

Botany & Conservation

A newsletter for alumni and friends of Botany and Conservation Biology

Spring/Summer 2016



Magnolia x soulangeana (Saucer Magnolia), with Birge Hall and the Greenhouse in background

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to retire

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A global reach



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Joy Zedler to retire: reminiscence of a Botany and UW Arboretum icon

— Steven J. Hall, Assistant Professor, Ecology, Evolution and Organismal Biology, Iowa State University

Joy Zedler is an inspirational mentor and innovative ecologist who has developed and led the interdisciplinary field of adaptive restoration ecology over her impressive career. She showed legions of her graduate students (at least 30 at UW, and many more at San Diego State) how to creatively blend basic science with the practical and messy imperatives of wetland restoration. Her academic work spans several hundred publications, now collectively cited tens of thousands of times, which have directly or indirectly inspired tremendous progress in how we conduct and conceptualize wetland restoration ecology. Joy's impact now stretches through the ecologists she has trained, who span the forefront of restoration practitioners, government and NGO scientists, and academics—both across the U.S. and in Latin America—who continue in her tradition of melding basic and applied research to understand and restore wetlands.

As a student, I was especially struck by Joy's generosity in time and spirit. What other distinguished professor allows an undergraduate to set up shop with a sewing machine in her living room to construct litterbags, or hosts a gathering to construct root in-growth cores for an experiment? Her door was consistently



Joy Zedler with neighbor and longtime co-conservationist Cal Dewitt discussing the past, present and future in the middle of Waubesa Wetland. Photo: David Tenenbaum

open, and she would drop whatever she was doing to graciously help her students through whatever roadblocks—scientific or otherwise—we encountered. We could count on Joy to sketch up a whimsical diagram to help us work through the conceptual dilemmas of the day—I still have a sheaf of these masterpieces of scientific art. Perhaps most influential for me was her devotion to training her students in the craft of scientific writing. Often returning drafts within hours of their receipt, she worked and re-worked manuscripts until our muddled thoughts and data yielded the most compelling narrative possible—efforts far beyond the norm for a “typical” advisor. In the midst of running a large research group, Joy also somehow found time to host gourmet extravaganzas at her home, and to provision lab meetings with legendary baked goods from the backyard brick oven.

Beyond her own productive lab group and service to the scientific community,

Joy donates an enormous amount of time to the conservation arena. She serves and has served on dozens of advisory committees and panels, local, national, and international, that tackle the thorny policy issues of our time. This work has led to major coups in conservation and restoration—the revitalization of Tijuana Estuary, improved standards for compensatory wetland mitigation, and re-integration of science and management at the UW Arboretum, among many others. In her “retirement”, she will continue to help the Town of Dunn protect the Waubesa wetlands from upstream development, advise the management of California's largest estuary (the Bay Delta), continue her long-term plant monitoring in San Diego Bay wetlands, develop training programs for the association of state wetland managers, and prepare long-awaited invited review manuscripts.

This newsletter is published by the Department of Botany at the University of Wisconsin-Madison for alumni, colleagues and friends.

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In Memoriam: Edward (Ed) Wesley Beals (1933-2015)

— Susan Will-Wolf, Senior Scientist emerita, Botany, University of Wisconsin-Madison

Ed Beals, a former Botany Department student and colleague, died on December 27, 2015, in Newberg, Oregon, at age 82.

Ed received his PhD in Botany (ecology) at the University of Wisconsin-Madison in 1961 under Grant Cottam. After four years teaching in Lebanon and Ethiopia, he returned to UW-Madison in 1965 as Zoology faculty with an adjunct appointment in Botany.

Ed's research ranged widely in community ecology, though focused on the Neotropics, with a strong second emphasis on mathematical analysis of ecological data. Over 28 years, he trained as many ecology grad students in Botany as in his home department. Alumni will remember Ed chiefly for his teaching:

developing and team-teaching General Ecology with Grant Cottam, teaching Tropical Ecology, and developing Community Analysis with Tim Allen and Bob Kowal. His pioneering geometric perspective on multivariate statistics was a great help to students, as was his emphasis on choosing appropriate methods.

After retiring from UW-Madison in 1992, Ed continued his commitment to ecological education by teaching at Unity College in Maine for 11 years, then botany and evolution at George Fox University in Newberg, Oregon until 2012. Ed continued his lifelong love of travel, plants and birds with trips in his late 70s to China, Spain and the Falkland Islands (for penguins!). Ed's scientific career was outlasted by a second pursuit,

playing and composing music for the organ. His students and colleagues fondly remember Ed's big parties featuring lively organ renditions including Bach's Toccata and Fugue in D minor as well as less lofty offerings.



Q&A with Ken Keefover-Ring Assistant Professor of Botany and Geography



What are you researching, generally speaking?

I study the variation of plant secondary chemistry, both intra- and interspecific, over various spatial and temporal scales. I then use these patterns to help understand how plant secondary chemistry mediates interactions between plants and other organisms. Thus, my work consists of chemical ecology framed by biogeography.

Tell us about a current project that you're working on and excited about.

Currently, I am involved in a large project looking at biodiversity in the Salicaceae, a dioecious plant family. My part includes examining several *Salix* (willow) and *Populus* (poplar) species to determine whether females and males differ in either floral attraction (scent compounds in insect-pollinated willows) or non-volatile defensive compounds found in both flowers and foliage. Ultimately, we will use this information to try and understand the current patterns of biodiversity in the family, with over 400 species of *Salix* and only about 30 species of *Populus*.

How did you become interested in your field?

I had a love for the natural world from an early age. As an undergraduate I studied biochemistry and chemistry, after which I worked as a chemist in industry. I went back to school to get a graduate degree to become a biologist and get out of chemistry. Once there, I discovered the

field of chemical ecology and that I could do both biology and chemistry.

What's one aspect of your research that you'd like the general public to know more about?

That plants are important because of the incredible diversity of secondary compounds they make. While humans use these chemicals for fragrances and flavors, medicines, and even pesticides; plants have evolved these compounds to help them find mates, deter herbivores, and inhibit other plant competitors.

What's your favorite secondary compound in plants? Why?

Terpenoids. They exist in many plant families where they serve roles from signaling to defense, sometime simultaneously. Most smell great and people easily recognize many of them (for example the smell of lavender or pine resin).

What do you enjoy in your free time?

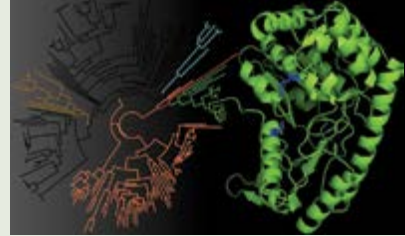
I like to spend time outside, biking, hiking, or cross-country skiing. I like building and fixing things. But mostly, I enjoy spending time with my partner and wife.

Arabidopsis thaliana

EVOLUTION OF ENZYMES

Hiroshi Maeda

Protein structure model of *Arabidopsis thaliana* prephenate aminotransferase. We study the genetic and biochemical variations found in the pathway enzymes across different plant species. Such work can aid both structure-function analysis and plant metabolic engineering.



ALBINO SEEDS

Stacy Anderson, Fernandez Lab

We use mutant plant lines to understand biogenesis of chloroplast membranes. In this young fruit, protein named SecE2, required for *Arabidopsis* seeds to form photosynthetic membranes, is missing. The plants lacking SECE2 have an albino phenotype (white seeds) whereas the non-mutant sibling seeds are able to develop normally (green seeds). PHOTO: DONNA FERNANDEZ



BEETS

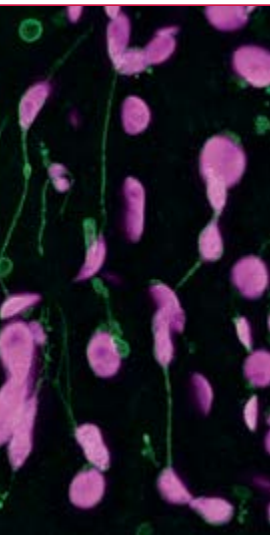
Maeda Lab

Plants produce a diverse array of secondary metabolites, which are derived from primary metabolites such as amino acids. The Maeda Lab investigates the biosynthetic pathway of L-tyrosine, which is an essential aromatic amino acid in the human diet. In plants, tyrosine is a key precursor of many secondary metabolites, including betalain pigments which accumulate in plant families within the order Caryophyllales and give table beet its distinctive color. PHOTO: SARAH FRIEDRICH

CHLOROPLAST MEMBRANE

Marisa Otegui

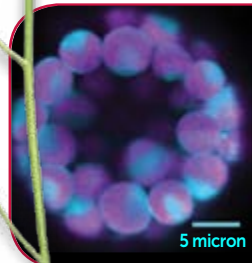
The Otegui lab investigates the regulation of protein and membrane trafficking in plant cells to understand how proteins move between organelles. In this confocal micrograph, we see chloroplasts with their outer envelope decorated with GFP in an *Arabidopsis thaliana* mutant defective in chloroplast division due to the lack of a critical protein for plastid turnover. IMAGE: CRISTOPH SPITZER



CHLOROPLAST PROTEINS

Fernandez Lab

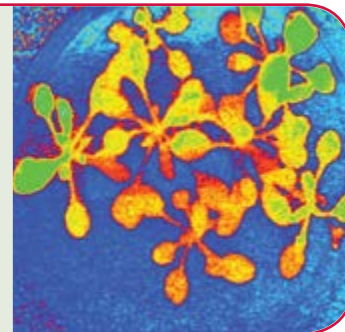
The Fernandez lab studies the targeting properties of chloroplast proteins using fluorescence microscopy. This image depicts our protein of interest (shown in cyan) localizing in the stroma, surrounding the photosynthetic membranes (shown in magenta). IMAGE: RAJNEESH SINGHAL



INFRARED LEAVES

Richard Barker, Gilroy Lab

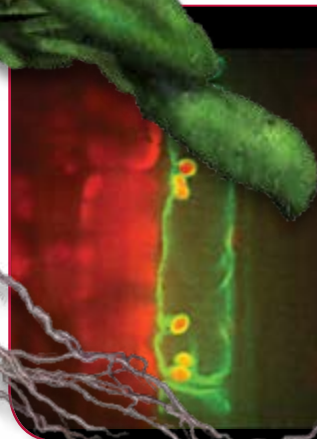
Normalized Difference Vegetation Index (NDVI) photography using visible and near-infrared imagery can provide a non-invasive method to observe plant stress levels, green indicates healthy tissue while yellow and red indicates that plants are diseased.



ROOT TIP GROWTH

Masatsugo Toyota, Gilroy Lab

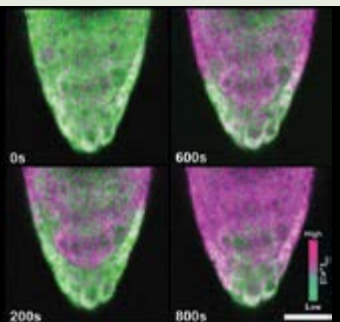
The Gilroy lab is interested in what makes plant roots grow down and shoots grow up. In certain plant cells, heavy starch-filled organelles called amyloplasts (labelled red in this micrograph) tell the plant the direction of gravity. Compressive forces of these organelles affect membranes, such as the vacuolar membrane (labelled green), which may then trigger the cellular response altering distributions of the hormone auxin, the hormone which causes differential growth in plants.



CALCIUM SIGNALING

Richard Hilleary, Gilroy Lab

Plants have an immune system that can distinguish molecules from bacterial pathogens. We investigate the molecular underpinnings of one of the most canonical signaling pathogen responses, influx of calcium into the cytoplasm. This image series depicts the spatiotemporal distribution of calcium influx in root tip cells of *A. thaliana* following treatment with flagellin, a protein important for bacterial motility. An increase in magenta indicates an increase in calcium.



1 Hawaii

Lisa Schomaker, Hotchkiss Lab

A dense mat of *Sphagnum palustre* moss covers the ground of a Hawaiian cloud forest. We study how forest composition and structure may be impacted by the moss's spread.

2,11 California & Colombia

Photos: Pringle Lab, Jacob Golan (CA, U.S.), Natalia Vargas (Colombia)

An invasive population of *Amanita phalloides* in California and *Amanita muscaria* in Colombia are studied to understand the ecology and evolution of fungi in new habitats.

3 Sylvania, Michigan

Kristin Michels, Hotchkiss Lab

Coring on a frozen lake surface in the Sylvania Wilderness. I analyze pollen and charcoal remains in lake sediment cores to learn about the history of vegetation changes in Sylvania across the period of human settlement.

4 Michigan

Ali Paulson, Waller Lab

We study the progress of a hemlock re-growth program across the Upper Peninsula of Michigan aimed at limiting deer herbivory on hemlock seedlings.

5 UW Arboretum

Katie Laushman, Hotchkiss Lab

Katie conducts an earthworm survey in the Arboretum to better understand the distribution of European earthworms as well as a newly introduced genus of earthworms, *Amyntas*.

6 Sheboygan

Rachel Toczydlowski, Waller Lab

Flower of *Impatiens capensis* in a floodplain forest. Rachel is using *I. capensis* to study if rivers help promote genetic

connectivity of plant populations in isolated floodplain forest patches.

7 Harvard Forest, Massachusetts

Anne Pringle

Recording demographic data from a population of *Xanthoparmelia* lichens growing on tombstones of a New England cemetery.

8 South Carolina

Alex Goke, Undergraduate, Conservation Biology

I analyze fecal samples of deer, feral hog, and coyote for seeds of coastal plants of the southeastern U.S. to determine seed dispersal strategies.

9 Mexico

Alex McAlvay, Emshwiller Lab

A Rarámuri woman holds a bundle of freshly harvested Field Mustard used to discourage bolting. I observe collections and plantings of this weedy specimen in Mexico to study domestication-like processes in real time.

10 Haiti

Alfonso Doucette, Cameron Lab

With the Audubon Society of Haiti, I collected orchids for my work on systematics of the orchid subtribe Pleurothallidinae.

12 Bolivia

Eve Emshwiller

Flower of a wild *Oxalis* species related to the Andean tuber crop oca, *Oxalis tuberosa*. I study origins of domestication and polyploidy in this regionally important food crop.

13 Chile

Linda Graham

Giant Equisetum. Marie Trest and Linda Graham use metagenomics to characterize the microbiome of the world's oldest plant genus (*Equisetum*) in the world's

oldest, driest desert (Atacama).

14 Western Cape, South Africa

Evan Efler

This is the first color photo of *Gibbaeum esterhuyseniae* (Aizoaceae) in the wild. Inferring the relationships of this 'ice plant' to others in its genus will help us understand the drivers of speciation in one of the most botanically diverse regions on Earth.

15 Madagascar

Nisa Karimi, Baum Lab

Collecting samples of the iconic Madagascar baobab, *Adansonia grandidieri* near Lake Ihotry. Extensive sampling across the island will aid in untangling the evolutionary history of the six Malagasy baobab species.

16 Western Australia

David Baum

Adansonia gergorii: the sole species of baobab occurring outside of Africa. How this species got to this remote corner of Australia, as well as the role of humans in shaping its population genetics, has interested me for many years.

17 New Caledonia

Giovanny Giraldo, Cameron Lab

Eriaxis rigida, one of the two New Caledonian orchid species related to Vanilla, survives the scorching midday sun by angling its leaves upwards. I study how these New Caledonian orchids relate to the other orchids of the Vanilleae tribe.

18 Hangzhou, China

Ken Cameron

I have been collaborating with botanists in Hangzhou, China for more than 15 years especially on systematics research focused on orchids and *Smilax*.

19 Montpellier, France

Don Waller

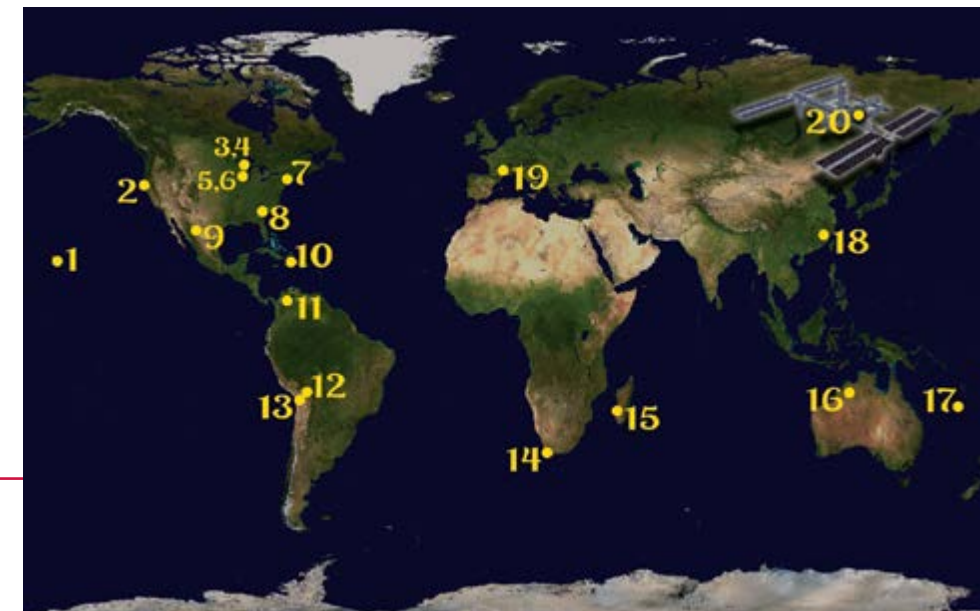
On sabbatical in Montpellier, France, Don Waller visits Allee DeCandolle in the oldest Botanical Garden in Europe.

20 Space Station

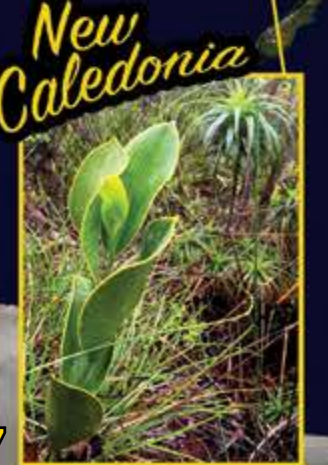
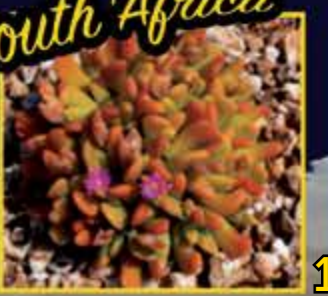
Richard Barker, Gilroy Lab

Astronaut Reid Weisman injects a chemical fixative called RNAlater in petri dishes containing *Arabidopsis thaliana* from the Gilroy Lab and grown on the international space station.

See world map with photos from the field on next page →



Botany Beyond Birge



STUDENT PROFILES

Field Notes: Bridget Gilmore

Bridget Gilmore — Conservation Biology major graduating May 2017

While I was abroad, I extended my UW-Madison experience to Australia through the School for Field Studies (SFS). My abroad experience was fairly unique as I spent my semester studying and living in the Wet Tropics World Heritage Rainforests of Yungaburra, Queensland, Australia.

The highlight of my abroad program was the Directed Research I conducted over the course of my final month in



Australia. I was presented with the opportunity to challenge myself and conduct social science research—a field with which I was very unfamiliar. I ultimately received the Distinguished Student Researcher award for conducting a “gap analysis of the supply and demand of Indigenous tourism” in the region. This modest description, fitting for the title of my report, understates the impact my research experience had on me. As a scientist, it is important to remain objective. However, I confess that my Directed Research project irreversibly shaped the way I think, specifically my perception of time.

I interviewed indigenous tourism operators, strategic tourism planners of the region, and indigenous intellectuals. In my first interview with an indigenous tourism operator, I asked him what he wanted tourists to take away from their experience in the rainforest. My own experience included walking through the bush and learning about how the

Nywaigi aboriginal people of North Queensland used plants for food and medicine. I saw the mangrove ecosystem the indigenous guides had restored. I learned about his people's history, which involved aboriginal people being hunted for sport on the weekend and being kidnapped and brought into the Barnum and Bailey's Circus as “cannibals.”

When I asked the operator what he wanted tourists to remember, I expected his response to involve understanding the atrocities white colonialists had committed against the indigenous. Instead he said: What I want people to take away is appreciation of you, the legacy you want to leave behind.

His legacy was creating economic opportunity for his people. His response made me look carefully at the time I have been given. One life is short. One life pales in comparison to all the legacies men and women have left behind, stringing humanity together over tens of thousands of years.

Field Notes: Bri Vogel

Bri is a Conservation Biology and Zoology major graduating in May 2016

From a young age I was drawn to nature and wildlife, constantly exploring outside and playing inside with a diversity of toy animal figurines from lions to ladybugs. At UW-Madison, I knew I wanted to study animals and their environments further. Majoring in Conservation Biology and Zoology has proven to be the perfect fit for my interests.

These majors gave me the opportunity to take classes on nearly anything I was interested in, from entomology to primatology to environmental economics. I also had the incredible opportunity last summer to study abroad in Rhotia, Tanzania through the School for Field Studies. The program focused on wildlife management and conservation and allowed me to apply what learned in my classes to real-world situations, such as resolving the conflicts between local

people and lions or investigating baboon behavior and activity budgets from the roof of a land cruiser.

For the latter, we constructed an ethogram of olive baboon behavior prior to venturing out into Lake Manyara National Park. We followed a troop of baboons and recorded their activity every five minutes for two hours including observations of foraging behavior, locomotion, social interaction, grooming, and aggression to learn about the baboons' activity budgets and feeding behavior. I fell in love with my time in the field in Tanzania, despite the hundreds of tsetse fly bites I brought home as souvenirs. Working with local people and studying animals in their natural habitat is an opportunity you should never pass up!

Since returning to Madison this year, I focused my studies on primates, taking classes in primate

conservation and learning skills in primatology. After graduating, I will work with the Wisconsin National Primate Research Center in the summer caring for marmosets. My love for animals of all kinds remains, so I will join a sailing expedition in the San Juan Islands in July as a wildlife research intern with Global Treks & Adventures where I look forward to gaining even more field research skill and experience.



ALUMNI NEWS

Wisconsin Idea Fellowship Award

The 18th year of the Wisconsin Idea Fellowships will feature nine unique undergraduate projects at home and across the world. These fellowships are awarded annually to UW-Madison undergraduate

projects working to solve issues identified by local or global communities.

This year, two Conservation Biology undergraduates, juniors Amelia Rossa and Joshua Kalman (along with sophomore Caden Lambie), in partnership with the Ceiba Foundation, have been awarded a 2016-17 Wisconsin Idea Fellowship to implement a water quality monitoring

project in coastal Ecuador. Their project, “Empowerment of coastal communities through permanent water quality monitors,” will train others in the Manab Province in water quality monitoring techniques, establish permanent water quality monitoring sites, collect water quality data and compose informational materials for community dissemination.



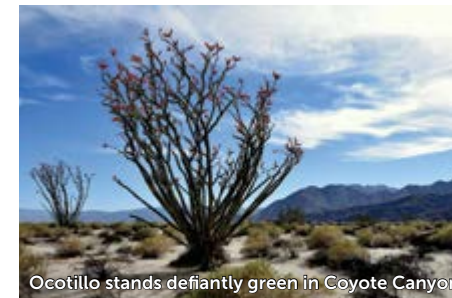
Carl J. Bowser – Silver Pixel Images

some of the more spinescent species from our legs and hands). Other highlights included visiting the San Andreas Fault, the Mojave Desert of Joshua Tree National Park (group photo at left), and, in refreshing contrast, the snowy San Jacinto Peaks above Palm Springs. The class then split into two teams, one to collect leaf

Southern California Desert Ecology by Evan Eifler

With generous support from an anonymous donor, our rotating ecology field course traveled to the deserts of Southern California earlier this spring. The strong El Niño year boosted the amount of winter rain that desert annuals rely on to bloom and provided the class with a privileged view into the wealth of plant diversity that this arid corner of the US has to offer. Based in Anza-Borrego State Park the class quickly became familiar with the flora of the Sonoran Desert (occasionally too familiar requiring the use of pliers to remove

tissue for a study of the population genetic structure of a species of California Poppy (*Eschscholzia*), the other to measure physiological traits of a suite of annual species to study how they are able to withstand and partition the harsh desert environment. Despite a significant portion of the class coming down with lung infections, a few painful run-ins with the well-defended flora, and a sprained ankle or two, the class maintained high spirits throughout the trip and has hopes of publishing results from the data so painstakingly collected from the desert wild this spring.



Ocotillo stands defiantly green in Coyote Canyon



Honey bee pollinates a Palo Verde

ALUMNI NEWS

Thank you to all the alumni who took the time to send us their updates. Please keep the news coming!

Osmund Holm-Hansen (Botany PhD 1953) is still enjoying life in La Jolla, with some time each day going to the lab/office at SIO (UCSD) and working on my research which deals mostly with effects of climate change on the marine ecosystem in the southwest Atlantic Ocean and the northwest Bellingshausen Sea in the South Pacific Ocean. Relaxation time is mostly with my two dogs at home.

Ronald Liesner (Botany BS 1967) has worked at the Missouri Botanical Garden for 42 years where he worked on general identification of Central and South American plants. He has collected in Costa Rica, Panama, Honduras, Belize, and Venezuela and has probably identified more plants to species in more families than anyone else ever has in this very diverse area. He has collected at least 150 new species and once, in four weeks on Arecamuni Tepui in Venezuela, collected twenty eight new species, several new subspecies, and two new genera. He even has seventy two species and one genus named after him.

Don Wicklow (Botany PhD 1971), has recently received the 2016 Distinguished Mycologist Award from the Mycological Society of America. A fond memory he has from graduate school was that both Professors Backus and Raper were present at the

first meeting of Mycological Society of America in 1932.

In May 2016, **Dr. Douglas O. Fuller (Botany BS 1983)** will return to the miombo and mopane woodlands of the Luangwa Valley, Zambia to assess long-term changes in vegetation structure and plant diversity there, nearly twenty-five years after surveying vegetation study plots in and around South Luangwa National Park as part of his dissertation research (PhD, University of Maryland, 1994). Dr. Fuller will be joined by his former PhD advisor, Dr. Stephen Prince, a plant ecologist/biogeographer from the University of Maryland, who first established the plots in the South Luangwa in 1967, nearly 50 years ago! Few ecological studies of African savannas have such long return intervals, sufficient to document the multi-decadal effects of protected-area management, conservation, and climate change.

Honey bee on swamp milkweed



Raffica La Rosa

Raffica La Rosa (Botany BS 2003) received her PhD in Plant Biology and EEBB from Michigan State University in 2015. Her dissertation was titled: Floral evolution in milkweeds: evidence for selection past and present. She is currently a postdoc at the University of Colorado-Boulder studying plant adaptation to variable environments.

Natalia Ivalu Cacho (Botany PhD 2009) is currently an assistant professor at

the National Autonomous University of Mexico (UNAM). Institute of Biology, Department of Botany. She continues to work on *Streptanthus* and *Euphorbia*.



Rollin Reinart

Rollin Reinart (Botany BS 2010) is currently a Peace Corps Volunteer (PCV) serving in The Gambia, West Africa. He is working with an NGO named MyFarm that works to train young adults about gardening, food processing, selling, and business management. He functions as a garden advisor, assistant and a trainer for garden and small business management. As a PCV, he is working with other PCVs in The Gambia to promote sustainable agricultural and agroforestry practices.

He is also a Masters International student, attending the University of California-Davis, working towards a M.S. in International Agricultural Development. Above is a photo of me teaching children about solar baking while preparing a cake.

Dr. Andy Gardner (Botany PhD 2013, BS

2005) started a tenure track assistant professorship in the Department of Biological Sciences at California State University- Stanislaus. He finished up a successful postdoc with **Dr. Rachel Jabaily (PhD Botany 2009)** on her NSF Grant project entitled Phylogenetics & Floral Symmetry Evolution of the Core Goodeniaceae.

Jacob Zeldin (Botany BA 2013) is finishing his first year as a Master's student in the Plant Biology and Conservation program at Northwestern University and the Chicago Botanic Garden (CBG). During his first year he has been completing course work with a focus on community and conservation ecology as well as working with other students to form a Botanical Society of America Student Chapter at Northwestern. This summer he plans to work with fellow UW alums Dan Larkin and Evelyn Williams on a greenhouse study looking at phylogenetic community ecology. Alongside that study, he will be conducting a greenhouse experiment and an observational field study. He hopes that all of the projects he is involved with this summer will help to inform restoration and conservation efforts in the Midwest.

Chris Hirsch (Botany MS 2015) is now working as an environmental scientist for the Neponset River Watershed Association in Boston Mass. His projects include environmental monitoring and ecological restoration.



Gardner on left, Jabaily next to Andy

Consider helping our Department's people and programs

Botany Department General Fund (fund # 1216106)

The generosity of our donors allows the Botany Department to help our students, faculty and staff reach their full potential via grants, awards, travel support, internships, guest lectures, and buying critical equipment. Please consider making a donation to via the UW Foundation. See: <http://www.supportuw.org/giving?seq=1254> Additional targeted funds are available at: <http://www.botany.wisc.edu/giftgiving/>

Conservation Biology Major Fund (fund # 12168143)

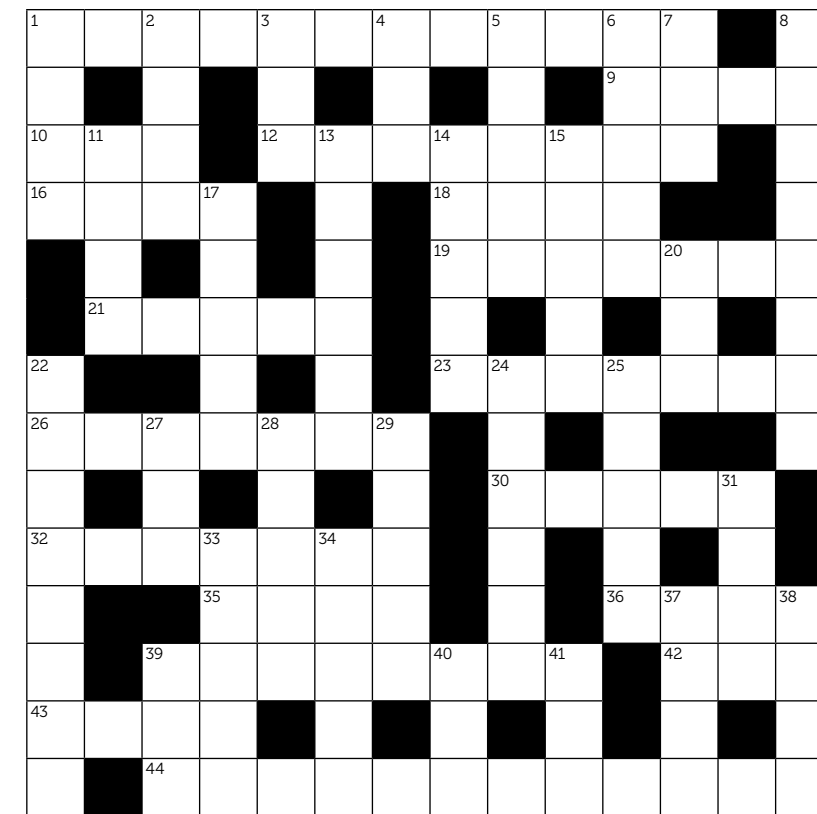
Please join us in our efforts to provide support for important program priorities. Gifts to the Conservation Biology Major are used to recognize outstanding undergraduates, support various activities such as research and study abroad, and to sponsor special lectures and other professional development opportunities for students. See: <http://www.supportuw.org/giving?seq=19206>

Online donations at the links provided are easy and secure. Check donations can be made out to the University of Wisconsin Foundation. Please include the fund number on the check.

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All Botany Crossword contributed by David Baum (answers at botany.wisc.edu/alumni-newsletter.htm)



Across

- 1. Burning ornamentals in Xanthorrhoeaceae?
- 9. Famous garden
- 10. Urceolate inspiration
- 12. Weedy sedge

that will drive you crazy?

- 16. Sporophyte stalk
- 18. Greek equivalent of *Viola*
- 19. A helicoid cyme
- 21. "Moss" in the Diapensiaceae (alt.

spelling)

- 23. Category of pesticide (or sunscreen)
- 26. Caryopses more familiarly
- 30. Euphorbia-ceous toxin
- 32. Jacob's and others

35. Human waste chemical often used as a fertilizer

- 36. Spore-filled sacs
- 39. Lights harvesting complexes
- 42. Spectroscopic method sometimes used on plant leaves

- 43. Farm area
- 44. With as many filaments/anthers as petals

Down

- 1. Sumac, for example
- 2. Corn variety
- 3. Of garden plants (abbrev.)
- 4. Endocarp
- 5. South African vegetation
- 6. Something a Venus fly trap can do
- 7. Anionic surfactant sometimes in DNA extraction buffers
- 8. Membranous layer in pollen wall
- 11. Harvest
- 13. Remove a basiomycete's velum?
- 14. Free energy
- 15. Fowl basis of silverweed's epithet

- 17. Hormone
- 20. Floret kind
- 22. Lamiaceae found in Synagogue?
- 24. Edible laurac
- 25. Hollyhock
- 27. Pelargonidin, for example
- 28. Botany emeritus who turns inside-out?
- 29. Botany emerita with black eyes?
- 31. Four o'clock family (abbrev.)
- 33. Habitat of the endangered *Cirsium pitcheri*
- 34. *Phragmites* and *Phalaris*
- 37. Edible palm

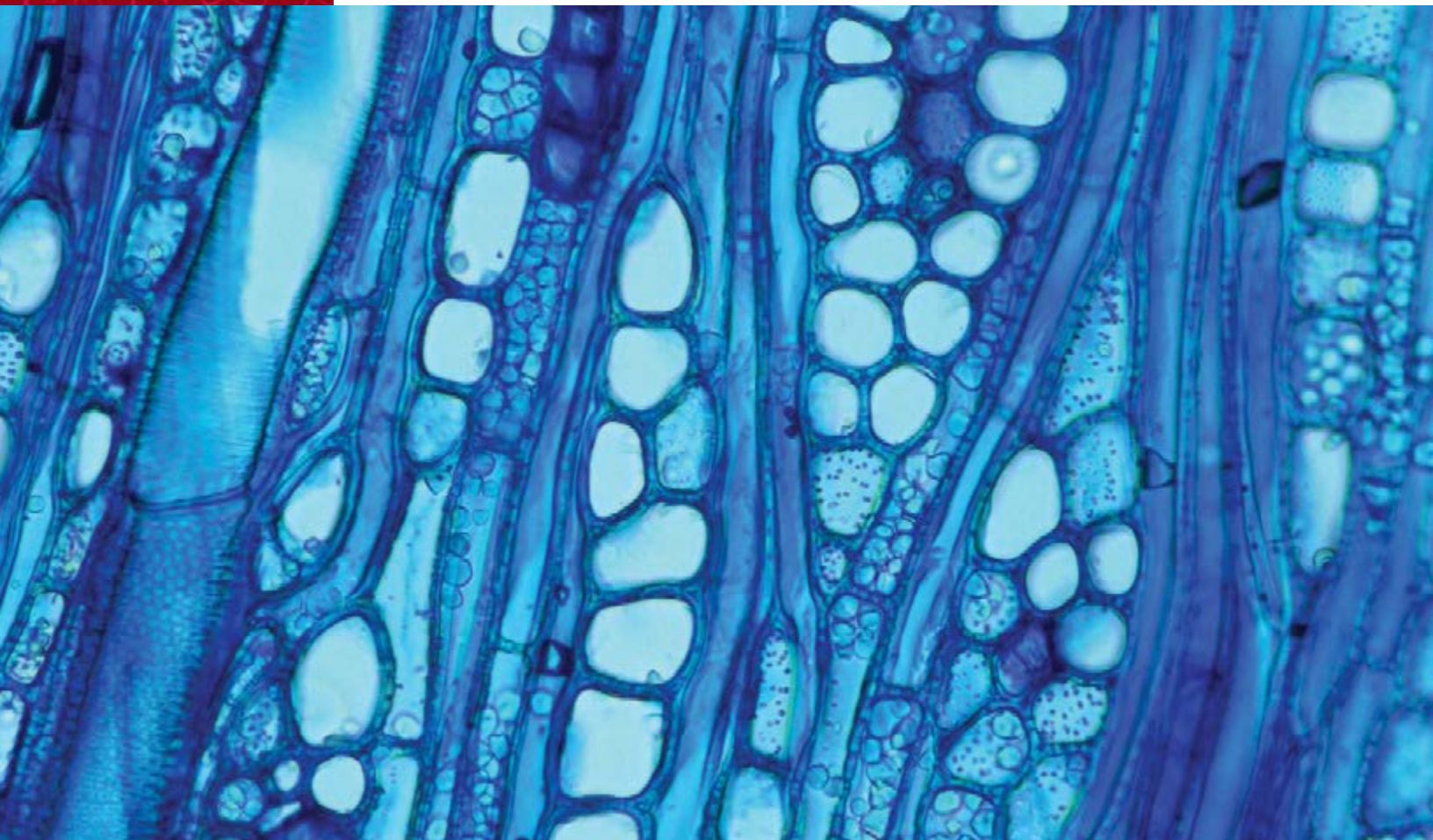
- 38. Showy flower that gets in your eye?
- 39. *Musc*___ (Grape hyacinth)
- 40. Prof. Graham ___ Edwards
- 41. Part of the herbarium SP name



DEPARTMENT OF
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ROOT XYLEM: Post-doc Duncan Smith's micrograph of a Texas Persimmon (Root Xylem) / 2016 Cool Science Image contest winner