of the earliest articles ("Callose substance in sieve elements", 1964) is significant because it demonstrated that the sieve pores of uninjured sieve elements are virtually devoid of callose. The article that was the most fun was "Observation on penetration of linden branches by stylets of the aphid *Longistigma caryae*" (1968), in which we

demonstrated that sieve tubes greater than one year old are still functional.

Why have I chosen *AJB* as one of the journals in which to publish? *AJB* is the premier botanical journal with a broad readership. Its reproduction of micrographs, both photo and electron, is superb, a matter of great importance to an anatomist. And then, there is a matter of loyalty—*AJB* is “home.”

Dr. Evert's complete list of AJB publications, which are free for viewing throughout 2014, can be found at <http://botany.org/ajb100/revert.php>.



Left to right: Ray Evert, Vernon Cheadle, Charles Heimsch, William Stern, August 1989, in Toronto.

SHERWIN CARLQUIST

Dr. Sherwin Carlquist joined the BSA in 1955--nearly 60 years ago--and published his very first article the following year in the American Journal of Botany. He has received numerous awards over his career, including the Grady L. Webster Publication Award in 2011 and the BSA Merit Award (the Society's highest honor) in 1977. Dr. Carlquist recently shared his thoughts about his career and publications.

In the winter of 1955-56, after finishing my graduate work at Berkeley, I thought that a learning experience in a different locality would be of value, and I had a postdoctoral fellowship from NSF I could take anywhere. I chose Harvard, hoping to imbibe some wisdom about plant anatomy from I. W. Bailey—he was retired, but said he would be available. I got a room off campus. Adequate, but the owners of the house said that I would have to vacate at Christmastime when their children came home. I accepted the deal, figuring that I could go see New York at that time or something.

As it turns out, Harvard was not a good choice. I. W. Bailey was so ostracized for being the author of the “Bailey plan” to unite botanical facilities at Harvard that he spent the year out of town, and I saw him for a total of only an hour or two. Ralph Wetmore did come to my office weekly, but for only one purpose: to try to dissuade me from working in comparative plant anatomy. He thought that his brand of morphogenesis (long since superseded) was where the future lay and that I was misdirected.



Sherwin Carlquist at a scanning electron microscope in the midst of his research.

Harvard was a place of almost total personal and academic isolation for me—although Barbara and Grady Webster, who were refreshingly friendly, were there that year. I used the time to get my thesis ready for publication and I wrote five other papers. One of the papers I wrote was on pectic warts, curious extrusions of pectic droplets into intercellular spaces of certain plants. At the time I was about to write this paper, my holiday-season eviction from my rented room was looming. I did not want to take a winter vacation in a snowy city like New York. One was not allowed to sleep overnight in one’s office in the Biological Laboratories—a watchman signed one in and out, preventing that. However, I had a key to the then-new herbarium building. Nobody was in the building at night, and nobody had used the darkroom. So for the holidays, I was in my Biological Laboratories office during the day, and I slept on plant press blotters laid on the floor of the Herbarium darkroom at night.

I was determined to produce a positive outcome from this experience, so I decided that the outcome would be the paper on pectic warts, and that I would try to get it published in *American Journal of Botany*. A sort of revenge–triumph gesture. It did appear in *American Journal of Botany* in 1956, the first paper of mine to appear (“On the Occurrence of Intercellular Pectic Warts in Compositae,” 43(6), 425).

The following year I took the job at Claremont—the best possible job in botany, my first and last. I had great students at Pomona College, a first-rate liberal arts college, and at the Rancho Santa Ana Botanic Garden, I had an office and laboratory. It hosted a graduate program and had a truly astonishingly great library—much better than a job at a big university. Immediately my research program took off, and almost every year for the first several years after I took the job, I published various papers in *AJB*. The 1957 paper (“Leaf Anatomy and Ontogeny in *Argyroxiphium* and *Wilkesia* (Compositae),” 44(8), 696) was about the leaf anatomy of the famed Hawaiian silversword. It manages life on alpine volcanic cinders by storing water in pectic gels extruded into intercellular spaces of the leaf—so in a sense, it was a follow-up to the 1956 paper on pectic warts. It was also a clue that the Hawaiian silverswords were related to the Californian tarweeds, some of which also had the foliar pectic gels. I became certain by 1959 that the Hawaiian silverswords and the Californian tarweeds were related, but was widely disbelieved

DR. WILLIAM CREPET
CORNELL UNIVERSITY

until Bruce Baldwin's molecular work showed indisputably that the two groups were related (a hybrid was even made!).

Most of those who published frequently in *American Journal of Botany* tended to have a central theme—like Norman Boke and his papers on cactus areole ontogeny. But I tried to put my best papers representing a wide range of interests in the *AJB*. The papers had to be brief ones—the long papers had to go elsewhere. And also, I was publishing actively and so I could put only a fraction of my papers in any one journal.

For the last decade, I have been devising large-scale synthetic views of wood and primary xylem evolution, and these are too big to be published in *AJB*. *AJB* and other “high-impact” journals have become the provinces of ambitious young professors, whose placement of research papers in such journals becomes their ticket to success in obtaining grants and in securing professional advancement. Fortunately, my research is a low-cost field, and I am able to finance my research largely out of my own pocket. Thus, the “impact factor” becomes irrelevant to me, and while publication of my results is still a very essential part of my research, the precise venue for publication doesn't matter. I'm not turning my back on the high-impact journals so much as enjoying the freedom to cast my work in papers representing interdisciplinary interests that inevitably require greater length. These long papers, ironically, do not have bigger audiences (too much background in too many fields is required, compared to single-topic papers)—so publishing them in *AJB* would be a disservice to that journal.

Whatever pathway one takes that preserves one's research interests is good—and these pathways do change over time. I am very grateful that *AJB* has been willing to host my research, and to maintain a high degree of diversity in what it offers readers.

Dr. Carlquist's complete list of AJB publications, which are free for viewing throughout 2014, can be found at <http://botany.org/ajb100/scarlquist.php>. Find out more about his entire career and research at <http://www.sherwincarlquist.com/>.

Dr. William Crepet first started publishing in the AJB in 1972 and joined the BSA 6 years later—and he's been a Society member and AJB author ever since. Over this time, he published 28 articles thus far in the AJB, and in 2007, he won the BSA Merit Award, the Society's highest honor. Dr. Crepet recently reflected on his AJB publications and career.

The first article you published in AJB was “Investigations of North American Cycadeoids: Pollination Mechanisms in Cycadeoidea” in 1972. Take us back to that period; where were you, what were you doing, and what were you studying/most interested in at the time?

At that time I was a second year graduate student at Yale with Ted Delevoryas, my advisor, and Ian Sussex and Don Levin on my graduate committee. At the time G. Evelyn Hutchinson was teaching Ecological Principles, and he was also a significant influence on how I viewed studying paleobotany. Peers were also an important influence and mine included colleague Barbara Schaal, and office mates Ginny Walbot and Rod Gould (later to become a successful businessman in Australia). I was quite interested in explicating the details of cycadeoid reproductive biology. I was furiously breaking promising well-preserved cycadeoid trunks from the enormous Yale collection, amassed by G. R. Wieland in the late 19th century, with a sledgehammer and then trimming the pieces with oil-lubricated diamond saws in order to make it possible to mount and section the cones. Our equipment was certainly crude by today's standards, and technique execution (probably not that different from the techniques used by Wieland) made all of the difference. I suppose many of my peers would say that graduate school was one of the best times in their professional lives and this was certainly true for me. The excitement of discovery combined with the inspiring environment, wonderful peers and peerless committee made it a fabulous experience.

Your latest article in the AJB was “Darwin's second “abominable mystery”: Why are there so many angiosperm species?” in 2009. How has the thread of your research changed over time?

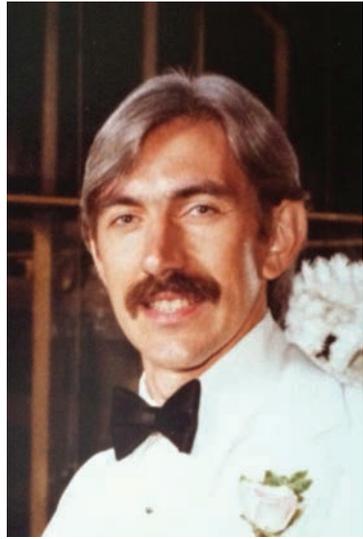
In a sense, I have always been interested in the evolution of reproductive biology in plants and in the evolutionary implications of shifting strategies in plant reproductive biology. I made a transition

in taxa of interest when moving from Cycadeoidales (Bennettitales) to angiosperms when I left Yale and began a really enjoyable and productive postdoc in David Dilcher's lab at Indiana University. Although the taxa of my principal interest shifted, I remained focused on the evolution of reproductive biology in plants and I think it is fair to say that together with David who very generously shared great fossil material with me, really initiated the sustained research on angiosperm flower fossils that persists and is important today. I would be neglectful if I did not mention my early and enjoyable collaborations with Else Marie Friis, who was a pioneer in the study of charcoalfied angiosperm flowers.

There is no doubt that two major influences affected the thread of my research subsequently: the advent of precise phylogenetic methodologies and of course nucleic acid based phylogenetics. These contributed to the establishment of reliable patterns in the fossil record in a number of ways. One of which was by allowing a more objective method for positioning fossil taxa that have unique combinations of characters relative to their extant relatives. Hence a great deal of my research effort has gone into the precise identification of angiosperm taxa in order to establish a reliable pattern and exploit its implications. This aspect of my research has been greatly aided by my colleagues at Cornell who had pioneering influences in phylogenetic methodologies, notably including Kevin Nixon. The fact that my colleagues at Cornell were also adept at angiosperm systematics and had ancillary or direct interests in paleobotanical research, especially Alejandra Gandolfo and Karl Niklas, greatly affected my research trajectory and this paper with Karl is an example of such an interaction in my favorable intellectual environment. In this particular paper, we examine how, among other factors, reproductive strategies may be involved in flowering plant evolutionary success in the context of the fossil record.

In looking back over the course of your research, what areas have you consistently explored? What areas did you not expect to explore?

As noted before, I consistently explored the history of reproductive structures and strategies in plants. However, I wasn't sure I would be immersed in systematics and phylogenetics when my career began. Certainly phylogenetics was in the early stages of development as a field and in general, there was still a need for careful structural



William Crepet, dressed up in his days at Yale in the 1970s.

morphological studies in paleobotany, especially in the angiosperms where there was a paucity of such reliable studies outside of those concentrating on leaves and pollen.

There has always been a balance in paleontological studies between the generation of reliable data (that is the generation of detailed descriptions and determination of affinities of fossil taxa) and the analysis of patterns based on these data. My emphasis has shifted somewhat to exploring the implications of certain patterns now that the record of key fossils (both organs and taxa) in seed plants, particularly angiosperms, has improved enough to allow such analyses.

In looking back at all of the articles you've published in *AJB*, which ones stand out above the others and why?

I would say illuminating details of cycadeoid reproductive biology, while esoteric (Investigations of North American cycadeoids: Pollination mechanisms in Cycadeoidea. *AJB* 59: 1048, 1972), stands out and fleshes out our understanding of an important extinct group of plants. With respect to angiosperms, a variety of detailed studies of charcoalfied Cretaceous flowers from the Turonian deposits of New Jersey set the bar for both description of fossil flowers in detail and the methods used to assess their phylogenetic position. These studies seem to have had a positive effect of the standards used in such studies in the field

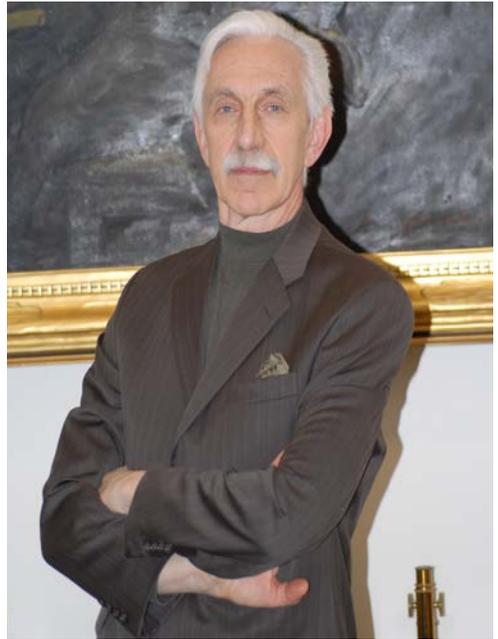
in general and are data significant to a set of the remaining major evolutionary mysteries grouped under “Darwin’s Abominable Mystery” (the reasons explaining angiosperm relative success and explanation of angiosperm origins).

The 2004 paper with Kevin Nixon and Maria Gondolfo (*Fossil evidence and phylogeny: the age of major angiosperm clades based on mesofossil and macrofossil evidence from Cretaceous deposits*, 91:1666) is important because it provides a well-rationalized and carefully constructed fossil record of angiosperms based conservatively on the most reliable evidence, creating a baseline pattern for angiosperm history that also introduced an independent means for inferring minimum ages for taxa that do not have adequate fossil records that is independent of, but complementary to, molecular clock-based models.

Why have you chosen *AJB* as one of the journals in which you’ve published throughout your career?

The *AJB* had an excellent reputation when I was a graduate student and was an appropriate venue for the kinds of papers that I submitted for publication. It has maintained its quality and appropriate readership.

*Dr. Crepet’s complete list of *AJB* publications, which are free for viewing throughout 2014, can be found at <http://botany.org/ajb100/wcrepet.php>.*



William Crepet, 2012.



*The Botanical Society of America took a minute to honor the *AJB* with a special celebration at Botany 2014.*



Cornell University Celebrates its Botanical Roots

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This article presents a brief history of the plant sciences at Cornell University in recognition of the department's pivotal role in USA academics ever since the University opened its doors in 1868. The primary justification for presenting this history rests on the fact that Cornell's botany faculty and former students have played important roles in the Botanical Society of America and the *American Journal of Botany* since the formation of the BSA and the *AJB*; for example George Francis Atkinson (1907), Joseph C. Arthur (1919), Benjamin W. Duggar (1923), Liberty Hyde Bailey (1926), Margaret C. Ferguson (1929), Karl M. Wiegand (1939), and Harriet B. Creighton (1956) served as presidents of BSA. Judith Skog and Karl J. Niklas have served more recently in this capacity. In addition, many Cornellians have served as other officers of the BSA. Likewise, many have been awarded BSA merit awards including Bassett Maguire (1990), W. Hardy Esbaugh (1992), Dominick J. Paolillo, Jr. (1998), Jack B. Fischer (2003), William L. Crepet (2007), Dennis Stevenson (2010), and Charles B. Beck (2013).

Indeed, in 1892, L. H. Bailey first suggested that a new botanical society be formed to unify and serve the general interests of the American botanical community (Steer, 1958). Although at the next meeting of the American Botanical Club (in Madison, Wisconsin), Bailey was made chairman of a committee to investigate the feasibility of his proposal and "A letter from Mr. L. H. Bailey . . . was read as virtually the report of the majority in favor of abandoning the attempt . . ." (Steere, 1958). Fortunately, Bailey's advice was not followed and the new society was formally created in 1894 and William Trelease was elected as its first president.

Thereafter, 21 Cornell botanists have served as presidents, including the original dissenter and founding instigator L. H. Bailey.

The histories of the botanical and plant science departments at Cornell University are rather complex (Fig. 1). However, the first *bona fide* botanist to be hired to the department was **Albert N. Prentiss**, (Fig. 2), who was born in Cazenovia, NY in 1836. Prentiss received both his B.S. and M.S. degrees from Michigan Agricultural College and, at the age of 32, became the first faculty member and Chair of the Department of Botany, Horticulture, and Arboriculture in the College of Natural Sciences in 1868. It should be remembered that, during the 1870s, there were probably fewer than six professorships of botany in the U.S. Although botany classes were held during the first semester with comparatively few students, the popularity of classes grew rapidly and enrollment increased swiftly, making it difficult to find space for lectures. The first classes were held in Morrill Hall, which was originally called South Hall. During the following Spring semester, botany classes were held in the wooden chemistry building, which was on the present day site of Sibley Hall. As class sizes increased, lectures were held in various, scattered rooms around campus.

Before the end of 1875, botany moved to its first permanent space in the southeast wing of Sage College (Fig. 3), which was also called Sage Hall. Funded by **Henry W. Sage**, Sage College was built as a residence and dining hall for female Cornell students (Cleland and Stundtner, 2011), many of whom took courses in botany. Soon after its construction, a three-story addition was added for the botany department. Prentiss described the new space as "a large lecture-room, thirty-six by fifty-eight feet, with seating for 156 students, which may be increased to 200 on demand. Adjoining the lecture-room is the principal laboratory, sixty feet in length and twenty-eight in breadth Adjoining this laboratory . . . is a laboratory and office, eighteen by twenty-three feet, for the use of the professor in charge of the department" (Prentiss, 1890). In the Fall of 1875, botany course enrollments grew substantially. The enrollment of some of the larger classes was over 175 students. The department taught many courses including agricultural horticulture and landscape gardening. The curriculum continued to grow, and, in 1877,

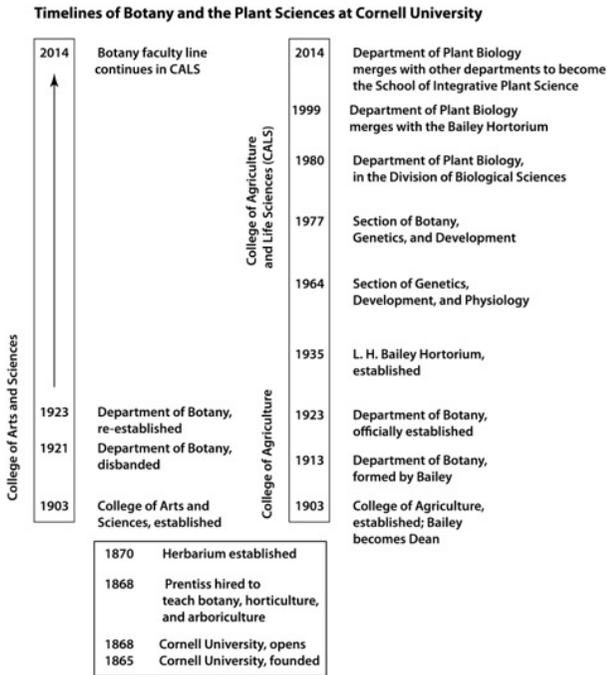


Figure 1. Timelines of botany and the plant sciences at Cornell University.

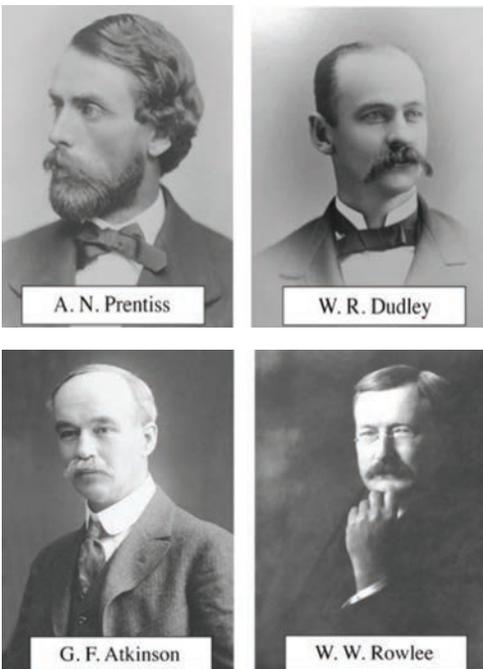


Figure 2. Faculty of the early years. (1868-1922): Prentiss (1868 – 1896), Dudley (1876 – 1891), Atkinson (1892 – 1918) and Rowlee (1893 – 1922).

courses dealing with pteridology and phycology were taught in the Spring and Fall semesters.

In 1881, a conservatory was built for the botany department with funds once again provided by Henry W. Sage (Fig. 4). The conservatory was dedicated in May or June 1882. It was a large structure measuring over 150 feet long with several rooms that could be held at different temperatures and humidities. The complex was designed by the Lord Company, which became Lord & Burnham in 1890.

THE IMPORTANCE OF THE EARLY STUDENTS

Plant biologists were relatively rare at the time botany was prospering at Cornell. Consequently, many of the early students in the botany department also served as laboratory or field instructors. The first student to obtain a degree in botany at Cornell was **David Starr Jordan**. Jordan, who was born in Gainesville, New York, in 1851, was also the first student instructor in botany at Cornell. Although he entered as a B.S. degree candidate, he did such a notable job as an instructor that the department awarded him its first M.S. degree in 1872 based on his thesis titled *The Flora of Wyoming County*,



Figure 3. Botany laboratory at Sage College. (Image courtesy of the Cornell Plant Pathology Herbarium.)

N.Y. Jordan later distinguished himself as the first president of Leland Stanford Jr. University, later simply called "Stanford".

William Rane Lazenby, who received his B. Agr. in 1874, was an instructor in horticulture and the superintendent of the botanical and general gardens. In 1879, he was named assistant professor of Horticulture. Lazenby resigned in 1881 to accept a position at Ohio State University where he later became the first director of the Ohio Experiment Station (Cornell Alumni News, Vol.1, No.11, 1899).

Another early student was **William Russell Dudley** who obtained a B.S. degree in 1874 and an M.S. in 1876, both in botany. Dudley was an instructor of botany from 1875-1876, after which he was appointed as an assistant professor in 1876. Dudley taught many courses including horticulture after W. R. Lazenby left Cornell in 1881 but his main area of teaching was cryptogamic botany. In 1886, he published *The Cayuga Flora. Part 1: A catalogue of the Phaenogamia growing without cultivation in the Cayuga Lake basin*, which catalogued some 1278 species and varieties of plants found in the Cayuga Lake area. Dudley joined the Cornell Experiment Station in 1888 after he had studied mycology in Europe with Heinrich A. DeBary and became the cryptogamic botanist for the newly formed Agricultural Experiment Station. Dudley began working more with fungal diseases of plants, both ornamental and cultivated crops, than actually researching plants *per se*. After many years as an assistant professor and no salary increase, Dudley pushed President Adams for a

raise and for improved laboratory space. Dudley wrote to former fellow student G. F. Atkinson explaining his situation and reasons for wanting to leave Cornell. Beside a low salary, Dudley felt that the administration did little to promote scientific research and did not appreciate his work. Dudley was offered a job at Wabash College, but he was eventually recruited by David Starr Jordan to join the faculty at Stanford University in 1892. Dudley, who was 42 years old at this time, took some of his herbarium specimens with him. He would eventually build the number of specimens to over 120,000 sheets, mostly representing the flora of California.

William Trelease was born in Mount Vernon, NY, and received his B.S. degree in 1880 in botany.

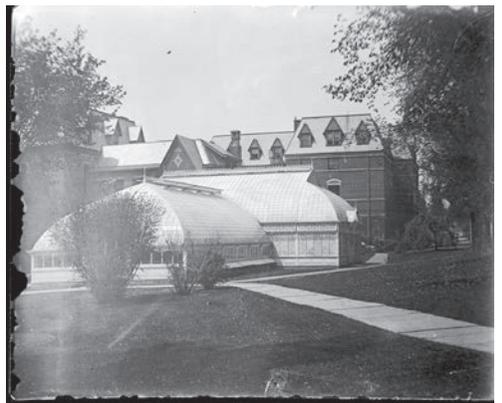


Figure 4. Sage Conservatory circa 1920. (Image from the author's collection.)

He assisted Dudley with The Cayuga Flora and went on to become the director of the Missouri Botanical Garden where he directed a 75 acre garden for over 20 years. He was a gifted botanist and taxonomist who also taught at the University of Illinois (where Trelease Woods is named in his honor). He published many papers and several books including *Winter Botany* in 1918 as well as many practical guides for gardeners. Trelease was elected the first president of the Botanical Society of America (BSA) in 1893.

The first Cornell doctorate in botany was awarded to **Joseph C. Arthur** in 1886. Arthur, who was born in Lowville, NY, held several positions including that of botanist at the Geneva Experiment Station from 1884 to 1886. Arthur took no formal classes at the main campus. He later became professor of botany and head of the Department of Botany and Plant Pathology at Perdue University. He devoted his life to the study of rust fungi.

Willard Winfield Rowlee came to Cornell in 1884. He completed his B. L. degree in 1888, and became an instructor the same year. He completed his D.Sc. in 1893 and joined the department as an assistant professor (for additional details, see below).

George Francis Atkinson obtained a Ph.D. from Cornell in 1885 and was named Assistant Professor of Cryptogamic Botany in 1892 when he replaced W. R. Dudley. Atkinson served as department Chair from 1896 until 1918. He wrote five botanical books and later devoted much of his time to mycology.

Jane Eleanor Datcher was the first African American woman to receive an advanced degree at Cornell. She received her B.S. degree in 1890 for a thesis entitled *A biological sketch of Hepatica triloba*. Datcher attended Howard Medical School from 1893 to 1894 and went on to teach chemistry from 1892 until 1934 at Dunbar High School in Washington, D.C. Many of her relatives would eventually obtain Cornell degrees (Kammen, 2009).

Bertha Stoneman received her Ph.B. in 1894 for a thesis entitled *Zygnemaceae cayugensis* and her D.Sc. degree in 1896 for *A comparative study of the development of some anthracnoses*. Stoneman was the first woman to get her doctorate in Botany at Cornell. She became a faculty member at Huguenot College in Wellington, Cape Colony (South Africa) in 1897 and also served as president of Huguenot College from 1928 to 1933. Stoneman wrote *Plants and their ways in South Africa*. The property

she donated to Huguenot College is still used as a retreat to this day (Jasper Slingsley, personal communication, Dec. 2010).

Karl McKay Wiegand was born in Truxton, New York in 1873 and attended Ithaca High School. He obtained a B.S. degree in 1894 for a thesis titled *A critical study of the order Ranunculaceae from the standpoint of the fruit* and a Ph.D. degree in 1898 for a thesis titled *Investigations on the sporogeny and embryology of certain monocotyledons*. After a brief position as Associate Professor of Botany at Wellesley College, west of Boston, Wiegand became the first department chair for the new Department of Botany established on February 1, 1913 in the College of Agriculture at Cornell.

Benjamin Minge Duggar received his Ph.D. degree in 1898 for a thesis titled *On the morphology of the gametophyte and the development of the sporangium in some angiosperms*. He was an instructor from 1896 to 1900 and an Assistant Professor of Botany from 1900 to 1901. Duggar was Professor of Botany at the University of Missouri from 1902 to 1907. He returned to Cornell in 1907 to become the Chair of the first Department of Plant Physiology at Cornell, a position he held until 1911. After his retirement, at age 71, Duggar discovered chlorotetracycline (Aureomycin) from a soil bacterium. He was to remain a life-long friend of L. H. Bailey.

Margaret Clay Ferguson was born in Orleans, N.Y. She attended Cornell from 1897 to 1901. Studying under George F. Atkinson, she received her B.S. degree in 1899 based on a thesis titled *A study of the sporogeny of Pinus strobus* and a Ph.D. degree in 1901 for a thesis titled *The development of the pollen tube and the division of the generative nucleus in certain species of pine*. She also did research with B. M. Duggar that was published in 1902 as the first successful germination of the spores of *Agaricus campestris*. Ferguson became a full professor and the Chair of the Department of Botany at Wellesley College (Wellesley, Massachusetts), where she studied plant physiology and genetics. She was the first woman to be elected as a vice president of BSA in 1922 and went on to become its first female president in 1929. The Margaret C. Ferguson Greenhouses and Visitor Center at Wellesley were named in her honor.

(Ella) Maude Cipperly Wiegand, who received her A.B. degree in 1904, was an instructor in botany at Cornell from 1898 to 1905. She and Karl M. Wiegand were married in 1906. From 1905 until



Figure 5. Collection trip to Enfield Gorge, c. 1898. From L to R: George F. Atkinson, Patrick B. Kennedy, Paul W. Magnus, Benjamin M. Duggar, Fred C. Stewart and Karl M. Wiegand. (Image courtesy of the Cornell Plant Pathology.)

1912, she was an instructor of botany at Wellesley College to which she donated 1000 herbarium specimens. Maude, as she affectionately became known, became a staff member in botany at Cornell in 1913 where she taught and prepared materials for class. She was clearly devoted to the students and the University. She sold Liberty Bonds for the University in 1918 (Cornell Alumni News, April, 1918) and she was remembered fondly for all that she did for the botany students including her famous steak cookouts. She insisted on buying sirloin steaks and preparing them for the many Summer and Winter field trips. The food was transported in a Model T Ford, which was the first department vehicle purchased by Karl Wiegand. Summer field trips were to McLean Bogs, Junius Ponds, Enfield Gorge (Fig. 5), Taughannock, Coy Glen, Buttermilk and Fall Creek. The Winter picnics were held in the gorges including Enfield Gorge.

THE BEGINNING OF THE END OF THE "OTHER SCHOOL"

In the College of Arts and Sciences, botany followed a different path. After W. R. Lazenby left Ithaca, W. R. Dudley was asked again to help Prentiss teach horticulture. Prentiss asked Cornell President **Charles Kendall Adams** for a faculty member to fill the need in horticulture, but Adams retorted that no one could be found (Cornell Alumni News, Vol. 1-No. 11, 1899). Eventually someone was and that person was none other than **Liberty Hyde Bailey**, who was hired in the Botany Department as a professor of general and experimental horticulture. By the Fall of 1888, Bailey was giving lectures. He became the Chair of Horticulture in 1889. With the

building of the Sage Conservatory greenhouses in 1882, the field of floriculture and the construction of practical greenhouses had greatly advanced. In 1889, the first forcing house was built on campus by Bailey. These facilities, along with the designation of approximately 20 acres of land for use by horticulture, gave horticulture a major boost.

Around the same time, Albert Prentiss had taken on many responsibilities on the Cornell campus. He was in charge of the campus grounds and its landscape, and in that capacity he was responsible for planting many trees on the campus grounds, which were subsequently removed to make room for new buildings and roads. Unfortunately, at the time of his death, only a few gymnosperms that he had planted were still surviving (Gardening, 1898) in part because the campus had grown so rapidly and in a largely unplanned way. Indeed, even faculty houses were removed to make way for new teaching and research buildings. Nevertheless, Prentiss could be very proud of the \$300,000 that was spent to pave the paths toward the central campus. This was a major improvement for the students that had been previously forced to walk through mud to get to classes for several months of the year. One can only imagine the condition of the floors in the university buildings before these paved paths were built.

In 1889, Willard W. Rowlee was appointed instructor and taught pharmaceutical botany as well as other topics. Rowlee also served as superintendent of grounds from 1897 until 1911. Previously Prentiss had been in charge of campus plantings. In this capacity, Rowlee planted exotic

trees, established a *Crataegus* collection (East of the Crescent) and created a water garden in front of the Veterinary School. He had a vision for an arboretum and remained in the College of Arts and Sciences wherein he served as Chair of the department from 1918 to 1922.

In 1892, George F. Atkinson (Cornell Ph.D. 1885) was hired to replace Dudley. Atkinson had been Chair of the Botany Department at the University of North Carolina at Chapel Hill and a Professor of Biology at the Agricultural College of Alabama before returning to Cornell. Atkinson was a mycologist as well as a botanist. He was also interested in pollination and seed development in the *Pinaceae*.

Albert N. Prentiss, who had been Chair for 28 years, was in poor health for several years. In the winter of 1896, he retired and was named professor emeritus for his long and faithful service to the university. George F. Atkinson became the head of the Botany Department and Willard W. Rowlee was advanced to the rank of Associate Professor of Botany (New York Times, March 9, 1896). Prentiss died August 14, 1896 at the age of 60. After Prentiss' passing, Rowlee became superintendent of grounds.

When the College of Arts and Sciences was established in 1903, the Botany Department was still located in Sage College. The facility was cramped and outdated. Several greenhouses and a conservatory were part of the occupied space. During this time a first year botany course included all the students not taking the zoology requirement. Field trips to Junius Ponds (Fig. 6) were an annual

ritual for upwards of 40 students to see plants not found in Tompkins County. Travel to Junius Ponds was by boat or train and horse drawn buggy. Today, Junius Ponds is an hour drive from Ithaca (just down the road from the present day Waterloo Premium Outlet Mall).

While collecting fungi, Atkinson became ill and died of pneumonia in a hospital in Tacoma, Washington on November 14, 1918. Upon Atkinson's death, Willard W. Rowlee became department chair. Rowlee was involved with many Cornell activities. He served as superintendent of grounds, as the life-long secretary of his Cornell graduating class of 1888, as the faculty advisor for football and also as a trustee of the Athletics Association. However, in 1921, the botany department in the College of Arts and Sciences was discontinued, and Rowlee was transferred in the following year to the Department of Forestry as a professor of dendrology. Rowlee died in 1923 after a brief illness.

The botanical facilities in Sage College were no longer considered adequate even though "*The name Department of Botany lingered on in the old laboratories until 1923*" (Thom, 1956). The Sage Conservatory was deemed by the administration "*a superfluous structure*" (Cornell Daily Sun, April 14, 1923). It was demolished on April 13, 1923. The botany department was reinstated in the College of Arts and Science in 1923. It remains a part of the College of Agriculture and the College of Arts and Sciences to this day.



Figure 6. Field trip to Junius Ponds c. 1906. Back row far right, K. M. Wiegand with vasculum, to his left, E. J. Durand and to his left M. B. Thomas. In the lower right, second row, W. W. Rowlee. (Image courtesy of the Cornell Plant Pathology Herbarium Photograph Collection.)

Before the turn of the 20th century, the success of the College of Agriculture required expansion and thus new agricultural buildings. Liberty Hyde Bailey was a key player in the founding of the new College of Agriculture. He was named Dean of the College of Agriculture after the retirement of **Isaac P. Roberts** in the summer of 1903. Roberts came to Cornell in 1874 as the Professor of Agriculture. Subsequently he became Director of the College of Agriculture and the Experiment Station. Pressure had been building in NY State to expand the College of Agriculture, and Bailey sought support from New York state farm groups as he increased the faculty. President **Jacob Gould Schurman** tried to secure funds from the state, but wanted to keep control of the college. After several years of lobbying by agricultural organizations and some disagreement between the Agricultural College Faculty and Schurman, progress was made. The focus changed from getting money for new buildings to securing funding for a new College of Agriculture as an official NY State institution (Colman, 1962). The timing for the \$250,000 funding of the college's new buildings was all important. Legislation, signed by Governor Odell in May of 1904, procured the necessary money to build Stone, Roberts and East Roberts buildings (Fig. 7). Ground breaking began on May 1, 1905 with the now famous plow pulled by students with Bailey gripping the handles (Fig. 8).

Construction proceeded rapidly. By the Fall of 1906, classes were held in the new building complex. On April 27, 1907, Governor Charles E. Hughes came to campus for the dedication. It was a proud day for Bailey who, in his speech, proclaimed that the State College fulfilled the dream of Ezra Cornell. Bailey also paid tribute to Isaac P. Roberts for his foresight and faith and for his "*long, patient and tenacious work*" (Dorf, 1956).

The new buildings were occupied in 1907 by several new departments created by Bailey. These included the Departments of Plant Breeding, Plant Physiology, and Plant Pathology, headed respectively by Herbert J. Webber, Benjamin M. Duggar, and Herbert H. Whetzel. Bailey had asked Whetzel to head up a botany department, but Whetzel selected Plant Pathology. Webber became chair of the Plant Biology department but changed the named to Plant Breeding in 1909 (Murphy and Kass, 2007). Knudson became Assistant Professor and acting chair of Plant Physiology from 1911 to 1913. Bailey pushed for the expansion of departments and areas of study.



Figure 7. Former Cornell President Andrew D. White breaking ground with L. H. Bailey for Stone, Roberts and East Roberts buildings, May 1, 1905. (Image of author's original photo.)

BOTANY IN THE NEW COLLEGE OF AGRICULTURE

Bailey quickly created other departments in the new college in response to his great desire to have as broad as possible a spectrum of the plant sciences taught in the Agricultural College. Curiously however, he delayed the formation of the Botany Department in the new College of Agriculture, probably because he felt there would be resistance to this part of his plan, particularly because the University was financially weak at this time. Nevertheless, after intensive planning during 1912, the new Department of Botany in the College of Agriculture was formed in February 1, 1913, in large part because of the increasing demand for more botanical instruction, which was to be expected in a college devoted to agriculture in a State wherein crops were a matter of great concern.

From its inception, the new botany department was a hybrid, since it was merged with the former Department of Plant Physiology (created in the College of Agriculture in 1907). Bailey selected Karl McKay Wiegand as the first head of the new department. Wiegand had an intimate knowledge of plant biology and how it was taught at Cornell, having obtained two degrees from Cornell: a B.S. degree in 1894 (thanks to Professors Prentiss and Rowlee) and a Ph.D. in 1898 (with no major professor acknowledged). Wiegand built the reputation of his new department by hiring Assistant Professor Lewis Knudson of Plant Physiology and key instructors including Arthur J. Eames, Maude C. Wiegand, Otis Freeman Curtis,



Figure 8. Bailey plowing the first furrow to mark the foundation for the new building. (Image courtesy of the Bailey Hortorium Archives.)

and William J. Robbins. More faculty were added to the department later, among whom Lester W. Sharp (in 1914), Jacob R. Schramm (in 1915), Walter C. Muenscher (in 1922), and Loren C. Petry (in 1925) are perhaps best known. Many women were active in the new department as can be seen in Figure 9.

The formation of the new botany department was neither easy nor well received across the University. Although Eames was brought into the botany department in the Arts College in 1912, he quickly transferred to the new department in the College of Agriculture in 1913. The relocation of Rowlee and other botanists from the College of Arts and Sciences to the Department of Botany in

the Agricultural College was met with resistance by the new botany department faculty perhaps because some felt threatened by “the new comers” (Colman, 1962).

Within a few years of the College of Agriculture moving into Stone, Roberts and East Roberts, the buildings were filled beyond capacity (Fig. 10). The botany group had shared space in Stone Hall with Plant Pathology. Before Bailey retired as Dean there was a push to build several new buildings including a Plant Industries building. New York State funded \$135,000 for Bailey Hall and when it was completed in 1913, Plant Pathology moved into offices and labs in the basement. The Plant Industries building was



Figure 9. Botany department, 1915. Third row on left, Karl M. Wiegand, Maude C. Wiegand. Second row L to R: Otis F. Curtis, Franklin P. Metcalf, William J. Robbins. Front row L to R: Ralph S. Nanz, Laurence H. MacDaniels, Lester W. Sharp, Cecil C. Thomas and Arthur J. Eames. (Attributed to L. H. MacDaniels.)

not funded until much later. Funding came from the State of New York, backed by Governor Smith and passed in 1927 after a seven-year fight in the legislature. The new building brought together five plant science departments and greatly improved conditions for the faculty and students. Upon completion in 1931, the Plant Industries building became known as Plant Science.

Fortunately, the new department of botany in the College of Agriculture flourished as it does today. Wiegand himself continued to study the local flora with the cooperation of students, staff, A. J. Eames, and other faculty members. *The Flora of the Cayuga Lake Basin, New York*, published in 1925, was an expanded version of the *Cayuga Flora* by W. R. Dudley and others published in 1886. Wiegand taught large courses with laboratory and field components. He built a herbarium that contained almost 300,000 specimens.

EARLY FACULTY, STAFF, AND STUDENTS

The following provides brief biographical details about the early faculty and staff in the newly created Department of Botany in the College of Agriculture (for more details, see Kass and Cobb, 2007).

Arthur J. Eames graduated from Harvard with an A.B. degree (1908) and an A.M. degree (1910). He came to Cornell in 1912 as an instructor in botany in the College of Arts and Sciences. In 1913, he transferred to Wiegand's department. Eames is best known for his contributions to plant morphology. He served as Secretary (1927-1931), Vice-president (1932) and President (1938) of the BSA. **Lewis Knudson** (Cornell Ph.D. 1911) got his degree on *Tannic Acid Fermentation* with Benjamin M. Duggar. After acting Chair of Plant Physiology in 1912, he became an assistant professor of botany in the College of Agriculture in 1913. Knudson is known for his diverse work with orchid seed germination, nitrogen fixing bacteria and fern chloroplast morphology. Knudson served as Chair of the department from 1941 until 1952. **Lester W. Sharp** (1912 Ph.D. University of Chicago) became an instructor of botany in 1914 and taught plant morphology and cytology. He is remembered for his great sense of humor and his clever cartoons. His famous spoof "The Wiffenpoof" (*Eoörnis pteroveloxygobiensis*, an exotic and very rare bird, which looked like the hood ornament of a car) co-authored with graduate student Cuthbert B. Fraser, continues to fascinate some eight decades later. Sharp served as Vice-president (1929) and President (1930) of the



Figure 10. Stone, Roberts and East Roberts buildings, Greenhouses and Fernow Hall, c. 1913 the year that the new botany department moved into Stone Hall. (Image courtesy of Sue Thompson.)

BSA. **Jacob R. Schramm** joined the department as an assistant professor in 1915 and served as a professor from 1917 until 1921. Schramm became Editor-in-chief of *Biological Abstracts*. He served as Secretary (1918-1921), Vice-president (1923) and President (1925) of the BSA. **Otis F. Curtis** (Cornell Ph.D. 1916) studied *The stimulation of root growth with special reference to formation of roots in cuttings* for his degree. Curtis became an assistant in botany, and subsequently rose from the rank of assistant professor to that of full professor. He taught plant physiology. His main area of research was translocation. The book he wrote with Daniel G. Clark, *An Introduction to Plant Physiology*, was a popular text. Curtis served as president of the American Society of Plant Physiologists in 1938. **Laurence H. MacDaniels** (Cornell Ph.D. 1917) was an assistant in the department. He wrote a text on plant anatomy with A. J. Eames, *An introduction to Plant Anatomy*, which is considered by many to be a classic in its field, rivaled only later by Katherine Esau's plant anatomy textbook. MacDaniels later transferred to Horticulture and became Chair of Floriculture in 1940.

Among the later additions to the botany department, the following are notable (Fig. 11).

Donald Reddick (Ph.D. 1909) submitted two theses, one on the Black Rot of grapes and the other on the development of some species of the Agaricaceae. He moved into the Plant Pathology department in 1907, but transferred to botany

in 1918 after some disagreements with the Chair of the Plant Pathology, H. H. Whetzel. Reddick returned to Plant Pathology in 1930 and continued to do research with potatoes. He is known for the release of the "Essex," a late blight resistant potato variety that was widely grown in Europe. **Edwin Fraser Hopkins** (B.S. 1915; Ph.D. 1920) became an assistant professor of plant physiology in 1925. Hopkins' research centered on mineral nutrition in plants. **Loren C. Petry** was hired at Cornell in 1925. He taught taxonomy and paleobotany. Petry worked with the summer program for teachers and founded the Paleobotanical Section in the Botanical Society of America. Petry served as Secretary (1933-1936) and Vice-president (1937) of the BSA. **Walter C. Muenscher** (Cornell Ph.D. 1921) was a student of O. F. Curtis. Muenscher became an assistant professor in 1923 and a full professor in 1937. He was a taxonomist and weed scientist. Indeed, he became known as the "Wizard of weeds". It is said that he visited every major swamp in New York and surrounding states. Muenscher wrote several books including *Weeds*, *Poisonous Plants of the United States* and *Aquatic Plants of the United States*. He taught the first course on "Poisonous plants" in the College of Veterinary Medicine. **Daniel G. Clark** (Cornell B.S. 1929; Ph.D. 1936) was a student of Curtis as he worked in the Plant Physiology stock room. He taught plant physiology and was a popular undergraduate advisor. In fact he sometimes had as many as 70 advisees. He co-

authored *An Introduction to Plant Physiology* with Otis F. Curtis.

Among the early students, the following deserve special recognition.

Stewart H. Burham had been an assistant in botany between 1904 and 1905. He served as the Assistant State Botanist at the New York State Museum in Albany until 1913. Burham returned to Cornell in 1920, where he served as the assistant curator of the Cornell University Herbarium until age 70 in 1940. **Mary Alida Fitch** received her Ph. D. in plant physiology in 1912 for *Studies in transpiration* with B. M. Duggar. Fitch worked on North American species of *Puccinia* on *Carex* with J. C. Arthur. She taught botany at Oxford College in Oxford, Ohio and later at Howard University in Washington, DC from 1919 until 1931. **William J. Robbins** studied plant physiology with L. Knudson and received his Ph.D. in 1915 for his thesis titled *The influence of certain salts on the digestion of starch by Penicillium camembertii*. His brilliant career in botany and science included contact with most of the botanists of his time including Duggar, Bailey, and Barbara McClintock as well as many scientists at the Fairchild Tropical Garden. Robbins was at the University of Missouri from 1919 to 1938 where he served as chairman of the botany department. In 1938, he became director of the New York Botanical Garden, a post he held until 1958. Elected to the National Academy of Sciences in 1940, he served in many capacities with that organization. Robbins also served on the board of the Fairchild Botanical Garden where he was president from 1962 until 1969. He was a member of the Boyce Thompson Institute for 29 years and served as its director. He continued to do research and published many papers dealing with tissue culture, vitamins and growth substances until his death in 1978 (Kavanagh & Hervey, 1991).

Sterling H. Emerson (B.S. 1922), son of R. A. Emerson, got his Ph.D. at the California Institute of Technology in 1928 and spent his entire career at Cal Tech. Emerson worked in several areas of genetics, including self-incompatibility and genetic recombination of *Oenothera*, and later on the biochemical genetics of *Neurospora crassa*. He became a member of the National Academy of Sciences. **Adriance S. Foster** (B.S. 1923), became the first plant anatomist in the newly reorganized Department of Botany, University of California Berkeley in 1934. He wrote *Practical Plant Anatomy* in 1942 and co-wrote *Morphology of Vascular Plants*



Figure 11. Department October, 1930. Back Row L to R: unknown, unknown, Robert H. Tshudy, Muneo Kikuchō, Walter C. Muenscher, unknown. Front Row: L To R: Mary Malone, Edwin F. Hopkins, Lewis Knudson, Otis F. Freeman, Daniel G. Clark. (Image gift of M. Kikuchō, courtesy of Cornell RMC.)

NOTABLE STUDENTS OF THE
1930S TO 1940

with Ernest M. Gifford in 1959. Foster taught at Berkeley from 1934 until 1968. **Barbara McClintock** (B.S. 1923; M.S. 1925; Ph.D. 1927) studied the genetics and cytogenetics of *Zea mays*. Her M.S. degree thesis was titled *Cytological investigation of the cereals*. Her Ph.D. thesis was titled *A cytological and genetical study of triploid maize*. Her major professor was L. W. Sharp, but she also worked with L. F. Randolph and Rollins A. Emerson (who was a corn breeder in the Department of Plant Breeding). McClintock was an instructor in botany at Cornell from 1927 to 1931. She was elected to the National Academy of Sciences in 1944. She went on to study corn genetics at Cold Springs Harbor Laboratory, NY and received a Nobel Prize in Physiology or Medicine in 1983 for her discovery of “jumping genes” or mobile gene elements in *Z. mays*. Another notable student was **Chester A. Arnold** (B.S. 1924; Ph.D. 1928) who was a student of L. C. Petry. Arnold was the Curator of Fossil Plants at the University of Michigan and is best known for his research on the Paleozoic, Mesozoic and Tertiary periods in North America. He wrote the *Introduction to Paleobotany* in 1947 and won a Distinguished Service Award from the Paleobotany section of the BSA. Several paleobotanical taxa were named in his honor (e.g., *Protosalvinia arnoldii*).

INTERNATIONAL CONGRESS FOR
PLANT SCIENCES, IBC IV

An important milestone in the early history of the Botany Department was the International Congress for Plant Sciences (the Fourth International Botanical Congress) held in Ithaca, August 16-23, 1926 (Fig. 12). Professor B. M. Duggar served as the chairman of the Organizing Committee and general secretary of the meeting. This was an important meeting because it was the very first formal opportunity for all U. S. professionals in the plant sciences to meet in one place. There was also unrestricted international participation. L. H. Bailey served as president and presiding chairman of the conference. Many Cornellians were selected as Secretaries to represent the various disciplinary groups, e.g., Cytology: L. W. Sharp; Physiology: O. F. Curtis; Pathology: D. Reddick; and Taxonomy: K. M. Wiegand. The proceedings were published with B. M. Duggar as its editor (Duggar, 1929).

Harriet Baldwin Creighton (Ph.D. 1933) was a friend and colleague of Barbara McClintock. Her Ph.D. thesis advisor was L. W. Sharp. The title of her thesis was *A cytogenetic study of crossing-over in Zea mays*. Creighton went on to become head of the botany department at Wellesley College, Boston. She was the third woman to be elected President of the BSA in 1956 after serving as Vice-president in 1955 and as the first woman Secretary of the BSA (1950-1954). Creighton also served as editor for the *Plant Science Bulletin* in 1958. **Robert T. Clausen** (Cornell A.B. 1933; M.S. 1934; Ph.D. 1937) was a student of Wiegand and worked as a taxonomist in the newly formed L. H. Bailey Hortorium in 1935. He became an assistant professor in 1939, an associate professor in 1941, and a full professor in 1949. Clausen taught taxonomy and was the Curator of the Wiegand Herbarium after Wiegand died in 1942. He wrote *Sedum of the trans-Mexican volcanic belt: an exposition of taxonomic methods and Sedum of the North America north of the Mexican Plateau*. **Edward Marshall Palmquist** (Ph.D. 1936) worked with Curtis on the movement of carbohydrates and fluorescein. Palmquist wrote *General Botany Laboratory* with Loren C. Petry. Palmquist became a professor of botany at the University of Missouri and later served as program director at the NSF for Education in the Sciences from 1956 until 1961. **Stanley J. Smith** (M.S. 1939) wrote his thesis on the *Preliminary investigations in the genus Astragalus*. He became Curator of Botany at the New York State Museum Albany, NY. Smith compiled several checklists including a *Checklist for grasses of New York State* (1965) and a *Preliminary checklist of the vascular aquatic plants of Lake George* (1971) with E. C. Ogden. **Arthur W. Galston** (B.S. 1940) became an important plant physiologist. His career was in the department of Molecular, Cellular and Developmental Biology at Yale. Galston concentrated on plant photobiology, hormones, protoplasts and polyamines. Perhaps he is most known for the first evidence of riboflavin as a photo receptor for phototropism. Galston served as president of both the BSA (1968) and the American Society of Plant Physiologists (ASPP) (1962-1963).

It is not possible to give details about all the students who were nurtured by the Department of Botany. Wiegand taught seven courses to some 852 students between 1913 and 1914 alone. By

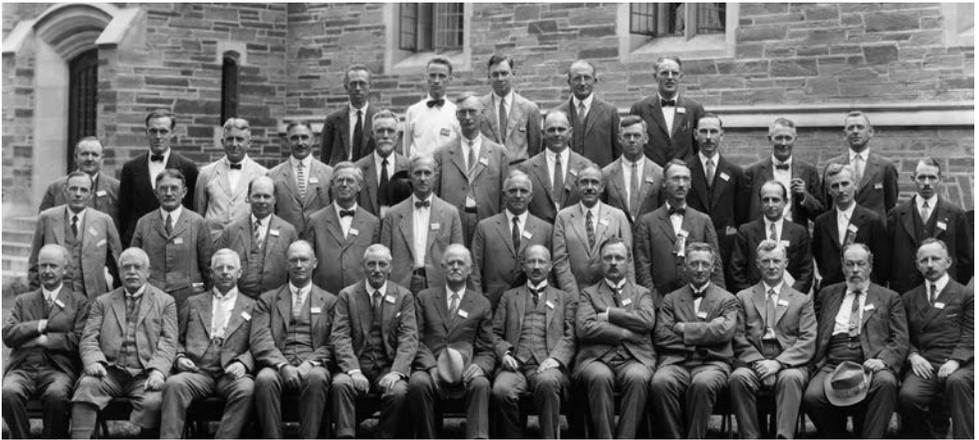


Figure 12. Officers of the International Botanical Congress IV (Plant Sciences), Ithaca, NY, 1926. 4th row (back row) L to R: Loren C. Petry, Lester W. Sharp, James M. Sherman, Robert S. Breed, Otis F. Curtis. 3rd row: Heber W. Youngken, Freeman S. Howlett, Homer L. Shantz, Charles A. Shull, Albert S. Hitchcock, Cornelius L. Shear, Harry M. Fitzpatrick, Roy B. Wiggins, Paul B. Sears, Herbert Hice Whetzel, Arthur John Heinicke. 2nd row: George Thomas Moore, Duncan S. Johnson, Henry C. Cowles, Karl McKay Wiegand, Charles E. Allen, Clifton D. Howe, Ralph S. Hosmer, Donald Reddick, Benjamin Minge Duggar, Jacob R. Shramm, Julian H. Miller. 1st row (front row): Edwin J. Butler, Robert H. Chodat, Eduard Rubel, Carl H. Ostefeld, John Briquet, John Merle Coulter, George Tischler, Egbertus Van Slogteren, Frederick J. Chittenden, Tor Jonson, Richard Wettstein, Ernst Lehmann. (Photo by John P. Troy.)

1937-1938, twenty courses were taught with a total enrollment of 1,625 students (Fig. 13). During a 25-year period, 69 Ph.D. candidates and 79 masters candidates earned their degrees in botany (Cobb, 2013). In addition, Prentiss started Summer instruction in botany as a separate endeavor, and, in 1923, Wiegand helped to organize summer school for biology for school teachers—a program that was continued by L. C. Petry and later by Harlan P. Banks. On October 15, 1938, the botany department celebrated K. M. Wiegand's 25 years as head of the department. A dinner was held in the Plant Science building's seminar room. Knudson wrote "A Brief History of the Department of Botany" (Cobb, 2013).

THE WAR AND POST WAR YEARS 1941-1952

With the retirement and death of Wiegand in 1942, the department entered a new era presided over by Knudson (Fig. 14). The University Herbarium became the Wiegand Herbarium in Wiegand's honor and in recognition of his long service to the department.

Many things were changing both here and abroad—students such as André Jagendorf, Reid Moran, and Charles Uhl went off to war, but fortunately returned to finish their degrees as

all areas of science, including the plant sciences, changed rapidly.

During this time, several notable faculty joined the Department of Botany. **Lowell Fitz Randolph** (Cornell Ph.D. 1921) obtained his degree with L. W. Sharp and worked with the Office of Cereal Investigations, USDA, in Ithaca, until 1939 when he joined the department as a professor. He resigned from the USDA in 1947, but continued in the botany department as a cytogeneticist working with *Zea mays* and *Iris*. **Harlan P. Banks** (Cornell Ph.D. 1940) studied paleobotany with L. C. Petry and was hired to replace Petry in 1949 (Fig. 15). Banks, who served as department Chair from 1952 until 1961, was acknowledged as an outstanding teacher. He taught courses in introductory botany and paleobotany. Banks was also active with the Science Teachers Summer Program. **Charles H. Uhl** (Cornell Ph.D. 1947) got his degree with L. W. Sharp and worked on the cytology and taxonomy of the Crassulaceae. Uhl joined the faculty and became an assistant professor upon the retirement of Sharp in 1947. **Frederick C. Steward** came to Cornell in 1927 as a Rockefeller Foundation Fellow. He worked with Otis F. Curtis. During the Knudson years, Steward joined the botany department as a professor in 1950. He taught advanced plant



Figure 13. Botany Department June 1, 1938, our most complete department photograph. Back row (L to R): Milton Arnold Lessler, Gabriel Raphael Mandels, Otis Freeman Curtis, J., John Irwin Shafer, Charles Arthur Taylor, Sidney Robinson Kennedy, Clayton I. Swayze, Robert Haydn Tschudy, Bassett Maguire. Third row: Leon Berstein, Elmer Arthur Palmatier, Charles A. John, Harlan Parker Banks, Dwain Vorhis, Oren Lloyd Justice, Clyde E. Harris, John T. Baldwin, Jr., George Hill Mathewson Lawrence, Robert H. Williams, Philip Cullodin Reece, "Tom" S. Boon-Long. Second row: Ruth Alice Petry, Beradine D. Tschudy, Rosamond Shurtleff, Carrolle E. Anderson, Mabel W. Allen, Mary A. Malone, Helvia Justice, Helen Heck, Ethel Belk, Elizabeth C. Mosher, Fannie Rane Randolph, Lois Will, Lela Koster, Louise Raynor, Eleanor Graham Coley, Elizabeth Richards, Doris Little, Ruth Krehl. Front row: Stewart H. Burnham, Richard August Laubengayer, Albert LeRoy Andrews, Edward M. Palmquist, Daniel Grover Clark, Loren Clifford Petry, Lewis Knudson, Karl McKay Wiegand, Lester Whyland Sharp, Otis Freeman Curtis, Walter Conrad Muenschler, Edwin Fraser Hopkins, Lowell Fitz Randolph, James A. de Tomisi. (Image courtesy of the Division of Rare and Manuscript Collections, Cornell University Library.)

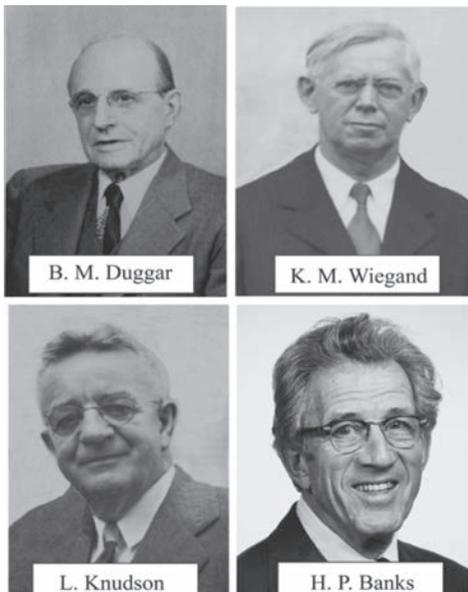


Figure 14. Chairs of the Departments of Plant Physiology and Botany (1907 – 1961): Duggar (1907 – 1911), Wiegand (1913 – 1941), Knudson (1941 – 1952), and Banks (1952 – 1961).

physiology and is perhaps best remembered as the scientist who first cloned carrots from pith cells (thereby coining the phrase *cell totipotency*). Knudson thought that Stewart would eventually become the Chair of botany but that never happened.

STUDENTS OF THE LATE 1940'S TO 1950

Sherret S. Chase (Ph.D. 1947) was a professor at Iowa State University and at SUNY Oswego. He also was a research geneticist and director of International Seed Operations for DeKalb AgResearch, Inc. Chase developed the "Double Haploid" method of *Zea mays* breeding. (**Ching Hsiung**) **C. H. Li** (Ph.D. 1948) became an outstanding corn breeder and cytogeneticist in China. Li was able to dramatically increase crop yields with his varieties. **Arthur Bing** (Ph.D. 1949) was a professor of Horticulture at Cornell and later directed the Cornell University-USDA Ornamentals Laboratory at Farmingdale, NY. **Robert Folger Thorne** (Ph.D. 1949) was a taxonomist at Rancho Santa Anna Botanic Garden and Claremont Graduate University. His research focused on the evolution of flowering plants. (**Haruyuki**) **Harry Kamemoto** (Ph.D. 1950) became an important



Figure 15. Harlan P. Banks, Charles H. Uhl, Lewis Knudson and Walter C. Muenscher, 1954. (Image from the H. P. Banks Archives.)

Dendrobium orchid and *Anthurium* breeder at the University of Hawaii at Manoa.

THE BANKS AND KENT YEARS 1952 TO 1965

During the chairmanship of H. P. Banks, several new faculty were hired. Some left within a few years undoubtedly because of the strong personality of F. C. Steward, who did not mesh well with newly hired faculty, many of whom went on to have accomplished careers. For example, **Walter D. Bonner, Jr.** came to the department in 1953. He was an Associate Professor of plant physiology, but left for the University of Pennsylvania in 1959. Another plant physiologist, **Conrad S. Yocum**, joined the department in 1955 and left for the University of Michigan in 1961. Other faculty also survived Steward's personality. **John M. Kingsbury** also joined the department as an assistant professor in 1954, after Walter C. Muenscher had suffered a stroke and retired. Kingsbury taught courses on the algae and poisonous plants and went on to found the Shoals Marine Laboratory. **David W. Bierhorst** joined the department in 1955, but moved to the University of Massachusetts in 1968 largely because of health problems and his dislike of the newly created Division of Biological Sciences. Loren Petry retired on July 1, 1955 (Fig. 16).

Harlan Banks stepped down as Chair of the department in 1961 when **George C. Kent**, the Chair of Plant Pathology, assumed the role of an acting Chair and remained so until **Harry T. Stinson** became Chair of the department that subsumed the old botany department (the Section of Genetics, Development and Physiology). Stinson served as Chair of the Section of Genetics, Development,

and Physiology between 1965 and 1977. With the formation of the Division of Biological Sciences, F. C. Steward was relocated in his own department as director of the Laboratory of Cell Physiology, Growth and Development. Steward moved to Clark Hall when it opened in 1965. Much like Steward, **R. T. Clausen** was also appointed as the Director of the one-manned Wiegand Herbarium, a position he held from 1954 until 1977.

Among the students receiving degrees (and their advisors) during this interval are:

David E. Fairbrothers	(MS '52, Ph.D. '54)	R. T. Clausen
Charles B. Beck	(MS '52, Ph.D. '55)	H. P. Banks
Wayne L. Fry	(Ph.D. '53)	H. P. Banks
Nancy G. Slack	(BS '52, MS '54)	H. P. Banks
Robert Rabson	(Ph.D. '56)	F. C. Steward
William C. Burger	(MS '59)	R. T. Clausen
Francis M. Hueber	(M.S. '59, Ph.D. '60)	H. P. Banks
James Douglas Grierson	(Ph.D. '62)	H. P. Banks
Abraham Der Krikorian	(Ph.D. 1965)	F. C. Steward

THE DIVISION OF BIOLOGICAL SCIENCES: 1965–1979

Many changes were made with the creation of the Division of Biological Sciences in the New York State College of Agriculture in 1964. In 1965, members of the botany department joined with some members of the zoology and plant breeding departments to become the Section of Genetics, Development and Physiology. Professors **Adrian M. Srb**, Harry T. Stinson, Jr. and **Bruce Wallace** left Plant Breeding to become members of this new section. During this time, several new faculty were added in the area of plant physiology. **André T. Jagendorf** (Cornell B.S. 1948) joined the department in 1966. Jagendorf taught and did research in plant physiology. **Roderick K. Clayton** also joined in 1966 and taught plant physiology, most notably courses in photosynthesis. **Roger M. Spanswick** joined the department in 1967 and taught courses in plant water relations, but transferred to Biological and Environmental Engineering in 2001. **Peter J. Davies** joined the department in 1969 and taught plant physiology. **Dominick J. Paolillo, Jr.** (Cornell B.S. 1958) joined the department in 1970 to teach plant anatomy, morphology and development. **Mandayam V. Parthasarathy** (Cornell Ph.D. 1966) joined the department in 1971 and taught courses in electron microscopy and plant ultrastructure.

On May 1, 1973, a symposium *Historical and*



Figure 16. Botany Group Photo taken in 404 Plant Science, May 20, 1954. Back row: L to R: Chuck Downing, Robinson Abbott, Conrad Meyer, John Pollard, Sally Watkins Christie, Charles B. Beck, Ken Howe, David E. Fairbrothers, Marvin J. Rosenberg, Dorothy Brown Beckel, Jesse F. Clovis Third row: Dorothy Niimoto, Elfriede Philena Townley, Edgar Shantz, Ken Burlington, Harlan Q. Stevenson, Krishnaier Subramanyam, Nancy Slack, Robert T. Clausen, Robert Rabson. Second row: Joan Smith, Janice S. Sanford, Abbe, Virginia Rock, Ester Spielman, Dorothy Van de Mar, Ruth Petry, Thoraya Lotfy, Harlan P. Banks, Loren C. Petry, Lewis Knudson. Front row: Jyotirmay Mitra, Kathryn Mears, Walter D. Bonner, Nathanael Grobbelaar, William B. Drake, A. S. Rao F. Randolph, Gerald Reisner, F. C. Steward, Charles H. Uhl and Mohammed Zahur (Absent from photo: Daniel G. Clark, James Cruise, Arthur J. Eames, Mohammed El-Ghawas, Harold Howard, H. Lugo-Lugo, Marjorie Maguire, Walter C. Muenscher (Department photo.)

Current Aspects of Plant Physiology: A Symposium Honoring F. C. Stewart was held at Cornell to celebrate his retirement. Speakers from five prominent universities spoke at the symposium. The talks were published in 1975 as *Historical and Current Aspects of Plant Physiology* with Peter J. Davies as editor (Davies, 1975). Later in 1977, the name of the section changed to Botany, Genetics and Development, and new faculty hires followed. The L. H. Bailey Hortorium also merged with the Wiegand Herbarium. **Neil A. Campbell** came in 1977 to teach Introductory Biology. He studied desert and coastal plants. Campbell's textbook *Biology*, first published in 1987, was used to teach many generations of biologists world-wide. **Karl J. Niklas** was hired upon the retirement of H. P. Banks in 1978. He has taught introductory botany and paleobotany since then.

The Banks Symposium, which was held in the Fall of 1979, brought together important paleobotanists to honor his career as a paleobotanist. Twenty-five authors contributed to the published two-volume set titled *Paleobotany, Paleoecology and Evolution (Vols. I and II)*, edited by Karl J. Niklas, the organizer of the symposium.

Among the students receiving degrees (and their advisors) during these years are

Patricia Bonamo	(M.S. '65, Ph.D. '66)	H. P. Banks
Jack B. Fisher	(BS '65, MS '66)	D. W. Bierhorst
Allan Witztum	(Ph.D. '66)	D. W. Bierhorst
Judith E. Skog	(Ph.D. '72)	H. P. Banks
Laurence E. Skog	(Ph.D. '72)	H. E. Moore
Stephen E. Scheckler	(BS '66, MS '70, Ph.D. '73)	H. P. Banks
Lee B. Kass	(Ph.D. '75)	D. J. Paolillo, Jr.
Larry H. Klotz	(MS '71, Ph.D. '77)	H. E. Moore

THE SECTION OF PLANT BIOLOGY
(1980-1999)

Harry Stinson, Jr. stepped down as Chair in 1980 when the former Section of Botany, Genetics and Development separated into the Section of Genetics and Development and the Section of Plant Biology (Figs. 17 and 18). Mandayam Parthasarathy became the first Chair of the new Section of Plant Biology (1980-1983). Successive chairs included Dominick J. Paolillo, Jr. (1983-1985) and André T. Jagendorf (1985-1986). While Jagendorf was on sabbatical leave from August 1986 until June 1987, Paolillo and Parthasarathy served successively as acting chairs. Jagendorf continued as Chair (1987-1992). Peter J. Davies served as Chair from 1992-1996. Paolillo once again served as chair from 1996 until 1999, when **William L. Crepet** became Chair of the Department of Plant Biology. **June B. Nasrallah** (Cornell Ph.D. 1977) joined the department in 1986. Nasrallah was a student of Adrian Srb. Her main research focus is on the molecular biology of self-incompatibility in the Brassicaceae. She was elected to the National Academy of Science in 2003. **Mikhail E. Nasrallah** (Ph.D. '65 in Plant Breeding) also joined the department in 1986.

THE DEPARTMENT OF PLANT BIOLOGY
(1999-2013)

In 1999, the Division of Biological Science, which was under the direction of Peter Bruns, was dissolved (amidst considerable controversy). Numerous faculty meetings were held to discuss the topic, and most of the faculty resisted the change. Nevertheless, the final report submitted to the President, Hunter Rawlings III, favored the dismantling of the Division, which was accomplished without fanfare or further discussion. At the same time, Rawlings also mandated the merger of the Bailey Hortorium and the Section of Plant Biology to form the new Department of Plant Biology. William Crepet became the first chair of the newly created department (Cobb, 2013). A curious twist of fate is that five departments will soon be merged to form a School of Integrative Plant Science with a new director and a supervisory council. The five departments will be called sections. Thus, 2014 will see the rebirth of a mini-Division of Biological Sciences and a new Section of Plant Biology.

The Cornell Agriculture and Life Sciences (CAL S) Centennial in 2004 and the BSA Centennial in 2006 got the Department of Plant Biology thinking about its own centennial in CAL S occurring in 2013. A

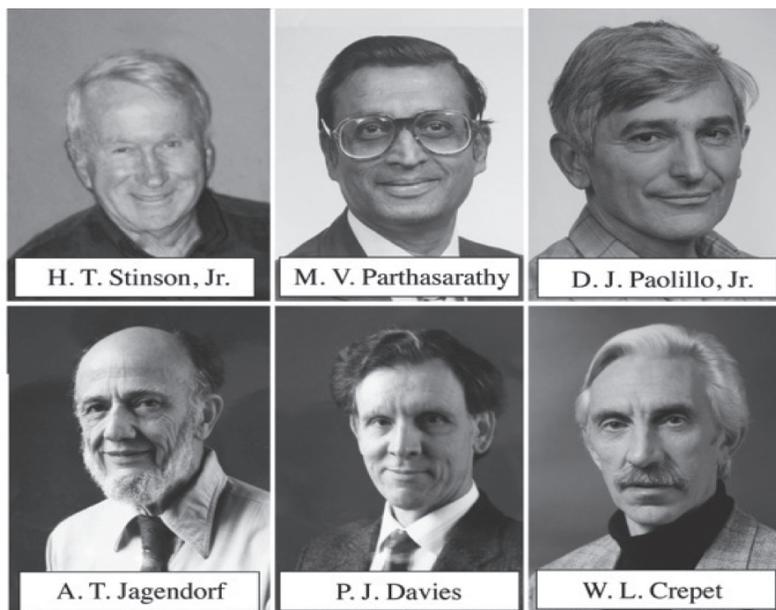


Figure 17. Chairs of botany / plant biology from 1964 until present: Stinson (1964 – 1980), Parthasarathy (1980 – 1983), Paolillo (1983 – 1985; 1996 – 1999), Jagendorf (1985 – 1992), Davies (1992 – 1996), and Crepet (1999 – present).

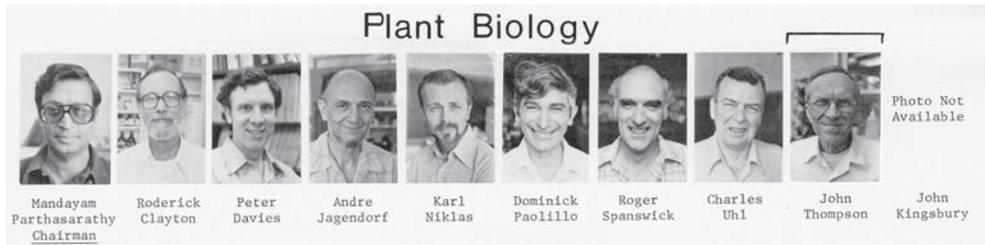


Figure 18. Plant Biology Faculty, early 1980s. (From a CALS poster.)

plan was devised by the organizing committee (Edward Cobb, William Crepet, Karl Niklas, and Maria Alejandra Gandolfo Nixon) to reach out to as many as possible of those who have made our department what it is today. Invitations were sent in the hopes of seeing as many alumni, faculty, friends, and staff as possible at a two-day celebration on June 28th and 29th, 2013. In recognition of the Department of Botany's 145 years of history and service, a series of events was held that included a keynote lecture by a former Cornell botany student Marcus A. McFerren, Ph.D., M.D. (Friday, June 28th, 2013), titled *A Journey Through Plant Biology: Botanical Medicine & All It's Warts*, and lectures about the department's history that culminated in a banquet (Saturday, June 29th, 2013). The series of events was videotaped and is available at <http://ecommons.library.cornell.edu/handle/1813/33671>. The rest is history (Figure 19).

ACKNOWLEDGEMENTS.

The author gratefully acknowledges former Cornell students, colleagues, and historians Robert Dirig and Lee B. Kass (who provided the dates for the various chairs of the department) for valuable shared information. He also thanks Kent Loeffler for providing and improving rare historical images; the staff at Mann Library including Meg Ackerblade, Liz Brown, Tom Clausen, Erin Eldermire and Judy Wayno for their invaluable assistance; the staff at the Kroch Rare Manuscripts Collection especially Laura M. Linke for tracking down photos, and the Department of Plant Biology for logistical support. Finally, he thanks William L. Crepet, Roysse P. Murphy, and Karl J. Niklas for their encouragement.



Figure 19. Plant Biology Retreat August 2011, held at the Cayuga Nature Center, Ithaca, NY. Back Row: L to R. Mingyue Gou, David Ruth, Wojciech Pawlowski, Ryan McQuinn, Adrian Powell, Sam Crowell, Jim Reveal, Robert Raguso, Andy Vail, Bill Crepet, Elden Rowland, Simon Gunner. Third Row: Margaret Frank, Baijuan Du, Andre Jagendorf, Eric Fich, Lisa Earle, Alfonso Doucette, Ed Cobb, Karl Niklas, Kevin Nixon, Susan McCouch, Klass van Wijk, Jiping Liu, Miguel Pineros, Maureen Hanson, Randy Wayne. Second Row: Karin Jantz, Dezi Elzinga, Laetitia Martin, Jitae Kim, Sam Lieboff, Rob Harbert, Holly Summers, Tao Sun, Beth Takacs, Xian Qu, Zhilong Bao, Arnaud Germain, Mike Scanlon, Jennifer Svitko, Peter Lundquist, Tracey Sherwood. Front Row: Sorina Popescu, Yann-Ru Lou, Soohyun Oh, Maria Carrizales, Gwynne Lim, Titima Tantikanjana, Haiyi (Heidi) Wang, Adrienne Roeder, Maria Alejandra Gondolfo Nixon, Manuel Aregullin, Jian Hua, Myat Lin. (Edward D. Cobb photo.)

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**The Making of a Student-Driven
Online Campus Flora:
an example from Rutgers University**

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ABSTRACT

Student participation in floristics at the university level is essential for the longevity and expansion of botany, plant ecology, and their many associated fields, but knowledge and college course options have been decreasing. In many cases students are unaware of the botanical biodiversity that is right in front of their eyes. We started a project called Flora of Rutgers Campus (FoRC), which provides students with hands-on outdoor fieldwork as an engaging and effective way to experience botany first hand. In 2011, 32 students participated in this project and uploaded 580 vouchered observations to a database. In total, we found 98 families, 200 genera, and 259 species on the Cook/Douglass campus of Rutgers University in New Jersey. Nearly 10% of the state's flora was found on 317 urban/suburban acres. This project strongly increased the students' knowledge of local plants, opened their eyes to "see" plants everywhere, and encouraged students to work cooperatively.

Key words: botany; biodiversity; campus; education; plant blindness; plant systematics

Humans are completely dependent on plants for our survival as the source of food for ourselves or for the animals that we eat, as providers of ecosystem services (e.g., oxygen generation, carbon dioxide sinks, soil stabilization) and as synthesizers of biofuels, building materials, medicines, oils, and other natural products (Costanza et al., 1997). Furthermore, in the current age of rapid urbanization, biotic invasion and climate change, basic botanical literacy is as important as ever if the public is to recognize and cope with the real threats to plants and plant communities that we depend on and that define each region ecologically. Plant blindness, the increasingly common lack of knowledge and "seeing" of plants in everyday life is also a powerful phenomenon that affects students personally, as well as the focus of media, educators, and popular culture (Wandersee & Schussler, 2001, see also Hershey, 2002). Many people nowadays see plants just as the green background to more important things such as cars, buildings, golf balls, dogs, and the erratic groundhog. This is at least partially due to less of a personal connection with plants (and nature) during our upbringing, and also to the agricultural production of plants as food, and an overwhelmingly zoo-centric media culture, especially by producers such as Disney, Discovery Channel, and National Geographic.

Despite the universal importance of plants and the current need for more plant awareness, plant science knowledge and course offerings, especially field- and taxon-based botany, have been reduced during the last decades at high school and college levels (Hershey, 1996; Reinsvold, 1999). The National Science Education Standards are also weak when it comes to plant knowledge and understanding (Hershey, 2013). In our own experience, few children and teenagers today can identify more than 100 plant species, and the ones they know are mostly supermarket or garden plants (see also Adams et al., 2010).

At Rutgers University, we teach a combined undergraduate and graduate level class in plant diversity and evolution and advanced plant systematics, which includes lectures, labs and written and practical assignments. In the labs, we bring in over 1000 species or cultivars of representative plants, highlighting plants of ethnobotanical use, including landscaping, agriculture, food and spices. To increase student knowledge of plants in the local ecosystems, we

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developed the project *Flora of Rutgers Campus* in 2011, which aims to provide students with a variety of skills.

Field-based botanical inventories strengthen skills in morphology, identification, vouchering and other biodocumentation, family recognition, georeferencing, and description. Any teaching that focuses on local and personally relevant issues and brings with it a “sense of place” for students has a higher chance of being found important to students (Gruenewald, 2003; Semken & Butler Freeman, 2008; Kudryavtsev et al. 2012). The project provided students with a focused, but open-ended research question, a positive challenge, and a valuable goal—the first floristic biodiversity inventory of any Rutgers campus in the history of our university.

Rutgers, The State University of New Jersey (aka “Rutgers University”) is located in three locations in New Jersey (Camden, Newark, and New Brunswick). Our project took place in the New Brunswick location, which is the largest part of the university. Of five Rutgers campuses located within the New Brunswick area, the campus flora project included two of them: the George H. Cook Campus, which is the old agricultural land grant school, and the adjoining Rutgers’ Douglass Campus, the former New Jersey College for Women. The Cook/Douglass campuses are located at approximately 40.48 N, 74.43 W on the east coast of the United States, in central New Jersey, and the local environment is influenced by the tidal Raritan River (Ashley & Renwick, 1983). New Brunswick is 8.5 miles (13.7 km) away from the Raritan Bay of the Atlantic Ocean and the distance to the outer coastline at Sandy Hook is 24 miles (38.6 km).

Our area of inventory covered 317 acres (1.3 km²), which included an abundance of maintained lawns, a remnant of an old growth hardwood forest (Frank G. Helyar Woods), ditches, wetlands (natural and artificial), and retention basins, a few small ponds (including Passion Puddle), one dammed lake (Weston Mill Pond), asphalted roads and parking lots, horse and cow fields, a pig, goat and sheep farm, a horticultural garden (Rutgers Garden), a research farm, an organic community garden, abandoned lots and fields, rocky cliffs, and several intensively used highways (Route 18 and US Route 1).

METHODS

During the fall of 2011, we challenged 32 graduate and undergraduate students to create a campus-wide floristic survey of all wild and naturalized plant species on Cook/Douglass campuses (317 acres, Rutgers University, NJ, USA). Students used both traditional tools (floras, hand lenses, knives, bags, herbarium presses, dissecting microscopes, and rubber boots) and high-tech equipment (smart phones with instant GPS, cameras, and internet identification resources). All newly found species had to be vouchered with herbarium specimens, and all observations had to have a photo of the plant either in the field or after being pressed (or both).

Identification was accomplished by keying out plants using floras or online-keys, or with comparison with other herbarium materials available at Chrysler Herbarium (CHRB, at Rutgers University). To help with the project, we provided manuals on (1) how to press plants, (2) georeferencing, (3) using Google Maps to find coordinates, and (4) how to identify the 50 most common plant families of temperate regions. All herbarium vouchers were photographed and included in the online database. Afterwards they could be donated to the CHRB at Rutgers University if the student so wished.

The observation data were uploaded by students to an online web portal housed by Consortium of Northeastern Herbaria (<http://neherbaria.org/>), a Symbiota Software Project portal (<http://symbiota.org/tiki/tiki-index.php>). Taxonomy for vascular plants follows the one used in the USDA-PLANTS database, which is the taxonomy utilized in the CNH portal. Classification for lichens followed Esslinger (2011).

The students’ resulting herbarium specimens, field observations, and photos formed a *Flora of Rutgers Campus* species list, image bank, and maps of species locations now publicly available online (<http://portal.neherbaria.org/portal/checklists/checklist.php?cl=28>). Included in the inventory were all vascular plants (flowering plants, conifers, ferns and fern allies, and lycophods), as well as lichens, mosses, liverworts, and algae. Generally specimens representing plants grown in cultivation were not included in the inventory.

Cultivated native plants were included, but plants that were non-native or unlikely in their natural range were only included if they appeared

to be escaped and/or naturalized to uncultivated areas of campus.

In order to identify their specimens, students had access to a variety of taxonomic keys, and they often collaborated when keying out difficult specimens. Students also had access to botanists who could verify their tentative identifications: the Professor (LS) and Teaching Assistant (CZ) for vascular plants, Bill Buck of The New York Botanical Garden for mosses and liverworts, and Richard Harris of The New York Botanical Garden for lichens. Many identifications were incorrect at first, and this input and subsequent feedback was important for quality control of the database. Most students relied on keys in Rhoads and Block's (2007) *The Plants of Pennsylvania* and Haines' (2011) *Flora Novae-Angliae*. Gleason and Cronquist's (1991) *Manual of the Vascular Plants of the Northeastern United States and Adjacent Canada* was also available, although students then had to compare the nomenclature to the USDA-PLANTS Database to ensure that names were current. For difficult groups, students used Barkworth et al.'s (2007) *Manual of Grasses for North America*, Brodo et al.'s (2001) *Lichens of North America*, Hinds and Hinds' (2007) *Macrolichens of New England*, Lincoln's (2008) *Liverworts of New England*, and Crum and Anderson's (1981) *Mosses of Eastern North America*.

To provide additional incentives to students we set up a system of gaining points according to the following schedule: 10 points for finding a new family, 5 points for finding a new genus, 5 points for finding a new species, and 1 point per observation overall. Ten observations were mandatory for each student. We recruited donations of prizes (books, botanical items, living plants, garden clippers, etc.) from faculty, deans, and department chairs.

At the end of the project, we arranged for a special celebration and the students got to select among the prizes in order of the number of points they had achieved. We also got the chair of the Department of Ecology, Evolution and Natural Resources to promise a pizza party for the whole class at the end of the project, if the class managed to find over 250 species on our campus.

As a separate small project, we ran a logo design competition, where the students provided brand-new logos which were then voted on by the students (Figure 1). This was an optional assignment and brought out some of the design and art skills in some students.



Figure 1. Logo for Flora of Rutgers Campus, developed and designed by Clayton Leadbetter, winner in the logo design competition.

RESULTS

The project started in late September 2011 and ran until mid-December 2011, three months total, and over that time period, 580 observations of 259 species were uploaded by 32 students. (Twenty-eight observations were plants that students had collected in July and August, before the start of the class.)

Right before our project started, our campus was hit by Hurricane Irene, which led to massive tree destruction in our area, which made epiphytes more accessible, but otherwise appeared not to affect our floristic work. However, in late October, the project was interrupted by an unusually early snowstorm that covered all vegetation in deep, wet snow for a few days. Some herbaceous plants recovered from this, others did not. Most of the plant observations (400) were recorded in September and October, before the storm.

The inventory resulted in us finding 259 species in 200 genera, distributed among 98 families (Figures 2 and 3). Compared with the reported species from Middlesex County, NJ on the USDA-PLANTS database, our findings represent 19% of the vascular plant species found in our county, 35% of the vascular plant genera, and 64% of the vascular plant families. Compared with the total number of land plant species reported from New Jersey (3207 species) in the USDA-PLANTS database, we found 8%.



Figure 2. Example of a species found on Rutgers University's Cook Campus: rosehips from *Rosa canina* (Rosaceae), easily identified based on its leaf and fruit characteristics. Photo by Lena Struwe.

Of the 580 observations, the most commonly reported species was *Trifolium repens* (white clover, Fabaceae), which was reported 15 times. The most species-rich family for this late fall time period was unsurprisingly Asteraceae, which included 27 species on campus (10.5% of all species reported). The genus with the most species was *Polygonum* (Polygonaceae), with nine different species. Approximately half of the reported vascular plant species can be considered weedy species (listed in floristic works on weeds and/or invasive species), either native or non-native. Thirteen of the species found are classified by the USDA as invasive plants in the Northeast.

Although students are often loosely familiar with tree groups, most of the observations of the plants were of forbs (356, 61% of all observations). Students also made many observations of trees, shrubs and vines (129, or 23%). Other groups were less well represented in the collections: 49 observations (8%) were grasses, sedges, or rushes, 24 (4%) were mosses, 15 (2%) were lichens, 4 (1%) were ferns, and one was a liverwort.

As part of the class the students had to hand in 10 pressed herbarium collections from 10 different plant families, and included in these were vouchers for any new species found during the Flora of Rutgers Campus project. Of the total of 310 collections that were handed in (by 31 students), only 33 (11%) collections were incorrectly identified or were lacking critical material that made species identification possible. The genera

that were most frequently misidentified were *Cyperus* (9 collections), *Persicaria* (4), *Plantago* (3), *Setaria* (2), *Digitaria* (2), and *Solidago* (2), which are groups known for being challenging to identify. The *Cyperus* specimens were so difficult to identify using the literature that the CHRBC Collections Manager had to pull reference materials from the main collection for comparison before the teaching assistant was sure about the species identification. Only four collections were misidentified at the generic level and those were in the Asteraceae. The students had access to expert help and floristic literature during all weeks before hand-in of the herbarium collections, and identification was practiced frequently during the indoor regular labs. It should be noted that most students in the class had never keyed out a plant before this class. The student that specialized in mosses and lichens (NH) estimated that her initial identifications were about 40% wrong for lichens and 75% for mosses, when she first started to look at these groups for the project, but then she went to The New York Botanical Garden and was taught there how to identify these correctly.

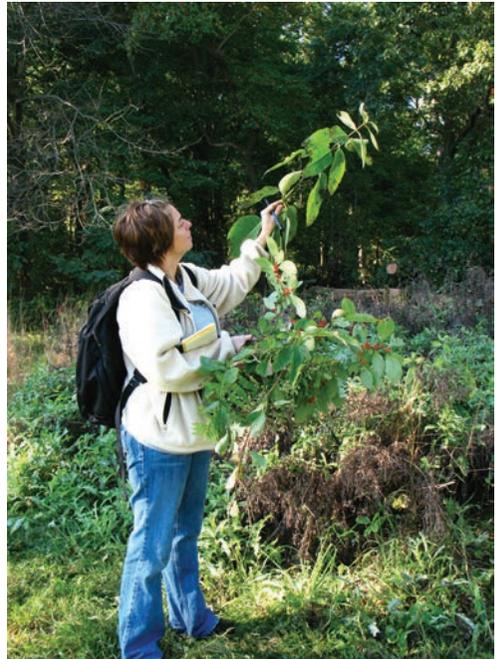


Figure 3. Graduate student April Jackson collecting species of *Asclepias* (milkweed, Apocynaceae) and *Lonicera* (honeysuckle, Caprifoliaceae) behind the old dairy barn on Cook Campus at Rutgers University. Photo by Lena Struwe.

A large majority of students were strongly engaged in the project and spent a large amount of time outside of regular class collecting and determining plants, and then uploading specimen data. We estimate that the time spent outside of the classroom for this project amounts to an average of 6-8 hours per student, with some students exceeding this average by far. The most active student (NH) put in over 60 hours outside the classroom.

The students visited many different parts of campus for the project. As expected, most of the observations were recorded close to the lab building (Foran Hall). The distance to Helyar Woods is 0.9 miles (1.6 miles following roads) and predictably most students did not visit this area but stayed closer to home. The types of habitats in which students recorded observations included: mixed hardwood forests and patchy wood lots (21% of observations); campus lawns and landscaped areas (20%); weedy parking lots, roadsides, and sidewalks (15%); pond edges and stream banks (7%); garden plots and agricultural areas (7%); abandoned meadows and fields (6%); and aquatic habitats (2%). Twenty two percent of observations did not include adequate habitat information to classify their habitat type. Twenty-two of the students (69%) submitted more than the 10 required observations. Only the professor (LS) got poison ivy dermatitis and the project as a whole provided a great learning experience to the students of the class.

Critical non-plant related skills learned during this class included species collection techniques, photography and resizing of digital images, and the basics of georeferencing and GPS use, including understanding latitude and longitude data and uncertainty in GPS coordinates. All students in the class quickly learned that the longitude of New Jersey needs to be negative, or their specimens would end up in Kazakhstan on the Google Map in the flora list portal (Figure 4).

At the end of the class when the points were tallied up, it was clear that the winner was the student that had largely focused on bryophytes and lichens (i.e., Natalie Howe, co-author on this paper). Her work led to a large swath of new families and genera and a large lead compared to other students working mostly with vascular plants. She ended as the winner with 809 points total, based on 59 uploaded observations, and won the three subcategories of most new families, genera, and species reported. The runner-up (Clayton Leadbetter) reported the most species and most

genera within vascular plants, accumulating 499 points, based on 54 observations. He also won the category of 'fastest point gain' when he went from 0 to 315 points in 10 days half-way through the semester.

BROADER IMPACTS AND CONCLUSIONS

Our learning goals for this project were accomplished by most of our students, and are listed here:

- strongly increase knowledge of and interest in local plants
- gain essential botanical skills in field identification, inventorying, and data management
- gain critical spatial skills in georeferencing and GPS use
- heighten appreciation and understanding of the biodiversity of semi-natural and urban landscapes
- increase ability to 'see' plants everywhere, especially in human-influenced habitats
- work cooperatively even when competing

In addition to these personal goals for individual students, this project provided the start of a long-term dataset that can be used both as an educational tool in future classes, as well as for ecological and biodiversity research on campus. It is the first floristic biodiversity inventory of any Rutgers campus, at a university that is nearly 250 years old, and is the beginning of building a database of the flora and its ecology and biodiversity to be used in future classes and research.

A project of this kind is a perfect example of how a college campus can become a living laboratory, field station, and specimen exhibit, right outside the classroom doors. The fact that students were able to record 110 observations of wild plants on the lawns and landscaped areas of campus, suggests that most college campuses will harbor unanticipated plant diversity, even if they aren't associated with old growth forests or wetland areas. Additionally, the fact that 121 of the observations were in wooded areas, and over half of those (66) were in the old growth forest area far from the main campus, suggests that projects of this type encourage students to spend time in natural areas that they might not have otherwise visited. After the class was over in 2011, it was clear that most students loved finding new species and exploring the botanical diversity outside the classroom.

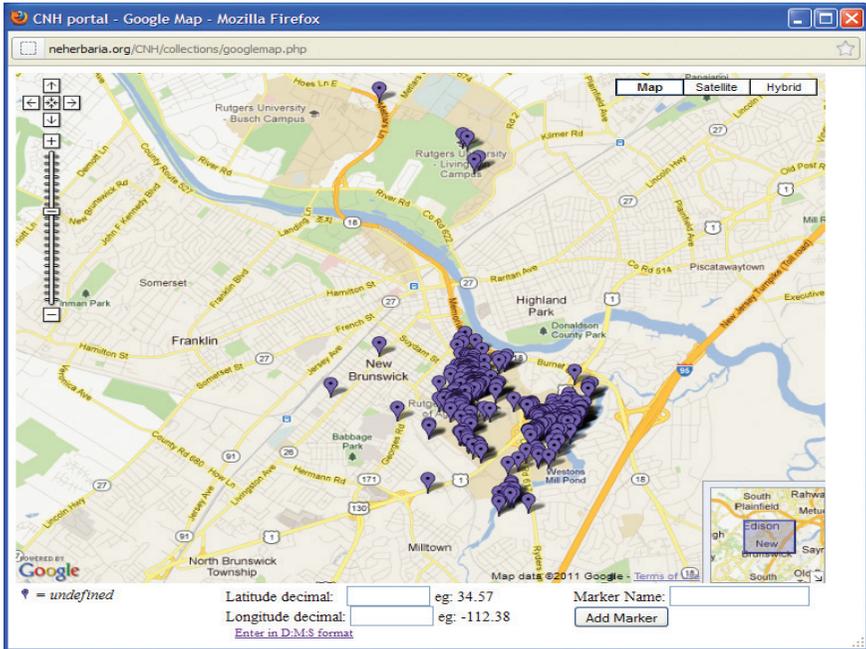


Figure 4. Map view in Google map of all collections and observations uploaded to the Flora of Rutgers Campus project. The map is centered over New Brunswick, NJ, and Raritan River crosses the map from northwest to east. Interstate 95 (aka NJ turnpike) is the highway a few miles to the east side of Cook/Douglass Campus.

This project strongly increased the students' knowledge of local plants, heightened their appreciation of the natural or human-disturbed world and their university campus, opened their eyes to 'see' plants everywhere, and encouraged students to work cooperatively.

Another feature of our findings is that it is ultimately important to make the plant groups accessible to students by providing accurate and straightforward keys and to have access to experts to verify tentative identifications. Particularly in the moss group, most of the original student identifications were incorrect even after using the dichotomous key, so having a verification step was key to maintaining an accurate and useful database.

At the time of the submission of this article (Fall 2013), we are running the Flora of Rutgers Campus project with 34 new students and the same incentives and learning goals. We have also expanded the flora area to all five campuses in New Brunswick, New Jersey, so we have increased the habitat diversity as well as area size significantly. The students are building on the database we started in 2011, and we expect to find new species, new

populations, and new campus areas that show high levels of biodiversity this year. We are also letting students develop small field identification guides to difficult groups or genera, which will build up a library of online tools for local plant identification.

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APPENDIX 1.

Species list from Flora of Rutgers Campus project as of December 2011. These species were all found in the field by students in the Plant Systematics class. A total of 259 species in 200 genera and 98 families were found, and non-seed plant groups are indicated in parentheses after family names below.

ADOXACEAE

Viburnum acerifolium
Viburnum dentatum

ALTINGIACEAE

Liquidambar styraciflua

AMARANTHACEAE s.str.

Amaranthus hybridus
Amaranthus retroflexus

AMARYLLIDACEAE s.lat. (ALLIACEAE s.str.)

Allium oleraceum
Allium schoenoprasum

AMBLYSTEGIACEAE (MOSESSES)

Leptodictyum riparium

ANACARDIACEAE

Rhus aromatica
Rhus typhina
Toxicodendron radicans

ANNONACEAE

Asimina triloba

ANOMODONTACEAE (MOSESSES)

Anomodon attenuatus
Anomodon rostratus

APIACEAE

Daucus carota

AQUIFOLIACEAE

Ilex laevigata
Ilex opaca
Ilex verticillata

ARACEAE

Arisaema triphyllum
Lemna minor
Peltandra virginica
Symplocarpus foetidus

ARALIACEAE

Hedera helix

ASCOMYCOTA (LICHENS)

Amandinea polyspora
Candelaria concolor
Cladonia chlorophaea
Cladonia coniocraea
Cladonia cristatella
Flavoparmelia caperata
Lecanora strobilina
Parmelia sulcata
Parmotrema perforatum
Peltigera didactyla
Physcia millegrana
Punctelia caseana
Pyrrhospora varians

ASPARAGACEAE

Maianthemum racemosum

ASPLENIACEAE (FERNS)

Asplenium platyneuron

ASTERACEAE

Achillea millefolium
Ageratina altissima
Ambrosia artemisiifolia
Anthemis arvensis
Arctium minus
Artemisia ludoviciana
Bidens bipinnata
Bidens frondosa
Cichorium intybus
Cirsium vulgare
Conyza canadensis
Erechtites hieracifolia
Erigeron annuus
Eupatorium dubium
Eupatorium serotinum
Eurybia divaricata
Euthamia graminifolia

<i>Galinsoga quadriradiata</i>	CANNABACEAE	CYPERACEAE
<i>Helianthus annuus</i>	<i>Celtis occidentalis</i>	<i>Cyperus esculentus</i>
<i>Hieracium flagellare</i>	<i>Humulus japonicus</i>	<i>Cyperus microiria</i>
<i>Matricaria discoidea</i>		<i>Cyperus strigosus</i>
<i>Mikania scandens</i>	CAPRIFOLIACEAE	<i>Scirpus cyperinus</i>
<i>Senecio vulgaris</i>	<i>Lonicera japonica</i>	
<i>Solidago canadensis</i>	<i>Lonicera maackii</i>	DENNSTAEDTIACEAE
<i>Solidago gigantea</i>		(FERNS)
<i>Solidago rugosa</i>	CARYOPHYLLACEAE	<i>Dennstaedtia punctilobula</i>
<i>Taraxacum officinale</i>	<i>Cerastium pumilum</i>	
	<i>Silene latifolia</i>	DICRANACEAE (MOSESSES)
BALSAMINACEAE	<i>Spergularia rubra</i>	<i>Dicranella heteromalla</i>
<i>Impatiens capensis</i>	<i>Stellaria media</i>	<i>Thuidium delicatulum</i>
BERBERIDACEAE	CELASTRACEAE	DITRICHACEAE (MOSESSES)
<i>Berberis thunbergii</i>	<i>Celastrus orbiculatus</i>	<i>Ceratodon purpureus</i>
	<i>Euonymus alatus</i>	
BETULACEAE	CEPHALOZIACEAE	DRYOPTERIDACEAE
<i>Alnus serrulata</i>	(MOSESSES)	(FERNS)
<i>Betula alleghaniensis</i>	<i>Cephalozia lunulifolia</i>	<i>Dryopteris marginalis</i>
<i>Betula nigra</i>		
<i>Carpinus caroliniana</i>	CERATOPHYLLACEAE	EBENACEAE
<i>Ostrya virginiana</i>	<i>Ceratophyllum demersum</i>	<i>Diospyros virginiana</i>
BIGNONIACEAE	CHENOPODIACEAE	ENTODONTACEAE
<i>Catalpa speciosa</i>	(AMARANTHACEAE s. lat.)	(MOSESSES)
	<i>Chenopodium album</i>	<i>Entodon seductrix</i>
BRACHYTHECIACEAE		
(MOSESSES)	CLETHRACEAE	ERICACEAE
<i>Brachythecium plumosum</i>	<i>Clethra alnifolia</i>	<i>Vaccinium pallidum</i>
<i>Brachythecium populeum</i>		
BRASSICACEAE	COMMELINACEAE	EUPHORBIACEAE
<i>Alliaria petiolata</i>	<i>Commelina communis</i>	<i>Acalypha rhomboidea</i>
<i>Capsella bursa-pastoris</i>		<i>Acalypha virginica</i>
<i>Cardamine hirsuta</i>	CONVOLVULACEAE	<i>Euphorbia maculata</i>
<i>Lepidium virginicum</i>	<i>Ipomoea hederacea</i>	<i>Euphorbia vermiculata</i>
<i>Sinapis arvensis</i>	<i>Ipomoea purpurea</i>	
<i>Sisymbrium officinale</i>		
BRYACEAE (MOSESSES)	CORNACEAE	FABACEAE
<i>Bryum capillare</i>	<i>Cornus amomum</i>	<i>Cercis canadensis</i>
<i>Bryum pseudotriquetrum</i>	<i>Cornus florida</i>	<i>Gymnocladus dioicus</i>
		<i>Medicago lupulina</i>
		<i>Medicago sativa</i>
		<i>Robinia pseudoacacia</i>
		<i>Trifolium campestre</i>
		<i>Trifolium pratense</i>
		<i>Trifolium repens</i>
CABOMBACEAE	CUCURBITACEAE	FAGACEAE
<i>Cabomba caroliniana</i>	<i>Cucumis anguria</i>	<i>Fagus grandifolia</i>
	<i>Sicyos angulatus</i>	<i>Quercus alba</i>
		<i>Quercus palustris</i>
		<i>Quercus rubra</i>
CALYCANTHACEAE	CUPRESSACEAE	
<i>Calycanthus floridus</i>	(CONIFERS)	
	<i>Juniperus virginiana</i>	
CAMPANULACEAE		
<i>Lobelia inflata</i>		

GEOCALYCEAE (LIVERWORTS) <i>Lophocolea minor</i>	MALVACEAE <i>Abutilon theophrasti</i> <i>Althaea officinalis</i> <i>Hibiscus trionum</i> <i>Malva neglecta</i>	<i>Linaria vulgaris</i> <i>Plantago lanceolata</i> <i>Plantago major</i> <i>Plantago rugelii</i>
GERANIACEAE <i>Geranium carolinianum</i>	MNIACEAE (MOSESSES) <i>Plagiomnium cuspidatum</i>	PLATANACEAE <i>Platanus occidentalis</i>
HAMAMELIDACEAE <i>Hamamelis virginiana</i>	MOLLUGINACEAE <i>Mollugo verticillata</i>	POACEAE <i>Digitaria ciliaris</i> <i>Digitaria ischaemum</i> <i>Digitaria sanuinalis</i> <i>Echinochloa muricata</i> <i>Leersia oryzoides</i> <i>Panicum virgatum</i> <i>Phragmites australis</i> <i>Poa autumnalis</i> <i>Setaria faberi</i> <i>Setaria glauca</i> <i>Setaria pumila</i> <i>Setaria viridis</i> <i>Tridens flavus</i>
HEDWIGIACEAE (MOSESSES) <i>Hedwigia ciliata</i>	MORACEAE <i>Ficus carica</i> <i>Maclura pomifera</i> <i>Morus alba</i>	
HYPNACEAE (MOSESSES) <i>Hypnum imponens</i> <i>Platygyrium repens</i> <i>Pseudotaxiphyllum elegans</i>	MYRICACEAE <i>Morella pensylvanica</i>	
IRIDACEAE <i>Iris versicolor</i>	NYMPHAEACEAE <i>Nymphaea odorata</i>	
JUBULACEAE (LIVERWORTS) <i>Frullania eboracensis</i>	OLEACEAE <i>Fraxinus americana</i> <i>Fraxinus pennsylvanica</i> <i>Ligustrum vulgare</i>	POLYGONACEAE <i>Fallopia japonica</i> <i>Persicaria longiseta</i> <i>Polygonum arenastrum</i> <i>Polygonum aviculare</i> <i>Polygonum cespitosum</i> <i>Polygonum cespitosum</i> var. <i>longisetum</i> <i>Polygonum cespitosum</i> var. <i>cespitosum</i> <i>Polygonum lapathifolium</i> <i>Polygonum pensylvanicum</i> <i>Polygonum perfoliatum</i> <i>Polygonum persicaria</i> <i>Rumex obtusifolius</i>
JUGLANDACEAE <i>Carya glabra</i> <i>Carya ovata</i> <i>Juglans nigra</i>	ONAGRACEAE <i>Ludwigia palustris</i>	
JUNCACEAE <i>Juncus tenuis</i>	OROBANCHACEAE <i>Epifagus virginiana</i>	
LAMIACEAE <i>Collinsonia canadensis</i> <i>Glechoma hederacea</i> <i>Lamium amplexicaule</i> <i>Lamium purpureum</i> <i>Lycopus</i> sp. <i>Prunella vulgaris</i>	OXALIDACEAE <i>Oxalis stricta</i>	
LAURACEAE <i>Lindera benzoin</i> <i>Sassafras albidum</i>	PAULOWNIACEAE <i>Paulownia tomentosa</i>	
LESKEACEAE (MOSESSES) <i>Leskea gracilescens</i>	PHRYMACEAE <i>Mazus pumilus</i>	POLYTRICHACEAE (MOSESSES) <i>Atrichum angustatum</i> <i>Pogonatum pensilvanicum</i> <i>Polytrichum commune</i>
MAGNOLIACEAE <i>Liriodendron tulipifera</i> <i>Magnolia tripetala</i>	PINACEAE (CONIFERS) <i>Pinus strobus</i>	PONTEDERIACEAE <i>Heteranthera reniformis</i> <i>Pontederia cordata</i>
	PLANTAGINACEAE <i>Callitriche heterophylla</i> <i>Chelone glabra</i>	PORTULACACEAE <i>Portulaca oleracea</i>

PRIMULACEAE

Anagallis arvensis
Lysimachia quadrifolia

RANUNCULACEAE

Ranunculus hispidus

ROSACEAE

Duchesnea indica
Photinia pyrifolia
Prunus serotina
Pyrus calleryana
Rhodotypos scandens
Rosa canina
Rosa multiflora
Rubus pensilvanicus
Rubus phoenicolasius

RUBIACEAE

Cephalanthus occidentalis
Galium mollugo

SAPINDACEAE

Acer negundo
Acer nigrum
Acer platanoides
Acer saccharinum
Acer saccharum
Aesculus glabra

SCROPHULARIACEAE

Verbascum thapsus

SIMAROUBACEAE

Ailanthus altissima

SMILACACEAE

Smilax rotundifolia

SOLANACEAE

Datura stramonium
Physalis philadelphica
Solanum carolinense
Solanum dulcamara
Solanum ptycanthum

TYPHACEAE

Typha latifolia

URTICACEAE

Boehmeria cylindrica
Pilea pumila

VIOLACEAE

Viola blanda
Viola cucullata
Viola sororia

VITACEAE

Ampelopsis brevipedunculata
Vitis vulpina

WOODSIACEAE (FERNS)

Athyrium filix-femina
Cystopteris tenuis



BOOK REVIEWS



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ECONOMIC BOTANY

The Genus *Tulipa*: Tulips of the World

Diana Everett

2013. ISBN-13: 978-1-84246-481-6

Cloth, US\$112.00. 380 pp.

Kew Publishing, Royal Botanic Gardens,
Kew, Richmond, United Kingdom

Artist Diana Everett has assembled an annotated compendium of tulips by way of a travelogue, commencing with her paintings of tulips from her time as a student at the Chelsea Physic Garden, and expanded through her travels to diverse regions where tulips occur in the wild. She enriched her collection of drawings and photographs with information about synonymy, description, distribution, flowering, and in some cases chromosome number. Everett's explanatory text is expanded with chapters about current molecular phylogenetics and classification of *Tulipa* by Kew botanists Michael Fay and Maarten Christenhusz, and about tulip cultivation by Richard Wilford.

Each species is illustrated with the author's botanical paintings and a color photograph of the plants in habitat. There are several appendices, preceded by a two-page glossary and a four-page bibliography, which represents only a slight measure of the vast literature about *Tulipa*. Appendix 1 is an alphabetical checklist of the genus including synonyms, Appendix 2 gives a summary of Zonneveld's 2009 sectional classification of the

genus, Appendix 3 is a list of nurseries stocking tulips, and Appendix 4 provides biographical notes on select "prominent *Tulipa* authors, collectors and growers"; these are followed by an index to species names. The taxonomic treatment of accepted species (Christenhusz et al., 2013) follows the arrangement of the species into subgenera defined by Veldkamp and Zonneveld (2012). For a user, however, finding a given species is somewhat inconvenient because tulip species names are not arranged alphabetically throughout; yet this volume's arrangement is somewhat artificial because, as the author herself points out [p. 1], there have been many revisions of tulip nomenclature and classification; new studies generate varying opinions with regard to subgenera (e.g., Eker et al., 2014).

The chance choice of tulips as the subject of the painting portfolio for Everett's diploma subsequently led her to hunt tulips in the mountains and steppes of Central Asia: Afghanistan, Armenia, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, and Uzbekistan. Her geographic range expands the more restricted botanical survey of tulips by Tojibaev and Kadirov (2010), for which Everett served as translator. Her dramatic photographs of species growing in situ are a study of contrasts between the surrounding drabness of the steppe in early spring and the deep crimson and gold of the tulip. *The Genus Tulipa* is well illustrated with scenic views of little-known regions photographed in the course of Everett's field trips. For the botanist-reader, it would have been beneficial to include information about the ecology and conservation of each species.

Comparing this book with a related horticultural-botanical survey, *The Genus Lavandula* (Upson and Andrews, 2004), also published for Kew, the latter raises issues in biogeography, cites more detailed studies, and shows linkages between disparate parts of the Old World. It takes account of chromosome numbers. It too is beautifully illustrated with color plates throughout the book, including 31 full-page color paintings, close-up color photographs, 45 line drawings, and numerous distribution maps. *The Genus Lavandula* includes the results of phylogenetic studies that provide sequence data for hypotheses of relationships at the sectional level within the genus.

The Genus Tulipa is disappointing for several reasons. It does not provide a high degree of confidence in the major groupings of species. John Parkinson (1567–1650), a historically significant English herbalist, gardener, and pharmacist who contributed a sizeable number of pre-Linnaean descriptions of tulips, is not mentioned on a single page. Parkinson apprenticed as an apothecary and was an important member of the Society of Apothecaries from its foundation in 1617, being awarded the title of ‘botanicus regius primarius’ by Charles I. Later in life, he produced his own herbal, *Theatrum botanicum*, but his real passion was his garden at Long Acre in London. *Paradisi in sole paradisius terrestris* (Parkinson, 1629) captures his delight in his garden exquisitely. Although Parkinson’s descriptions pre-date Linnaeus (1753) and therefore have no nomenclatural standing, it is of huge interest to this writer that Parkinson (1629) described a species named *Tulipa armeniaca*, perhaps due to its geographic origin, but equally plausibly for the color of its flower. That name reappears in the literature as a synonym of *T. montana* Lindl. (Baker, 1883) described by Lindley (1827). Haybusak [Armenian Plants, an encyclopedia] (Alishan, 1895: 283–284) gives details about tulip, under the name *gagach*. Because this source would be inaccessible to most readers, a literal translation is provided here:

“It is a flower known in many varieties and many beautiful colors. In springtime one is delighted by the sight of them, not only in gardens but (perhaps even more) in uncultivated places. It is one of the principal wild flowers [in Armenia] to the point that some believe that it was the tulip that Christ Our Lord pointed out as the wild lily (shushan vayreni). Because of its many colors, Saladzoret’si [the poet] sings: “Red tulip, white and yellow...” Despite

the laudable and desirable circumstance of its many types and colors, [the tulip] is not said to have any uses in the Medical Books, especially since when [such books] were written down, the types of tulip were not so widespread, since [the variety mentioned in the Medical Books] was brought from afar. Although [medieval physicians such as] Beytar and Amirdovlat mention it under the eastern name of Leashe, [this variety of tulip which they describe] was foreign and unknown. ‘It is a plant which comes from the Maka area and aids in digestion...good for the stomach.’ Latin *Tulipa*, French Tulipe and Russian Shushan/Tulip is a word which derives from Persian Tyulpent since it was brought to Europe in the 16th century from the Turks and the Tatars.

“Now as for our own Armenian variety, it is restricted to our nation, since it appears to be a native, indigenous flower and there are also variations on its name such as karkajanats, which have related meanings such as “bright/glittery/iridescent/shining” or “multi-colored.” Numerous types are recalled under their Latin name *Oculus Solis* (Arm. Arevak – “eye of the sun”), in the Sinjar mountains. Among those [tulips] designated mountainous, is a particular one called Armenian, *T. armeniaca*, known at Van, Baghesh [present-day Bitlis], Karin [present-day Erzeroum], the banks of the [upper] Euphrates, and other areas; *T. gesneriana* Minor, in Karin, Tsanax, and elsewhere; *T. eichleri*, in Shamaxi; *T. suaveolens* in the Caucasus; *T. pulchella* (Arm. Geghazan) in the highlands of Cilicia at an elevation of 6500–8000 feet; *T. violacea* (Arm. Manishagoyñ) among the Caspian Talysh; *T. bibersteiniana*, in the environs of Tiflis. Without recalling a specific type (which had not been determined then) at the beginning of the last century [18th c], Chemelli, the Italian topographer rapturously recalls tulips observed at Mzhnkert in Basen and in the hamlets of Xorasan which could become charming adornments to European gardens. The colors recalled by Saladzoret’si [in his poem above] today are called different types: Red Tulip, Mor Tulip, and Siwt’ma Tulip, which I do not know what is designated.”

Parkinson (1629: 54) included *Tulipa armeniaca* among the class of early tulips: “This small *Tulipa* is much differing from all the former (except the small or dwarfe white *Tulipas* remembred by Lobel and Clusius, as is before set downe) in that it beareth three or foure small, long, and somewhat narrow greene leaves, altogether at one joynt or

place; the stalke being not high, and naked or without leaves from them to the toppe, where it beareth one small flower like unto an ordinary red *Tulipa*, but somewhat more yellow, tending to an Orange colour with a blacke bottome: the roote is not much bigger than the ordinary yellow *Bolonia Tulipa*, before set downe.”

According to Francis (2014), “Parkinson provides an early modern example of the benefits of interdisciplinary study: perhaps the reason he was such a skilful and meticulous apothecary was because he was also a passionate and knowledgeable gardener.” Parkinson is a link between the older texts treating plants from the point of view of their utility, and the horticultural literature produced in the later 17th and 18th centuries.

Visually pleasing, *The Genus Tulipa* will appeal to gardeners, tulip enthusiasts, botanical libraries, and botanical artists.

–Dorothea Bedigian, *Missouri Botanical Garden, St. Louis, Missouri, USA. dbedigian@yahoo.com*

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Sustainable Landscaping: Principles and Practices

Marietta Loehrlein

2014. ISBN-13: 978-1-4665-9320-6

Cloth, US\$89.95. 305 pp.

CRC Press, Taylor and Francis Group, Boca Raton, Florida, USA

Landscaping has emerged as an important industry over the past five decades and as an art form that has monumental influences on the human mind and aesthetics. As a significant source of employment for architects, landscape designers and contractors, professional gardeners, and builders, landscape design is experiencing a new surge of conceptual changes and paradigm shifts in the basic philosophy behind it, making it more environmentally friendly and relevant to our modern lifestyle. Consequently, the lack of a comprehensive recent textbook for this emerging discipline has become a serious deficiency.

The current volume, *Sustainable Landscaping: Principles and Practice*, fills this vacuum with a comprehensive textbook that captures these paradigm shifts in a reader-friendly fashion. The volume points out the important challenges faced from the perspective of sustainability and provides viable solutions with sound, environmentally friendly approaches. The suggested solutions provide food for thought for designers, managers, builders, and researchers of sustainable landscaping, such as sustainable management of available

resources; minimizing waste generation; utilization of storm water; dealing with challenges of different water parameters for assessing water quality and quantity; use of integrated pest management and organic manures; assessing and conserving soil, water, and energy in the design process; utilizing plants judiciously across different seasons for adding optimal value to the redesigned landscape from the perspective of better economics; environment friendliness; and long-term sustainability in the design process, to mention only a few.

The current volume is divided into 15 chapters approaching sustainable landscape from multiple perspectives in philosophical, fundamental, and applied terms. Topics include wind and solar energy conservation, water issues and water conservation, management of excess water in the landscape, soil health, sustainable fertilization, improving landscape soils with organic matter, pesticides in the landscape, integrated pest management, different energy sources and uses, application of different tools and equipment, and sustainable landscape materials and products. Individual chapters are divided into different thematic sections and subsections with clearly stated objectives and definitions of key terminologies at the beginning, and ending with a short summary of the chapter content along with a useful bibliography.

Within each chapter, the author has provided solid justification and arguments for each approach, provided a workable background for the reader to comprehend different issues, and highlighted pros and cons in a simple language that is easily understandable by general landscape enthusiasts as well as by highly trained professionals from the discipline. The careful use of pictures, images, word diagrams, and summary tables further enhances the information content of each chapter. The only criticism is that the arrangement of different topics appears to be rather haphazard, and it would have been nice if the chapters had been grouped in sections with broader thematic concepts.

The volume also includes two appendices, one providing useful tips for sustainability audits that would certainly be helpful for landscape managers and designers in evaluating the success and failure of projects and the other a helpful compilation of important websites used as resources in the current volume. The author indicates that the targeted readership includes landscape designers and architects, contractors, gardeners, and builders. The volume will be also useful as a standard text

for upper-division undergraduate and graduate students and would be helpful for enthusiasts interested in learning about sustainable landscape design.

—Saikat Kumar Basu, University of Lethbridge, Lethbridge, Alberta, Canada.

New Lives for Ancient and Extinct Crops

Paul E. Minnis, editor

2014. ISBN-13: 978-0-8165-3062-5

Hardcover, US\$65.00. vi + 275 pp.

University of Arizona Press, Tucson, Arizona, USA

This volume provides a look at the subject from the viewpoint of the archaeologist. The editor has arranged for 15 experts (not including himself) to contribute treatments on plants as diverse as *Iva annua* (sumpweed; Asteraceae) to *Maranta arundinacea* (arrowroot; Marantaceae). And this is not to scant excellent treatments on *Phalaris caroliniana* (maygrass; Poaceae), *Hordeum pusillum* (little barley), and *Vicia ervilia* (bitter vetch; Fabaceae), and several others. It should be mentioned that species of both the Old and the New World are treated.

Following a thoughtful Introduction from the editor, the format of each chapter is a survey of the taxonomy of the plant, followed by a very detailed survey of the archaeological evidence of the plant's prior cultivation, and concluding with comments on how, where, and why cultivation of the species in question might be resumed. The "extinct crop" of the title is a large-fruited race of *Iva annua*.

For many of the species, the authors have prepared maps, with the archaeological sites indicated beside modern highways and place names; for some species, continent-wide maps are used to show the sites. Occasionally, the going is a bit hard, when authors use certain highly specialized terminology—for example, with respect to dates, the abbreviations (or acronyms?) cal. and cal* are used on p. 213. I have been unable to find out the meanings. But these are trivial interruptions in the flow of the argument. Each of the nine chapters of this book has its own "References Cited," blessedly free of abbreviations. There is a comprehensive index to the entire volume.

Salvia hispanica (chia; Lamiaceae) is treated in

Chapter 6; there is an especially detailed treatment of how artificial selection for certain horticultural traits might have proceeded. The Mexican origin of Chia Pets, ubiquitous on television at the Christmas season, is explained here, although without explicit mention of the product. The one-seeded nutlets have many other modern uses, including *agua de chía*, said to be very popular in Mexico today.

A continuing theme of the varied chapters in this book is that many ancient crops were very labor intensive; it may be inferred that their cultivation was abandoned when alternative foods became available. This seems to be especially the case with *Panicum sumatrense* (Poaceae), one of the “small millets” in the Indian subcontinent. It is today a crop for only the poorest of the poor. All the authors eschew mention of just how these ancient crops might be integrated into today’s agricultural world. And wisely so, I think, because such matters are enormously complex and outside the expertise of the authors.

The credentials of the authors are given very briefly on pp. 269–270, without postal or e-mail addresses. They are easily found on Google.

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SYSTEMATICS

Conifers around the World: Conifers of the Temperate Zones and Adjacent Regions, Vols. 1–2

Zsolt Debreczy and Istvan Rác
2011. ISBN-13: 978-963-219-061-7
Cloth, \$250.00. 1,089 pp.

DendroPress, Budapest, Hungary.
<http://conifersaroundtheworld.com/>

If you love plants, you need to own this book. *Conifers around the World* is a massive two-volume compendium of the conifers of the northern and southern temperate region. At over 1,000 pages, 3700 color photographs, 1,300 line drawings, and 470 range maps, it is easily the most complete, if not taxonomically comprehensive, treatment of conifers that has ever been published. It covers 56 of the 70 extant conifer genera, excluding only those that occur outside of the temperate

zone (broadly defined). The online Gymnosperm Database (<http://www.conifers.org>) is certainly more taxonomically comprehensive, but it seems unfair to compare online and print treatments and I will not undertake a full comparison in this review.

The structure and layout of *Conifers around the World* is impressive, the photographs are of extremely high quality, and the pen-and-ink drawings are beautifully executed. (Sample pages available at: <http://conifersaroundtheworld.com/samplepages/>.) The authors’ attention to detail and their ability to convey complex taxonomic concepts with clarity make this book the envy of anyone who has attempted to write taxonomic descriptions.

The geographical coverage of the two volumes is presented inside the front cover on a pseudocylindrical world projection map with boxes drawn covering the 11 ecological regions covered in the books. A brief table of contents printed on the same page alerts the reader to the order of presentation. This table would be even more useful if it contained starting page numbers for each region so that the reader could quickly find their region of primary interest. The inside back cover contains another world map, this time divided into climatic zones. Inserted graphs show average annual temperatures for representative locations in each of the zones. Having just completed some consulting work where I needed to assemble this type of summary information for several regions, I know how hard it can be to find. Opening this book and finding the information I had just been struggling with laid out neatly on two pages was a revelation. Its placement at the back of the book makes it easy to find and reference while consulting the text. The authors’ attention to detail that is demonstrated through the inclusion of this material is reflected throughout the book.

Turning to the second volume, the inside front cover contains a map of the floristic regions and main vegetation types of the 34 regions recognized by Takhtajan in his 1986 book *Floristic Regions of the World* (University of California Press, Berkeley). The 15 regions whose conifers are discussed in the book are highlighted. The inside back cover contains a final map of the world showing its physical geography and the topography of the ocean floor. The text on this page is from a version of Chief Seattle’s famous 1854 speech, highlighting the fact that conservation themes run throughout both volumes. (Note: Please see <http://www.snopes.com/quotes/seattle.asp> for a discussion of the

authenticity of this version of the speech, and <http://www.synaptic.bc.ca/ejournal/wslibrry.htm#>. for a history of the different renditions of the speech.)

The first 86 pages of Volume 1 are dedicated to introductory material. This material includes a general introduction with information on conservation, classification, morphology, distribution and climate, and a brief survey of the evolution of conifers from the Carboniferous to the present. Some of these sections are very short, but all are very well written and well illustrated.

Family and generic descriptions begin on page 87 and occupy the next 45 pages. The family descriptions are assembled from the literature (cited at the end of the section) by Robert Price, the scientific editor of the volumes. Genus descriptions were written by the authors. These descriptions are illustrated with detailed and absolutely gorgeous pen-and-ink drawings, the only drawings of this sort that appear in the books. One of the really nice things about these drawings is that, instead of scale markers, the images are accompanied by small annotations indicating their magnification. For instance, a drawing of the mature cones of *Abies* (p. 94) bears a small "1/2" in the lower right-hand corner indicating that it is one half life-size. I find these types of scale indications much more useful than the typical scale bars, which are often difficult to interpret, partly because they are seldom sized consistently in all images. I was able to gain a very good idea of the size of the illustrated structures from the scale notations.

Since we are discussing the pen-and-ink drawings, this may be the place to mention one of my few complaints about the book, as it concerns these images. Though the pen-and-ink drawings are absolutely beautiful, they were printed in color so that they appear slightly brown, almost as if they were a tintype or a duotone (Figure 1; cone of *Chamaecyparis obtusa* var. *obtusata* [p. 99, top, drawing B2]). This effect is created by the use of colored as well as black ink on every page when the book was sent to press (Figure 2). This was likely a compromise forced on the authors by the printing house in order to economically allow the book to be printed in color. Essentially every other page of the book, except those containing the pen-and-ink drawings, contains at least one color photograph. Printing the drawings with only black ink would likely have necessitated a separate press run for only these pages, significantly increasing the cost of the book. As much as I understand why the authors

wanted to avoid cost increases on an already expensive book, the reduction in quality of these stunning images is lamentable.

The main body of the book begins on page 133 and continues through the two volumes to page 928 in Volume 2. (Pagination is continuous through the two volumes.) Each section of this portion of the book begins with an overview of the world region, including information on the human history of the region, the geological history, the geographic regions, the climatic zones, vegetation history, and an introduction to the conifers of the region. These introductions are followed by range maps of the included species, which are presented together instead of on the species pages for easy comparison. Again, having just searched for this information for another project, I very much appreciate the ease with which this is made available on these pages. Although these maps are a valuable resource in and of themselves, they would be even more valuable if the authors had made the data available as GIS-accessible files on their website. Easy access to GIS-compliant range maps would have increased the value of the data immeasurably.

The bulk of the book is made up of species description pages. These are arranged alphabetically by species within a region. The family name is given in the top left corner of each page, while the top right corner contains the species name in a much larger font size. At the bottom of the page, the world region is listed so that readers can always be sure of their place in the book. An introduction to the species occurs at the top of the page, followed by a synoptic morphological description. The majority of the page is occupied by photographs. The introduction includes information on the elevational range, a description of the typical habitat including associated species, and distinguishing characteristics from easily confused species. The synoptic descriptions are relatively short but include original observations on size and color, in addition to the more usual information. The arrangement of the plates is semi-standardized, with the largest photograph (of the full plant) usually placed along the cut margin and smaller detail photographs of the leaves and cones along the bound margin. Standardization really helps the reader find relevant information and make comparisons among taxa, so I was happy to see that the authors have used it as much as possible.

The final two sections of the books (Vol. 2) are a Bark Gallery (pp. 929–1004) and an Appendix

(pp. 1005–1037). The bark gallery contains 648 photographs (72 pages with nine images per page), which seems like a large number until you consider the range of variation that needs to be represented. With 541 taxa to cover, this left space for only a few of the most notable variants. The order of arrangement is alphabetical, as in the main text. Scale is indicated on these photographs by a notation in the caption indicating the trunk diameter. I personally do not think that scale is extremely important when considering bark, but if it is included I would have preferred that some other method could have been found. I found it difficult to translate stem diameters into anything meaningful in terms of bark pattern elements.

The appendix contains brief descriptions of 28 taxa that were excluded from the regional chapters for various reasons. Intraspecific taxa are included here, as well as taxa for which the requisite images were not available, and new species that were published after the main sections were completed. A few nomenclatural problems are also dealt with here, in more detail than would have been possible in the main sections.

Conifers around the World is a fantastic book. The authors' love of these plants comes through on almost every page, and is clearly expressed in the introduction. The level of detail is astounding, the photographs are beautiful, the range maps are extremely helpful, the species pages are laid out in a way that makes the information easily accessible, and the 72 pages of bark photographs are unprecedented in any publication of which I am aware. It is an indictment of the publishing industry that this book had to be published privately. No commercial publisher would have allowed the authors the freedom to produce this book. No commercial publisher would have produced something so beautiful.

–Bruce Kirchoff, University of North Carolina at Greensboro, Greensboro, North Carolina, USA

Genera Palmarum: The Evolution and Classification of Palms

John Dransfield, Natalie Uhl, Conny Asmussen, William Baker, Madeline Harley, and Carl Lewis

2008. ISBN-13: 978-1-84246-182-2

Hardcover, \$170.00. xi + 732 pp.

Kew Publishing, Royal Botanic Gardens, Kew, Richmond, United Kingdom.

It appears that this book, originally published in 2008, has undergone a second printing, because the website of the University of Chicago Press notes that it was published in February of 2014.

Officially, this is not the second edition of *Genera Palmarum* by Natalie Uhl and John Dransfield (published in 1987); that is, the title page says nothing to that point. Nonetheless, the authors themselves refer to the 1987 title as “Edition 1” in their introduction (p. vii), and advertising copy from the publisher refers to “the new edition.” And for all practical purposes, it is a new edition, greatly expanded from its predecessor, enhanced with excellent color photography throughout. The full-page line drawings that graced the 1987 work are repeated. The SEM pictures of pollen grains are an addition. The phylogenetic hypotheses are now based on molecular evidence. I think there are only two cladograms in the entire book, however.

Both versions feature a very helpful alphabetical listing of the genera of palms on the inside front and back covers, including both the accepted names as well as the names that are synonymized. The two lists appear to be nearly identical. A notable addition is the genus *Tahina*, which was first published in 2008, when this book was in its final stages of preparation. The genus is named for Anne-Tahina Metz, the daughter of the discoverer of the palm—which one knows because all the accepted generic names are explained or translated, a most useful feature not found in the earlier work. It happens that *Tahina* is a hapaxanthic species; that is, it flowers and fruits once, and then dies. The Greek roots are *hapax*, meaning “once,” and *anthos*, meaning “flower.” One learns that hapaxanthly is fairly widespread in palms, and is to be found in 16 genera representing two (out of five) subfamilies (p. 5).

There is a key to distinguish the subfamilies (p. 137)

and for each subfamily a following key to the tribes, and then a key to the genera (where appropriate). If a taxonomic account of a genus to species level exists, it is cited.

The glossary is a necessary addition to a book like this, because of the specialized terminology of the palm world. This one is unusual because it includes color photographs to illustrate the words.

The work concludes with two indexes; the first is to scientific names, the second to subjects, like hapaxanthly vs. pleonanthly (from *pleo*, meaning “more than once,” and *anthos*, meaning “flower”).

The 1987 edition of *Genera Palmarum* made no claim of permanency, nor does the current (2008) version. The earlier work stimulated a great amount of further work in palms, because it synthesized a vast literature and also pointed out what wasn't known. In short, excellent works like these almost guarantee that a third version will appear a few decades from now.

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A Guide to Orchids of Myanmar

Hubert Kurzweil and Saw Lwin

2014. ISBN-13: 978-983-812-147-7

Paperback, US\$67.00. 196 pp.

Natural History Publications (Borneo), Kota Kinabalu, Sabah, Malaysia

Myanmar (formerly Burma) is a country rich in orchids, but they are not as well known as they should be. One review was published 130 years ago (Parish, 1883). The author, Charles Samuel Pollock Parish (1822–1897), was a British missionary and an accomplished amateur botanist with a special interest in orchids (Anonymous, 1897a). Parish discovered a large number of species, many of which were described individually by H. G. Reichenbach (1823–1889) and later included in an enumeration (Reichenbach, 1874).

The first book on the orchids of Burma (including the Andaman Islands) is by an amateur, Captain Bartle Grant of the Border Regiment and Adjutant of the Rangoon Volunteer Rifles (Grant, 1895). At the time of publication, the book was praised (Anonymous, 1896) by the *Gardeners' Chronicle*:

“Too great praise cannot be bestowed ...[on] Captain Grant's work [which] will be of inestimable service.” But, as the orchid world contains, then as now, petty jealousies, backbiting, animosities, and treachery, the *Orchid Album* decreed that it “will not be of great value” because it “has serious defects” (Anonymous, 1897b). It did not take long for this book to become rare and expensive. (I bought my copy in the late 1960s for a pretty penny.) A reasonable-quality reprint was published in 1966 by the Central Press in Rangoon. As I recall, it cost only US\$2.00 at the official rate of exchange, but the Burmese government prohibited its export (I had to smuggle out my copy).

Over the years, orchids found in Burma were included in several publications and books, but there were no major publications dealing specifically with them. Political instability, regressive regimes, and visa limitations (for many years, visitors were limited to seven-day stays) are the reasons for this. I visited Burma ca. 1970, 1975, and 1979 and was taken to the forests by my friend Saw Han (at that time assistant director of the forestry department), but not being a taxonomist I could only look with amazement at the beautiful orchids and take pictures. Burmese botanists did collect and study the orchids of Burma during that period, but there were few, if any, publications.

Collection of Burmese orchids and publications about them has increased since the regime changes of a few years ago, but this is the first major, internationally published, full-color book on the orchids of Myanmar. The effort is international. One of the authors is an Austrian-born orchid taxonomist stationed in Singapore (Kurzweil); the other is an orchid specialist from Myanmar (Saw Lwin). The publisher is Malaysian (located in Sabah, Borneo) and well known for exquisite books about orchids and other natural history subjects. [Full disclosure: I consider Kurzweil a friend, have met Lwin several times at orchid conferences, and have spent time over a cup of tea with Chan Chew Lun, owner of the publishing house.]

The book is not physically large (21.5 × 15.2 cm and vii + 196 pp.), but it provides a large amount of information. The introduction, illustrated with color and black-and-white photographs, describes briefly, but well, the geography, climate, and vegetation of Myanmar; the orchid flora (affinities to other regions, endemics, structure of roots, stems, and flowers); history of orchidology in the country; and uses of the local orchids. Conservation

is covered by Jacob Phelps (National University of Singapore) in a separate section. This is followed by what seems to be a very useful and usable key of the orchid groups in Myanmar. (I had no opportunity to test it.)

A list of the orchid genera found in Myanmar that are featured in the book is followed by descriptions and illustrations of 116 species (one per page, pp. 51–167). Each description includes two photographs (one of a plant in bloom or an inflorescence bearing flowers, and the other a close-up of a flower), a standard taxonomic description, and indication of habitat and distribution. Pages 168–172 are devoted to an extensive glossary that will be of great benefit for orchid growers and even botanists who work with other plants. The suggested reading list is short (15 entries), but should have been longer. Acknowledgments and photo credits follow. Welcome features are the two indexes (general on p. 176 and scientific names on pp 177–181). The last 14 pages of the book are devoted to a checklist of the Orchidaceae of Myanmar by Paul Ormerod and Hubert Kurzweil. Given that the book does not illustrate all orchids of Myanmar, this checklist is most welcome.

The publication of Grant's book and this one is separated by 119 years, perhaps a record interval between books on the orchids of the same country. Nearly half a century passed from the publication of the reprint of Grant's book and the present volume. Both are a long time, but the excellent content and production of this book make the wait well worthwhile.

I enjoyed placing the original and the reprint of Grant's book, Reichenbach's article, Parish's paper, and this volume next to each other and reading similar descriptions. However, I am sure that this book can be enjoyed all by itself.

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- Joseph Arditti, Professor Emeritus, University of California, Irvine, California, USA

Land of Enchantment Wildflowers: A Guide to the Plants of New Mexico

Willa F. Finley and LaShara J. Nieland

2013. ISBN-13: 978-0-89672-822-6

Paperback, US\$29.95. 352 pp.

Texas Tech University Press, Lubbock, Texas, USA

This is a full-color work, in which some 200 commonly encountered herbaceous plants are pictured and discussed, but not in any usual sense described. There are no keys; one finds one's plant by flower color: red, yellow, green, etc. But the color-tabbed page edges are subtly tinted, and the "red" looks orange to my eye. "White flowers" gets a gun-metal gray tab.

According to Allred (*Flora Neomexicana*, 2008, a work not cited in the bibliography), there are 3696 species of vascular plants in New Mexico, an area about the same size as modern Poland. It's an unavoidable fact that a book that includes only 200 species can scarcely qualify as a guide to the plants of the state.

On Cover 4, the publisher calls this "The New Mexico companion to Lone Star Wildflowers." That title, by these same authors, is similarly subtitled "A Guide to Texas Flowering Plants." Again, the authors must have made some very hard choices as to what to include.

I recall my first plant taxonomy class, when the

professor said “No, we don’t include that in the herbarium—it’s just a weed from Europe.” The present authors do not harbor such silly prejudices, and obvious roadside weeds like Hound’s Tongue, *Cynoglossum officinale*, regularly over a meter tall, are included, along with *Peganum harmala* L., with a delightful story of how it came to be introduced from the Old World.

In lieu of descriptions, the authors explain all the Latin names, give some botanical history where appropriate, and especially feature uses of the plant by Native Americans and early settlers. Toxicity is also mentioned. Many of the plants featured in this book are alleged to be cures for everything from fallen arches to baldness. Wisely, the authors refrain from commenting on the efficacy of such remedies; the obligatory warning about possibly poisoning oneself is on page 5.

A search at amazon.com for “flowering plants of New Mexico” will turn up at least the second and third editions of Flowering Plants of New Mexico, by Robert DeWitt Ivey, which features keys (after a fashion) and copious line drawings. There are no color photographs, but at least one can tell if the leaves are opposite or alternate, which is sometimes tricky in color photographs that concentrate on the flowers themselves. (The search does not turn up the title under review here.)

Pretty much at random, I turned to the account of *Zinnia* (pp. 84–86). The genus is indeed named by Linnaeus in honor of Johann Gottfried Zinn (1727–1759), author of *Catalogus Plantarum Horti Academici et Agri Gottingensis* (1757). Finley and Nieland repeat the tale that Zinn himself travelled to Mexico and collected the seed of what is today the common garden zinnia, *Zinnia elegans* Jacquin, 1789. They may be forgiven, because the story is to be found in many places on the Internet (University of Wisconsin Garden Facts, for example). If only it were true! Linnaeus’ decision to found the genus *Zinnia Systema Vegetabilium* ed. 10, 2: 1221, 1759) was spurred by Zinn’s description (p. 409 and plate 1 in his *Catalogus*) of a kind of “Rudbeckia,” for lack of a better place to put it. Zinn himself expressed considerable doubt as to what genus his plant belonged to and in any case made no comment whatever as to the seed source. Had he travelled to Mexico (a most improbable voyage and trek at that time in history) and personally returned with the seeds, he would surely have said so. Various biographical sketches (both old and modern) of Zinn make no mention of his having travelled to Mexico.

The book concludes with a glossary, a bibliography, and a very thorough index, important in a work that relies on multiple common names. The book will become a favorite of tourists, surely, along with all those who delight in excellent color photographs.

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Red List of the Endemic Plants of the Caucasus: Armenia, Azerbaijan, Georgia, Iran, Russia, and Turkey

James Solomon, Tatyana Shulkina, and George E. Schatz, editors

2014. ISBN-13: 978-0-915279-82-1

Cloth, US\$65.00. 451 pp.

Missouri Botanical Garden Press, St. Louis, Missouri, USA

Realizing the magnitude and importance of the ever-increasing threat to biodiversity, a new global standard in assessing environmental risk—the IUCN Red List of Endemic Plants—was prepared about the Caucasus region, linked to the Red List of Ecosystems. Straddling Europe and Asia and rich in endemic vascular plants, the Caucasus was identified as a biodiversity hotspot designated as a conservation priority in 2003 by the Critical Ecosystem Partnership Fund, part of the global initiative designed to safeguard the world’s rare and threatened species. This publication about the endemic plants of the Caucasus region contains the first floristic analysis of that territory, comprising all of Armenia, Azerbaijan, Georgia, and sections of Iran, the Russian Federation, and Turkey.

The book’s foreword, written by Peter Raven, draws attention to the fact that the biodiversity of the Caucasus region is being lost at an alarming rate. Nearly half of the territory in the hotspot has been transformed by human activities: the unsustainable harvesting of natural resources, including plants, animals and marine species. The loss, degradation, or fragmentation of ecosystems through land conversion for agriculture, forest clearing, and other activities have most heavily impacted the plains, foothills, and subalpine belts. Native floodplain vegetation remains on only half of its original area in the northern Caucasus, and only 2–3% of original riparian forests remain in the southern Caucasus. The major threats to biodiversity in the region are illegal logging, fuel wood harvesting,

and the timber trade; overgrazing, poaching, and the illegal wildlife trade; overfishing; infrastructure development; and pollution of rivers and wetlands.

All of the IUCN's Red Listing processes rely on the willingness of experts to contribute and pool their collective knowledge to make the most reliable estimates of species status. Without their enthusiastic commitment to species conservation, this kind of regional overview would not be possible. It identifies those species that are threatened with extinction at the regional level so that appropriate conservation action can be taken to improve their status.

This Red List publication summarizes results for selected vascular plants in the Caucasus. The Red List is a functional tool that will evolve with time as species are reassessed according to new information or situations. It is aimed at stimulating and supporting research, monitoring, and conservation action at local, regional, and international levels, especially for Threatened, Near Threatened, and Data Deficient species. However, this volume leaves out a unit with conclusions and recommendations about which threatened vascular plant species require further conservation actions to improve their status.

The species names included were those contributed by authors from each country; therefore, some omissions are inevitable. Nomenclature is also open-ended: the editors indicate that it is beyond the scope of this volume to resolve the circumscription and application of taxonomic conflicts. Therefore, for example, the name *Iris iberica* Hoffm. utilized in this volume should be revised as *I. iberica* Steven, which has priority of publication, and was applied correctly by Akopian (2010). The editors write that the absence of an "x" indicates that a particular country does not have evidence of the presence of this species, under this name. However, considering the same example, although Turkey does not report "*I. iberica*" (as named in this volume) it is present there; also in the case of *I. iberica*, no subspecies are indicated in this work, although they figure in Akopian (2010).

The book's arrangement follows, more or less, the same pattern for each of the six chapters, each chapter reporting on one of the six nations: [a] opens with a synopsis in the language script (alphabet) of each respective country, augmented with each associated nation's flag; [b] an introductory environmental summary preceding the main text: nation's capital, other cities, population,

language, flora, botanical institutions, protected areas; [c] ecology: climate, flora and vegetation, main threats; [d] thematic content: distribution of endemic species within each type of vegetation zone; [e] description of the top 50 species viewed as each country's National Conservation Priorities, followed by a distribution map of each species; [f] succinct bibliography. Printed on thick, heavy-duty paper with a high-gloss finish, the book's 140 photographs are presented with high-quality, bright color vibrancy.

Collectively, the participating authors of each chapter represent the robust scholarship of botany in their respective countries, i.e., sourced from botanical gardens, institutes of botany, or universities. The editors are all current or former research staff at the Missouri Botanical Garden: James Solomon, Associate Curator and Curator of the Herbarium; Tatyana Shulkina, Associate Curator, Former Soviet Union (the Caucasus) Projects; and George Schatz, Curator, Africa and Madagascar, and Project Supervisor, Coordination and Development of Plant Red List Assessments for the Caucasus Biodiversity Hotspot.

An electronic version of this volume would enable it to become a more readily updatable, dynamic, living tool, as opposed to a static hard copy.

Regrettably, one error crept into the text, containing a symbolic and disturbing omission. The opening sentence of the chapter on Turkey, written by Ekim, Terzioğlu, Emanəğaoğlu, and Coşkunçelebi (p. 210) states: "The Caucasian region of Turkey occupies the northeastern portion of the country, bounded on the east by Georgia and Azerbaijan and southeast by Iran." It appears that Armenia was purged from among the countries bordering Turkey. Within the Caucasus region, Armenia shares a border of 268 km with Turkey, Georgia 252 km, Iran 499 km, while Turkey shares no common border with Azerbaijan, aside from a 9-km land bridge ceded by Iran that connects it to Nakhichevan.

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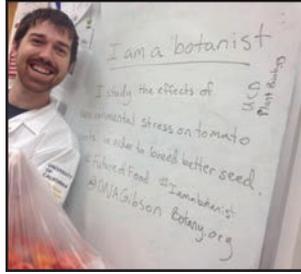
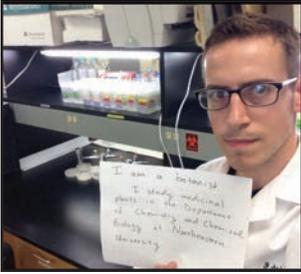
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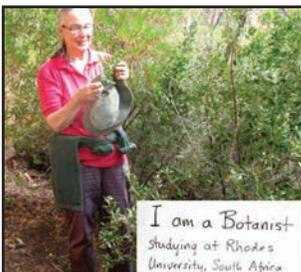
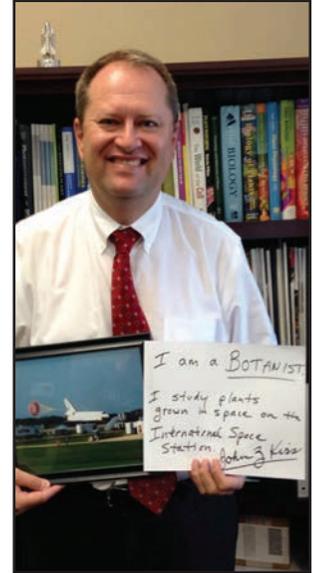
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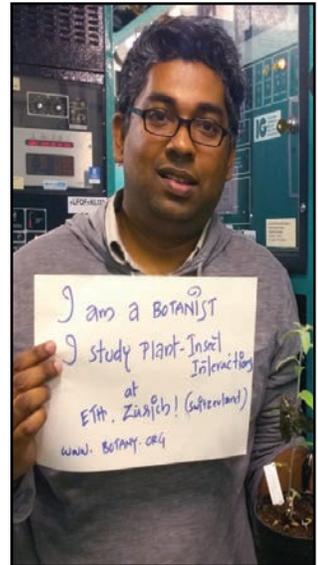




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Vassar College

My students are
jazzed about
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PLANT SCIENCE BULLETIN
FEATURED IMAGES



In September 2014, the BSA launched a social media campaign inviting anyone studying the plant sciences to “reclaim the name” of being a botanist. Botanists from around the world held up signs to show what they study and where they are from, centered around the hashtag #iamabotanist. The field can sometimes appear to be a “quiet science,” and the campaign served as a way for botanists to be recognized, for them to promote their scientific research interests, and to spread the news about the BSA being a home for all botanists, regardless of discipline.



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