



Notes from the Field

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Photo by Laura Radville

Bringing Photography to the Biology Classroom

By Christian John

Aquaponic systems. A 24-year-old-tarantula. Egg incubators. Mr. Lyke’s classroom at State College Area High School is the ultimate immersive biology lab. His scientific sophomores are taught to collaborate, make hypotheses, and evaluate results – things we ecologists do on a daily basis. I hoped to plan a lesson around these same concepts, but with a focus on photography as a means of data collection in ecological research. Having used both time-lapse photography and drone-based aerial photography in my own research, I wanted to bring my experience to the high school classroom. Perhaps some out-of-the-box approaches to biological inquiry might inspire a future generation of researchers.

So, I designed a lesson plan by which students would apply photography as a means of data collection in the classroom. Planning for two days of block-style high school class time is no small feat, but one that was made much easier with the help of Mr. Lyke and the instructors of Penn State’s first offering of BIOL 497F (Science Outreach and Communication). We used time-lapse to explore how a fish’s position in its tank changes with the presence of floating food flakes.

Working in groups, students stated their expectations, entered data, created and interpreted graphs, and suggested improvements for future experiments. They were nearly unanimously excited to produce a graph with real-world data, and more than happy to suggest improvements for the experiment. But the main attraction of each class was quite clearly show-and-tell. I invited them to come to the front of the classroom to check out a drone and time-lapse plant camera that had spent time collecting data at the Post lab’s Greenland field site. Questions ranged from “Is there internet in the field?” to “Does the UAV influence animal behavior?” and everywhere in between. The question that most affirmed my presence in that room, though, was so flattering I couldn’t even come up with a good answer on the spot: “What steps should I take to end up exactly where you are?”

Outreach does so much more than serve as an informational outlet. In just two days of teaching, I developed the ability to explain my research to a new demographic. I learned to organize a ton of material in a way that would keep a restless audience engaged. And maybe, just maybe, I inspired a young mind to work toward a future in ecology, exploration, and environmentalism.

Ecology students participate in local restoration project

By Katy Barlow

Ecology grads Erynn Maynard, Doug Manning, Tim Gould, and Katy Barlow are members of the Penn State student chapter of the Society for Ecological Restoration (SERxPSU). SERxPSU joined with the town of State College, Pennsylvania, to restore native flora to the entrance of Walnut Springs Park on University Drive. In late Fall of 2014, students removed the invasive exotic shrub layer, predominantly European Privet and honeysuckle species. The emerging garlic mustard was removed in early spring of 2015 to make way for native tree saplings and forest understory herbs. The plants were purchased at the Central Pennsylvania Native Plant Festival at Shaver's Creek Environmental Center with a generous donation from the Pennsylvania Native Plant Society.

Several residents of the Walnut Springs neighborhood joined SERxPSU for the big planting day on May 3, 2015, and some donated native forest understory herbs from their own gardens. Tree saplings included in the restoration were *Quercus macrocarpa* (Bur Oak), *Celtis occidentalis* (Hackberry), *Carya cordiformis* (Bitternut Hickory), *Carpinus caroliniana* (Hornbeam), *Asimina triloba* (Paw Paw), *Viburnum lentago* (Nannyberry), *Sambucus cana-*

densis (Black Elderberry), and *Magnolia acuminata* (Cucumber-Tree Magnolia). SERxPSU put up an informational sign on the ecological benefits of restoring with native plants, and will continue to monitor and manage invasives at the site.



Lower left: SERxPSU students and neighborhood volunteers planting native tree saplings. Lower right: Erynn Maynard on a mountain of garlic mustard removed from the site and composted. Upper right: Informational sign at the site. (Photos by Katy Barlow)



An adult male bobcat on Cumberland Island, Georgia, that was baited in to a deer carcass in 2015. Note the size of the bobcat relative to the deer. There is evidence that bobcat predation on deer has resulted in a trophic cascade on the island. (Photo by NPS)

You're Never Finished with your Dissertation

By Duane Diefenbach

For my dissertation, I reintroduced bobcats to an island off the coast of Georgia (USA). My focus was testing the scent station index (used to monitor bobcat populations) to see if it accurately reflected changes in bobcat abundance.

We could test the technique because we knew how many bobcats were on the island. The index is positively related to abundance, but with so much variability, it has limited power and can detect only large changes in abundance. I also conducted a population viability analysis and estimated that in about 20 years the bobcat population should decline to an average of about 12-13 bobcats.

Fast forward to 2012, and I returned to the island. Today we can extract DNA from scat and estimate abundance using spatial capture-recapture methodology. We estimated abundance was 14 bobcats in 2012! Pretty cool, but probably just luck that it matched the earlier PVA.

The reintroduction was done in 1988-89 and, in looking to the future, we collected tissue samples from all the bobcats in the hopes of comparing genetics to future populations.

However, here's a lesson for all young scientists. Do all you can to back up your data!

Half our tissue samples were destroyed in a fire in 1990 at a university facility. Fortunately, we were able to recapture almost all the bobcats on the island so we recovered an almost complete set of tissues from the founder population. To be safe, we sent some to a lab at another university for storage, but those samples were destroyed when a freezer failed and no one noticed until too late.

Today, 25 years later, I am working with a geneticist (using the remaining founder tissue samples) to try and create a profile of the founding population. We plan to return to the island and continue

to collect scat (DNA), as well as compare genetics of the island bobcats (and a bobcat population on another barrier island in South Carolina) to mainland bobcat populations.

It's been interesting to see the evolution in genetic techniques (no pun intended) and mark-recapture methodologies over the past 25 years. And to learn that you never know when you're finished with your dissertation research!

References

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Classing up Science Outreach

By Chris Thawley

I've loved teaching since I was a middle school science teacher all the way back in 2005 (oh dear!). But, as a Penn State graduate student, it can be tough to find ways to bring science to kids and even more difficult to get experience teaching a class at the university level. To reach kids with cool science education opportunities, many graduate students, including me, build outreach activities for different venues. But is there a way to meet both these goals—doing community outreach and gaining experience with more formal teaching—at the same time? In short, yes!

About a year ago, I, and two friends, Allison Lewis and Zach Fuller, were being stereotypical graduate students and lamenting our lots in life. We're supposed to be educators but the University won't let us teach classes to get experience! Are we wasting our time doing outreach? Will anyone use our materials again? Why are we so whiny? Fortunately, bemoaning the status quo can lead to good things if you get an

idea for positive change. We decided to incorporate our outreach experiences into a class that would facilitate other students in conducting their own outreach from their own experience.

It is harder than you might think to actually teach at a university. There are many hidden requirements and lots and lots of paperwork. However, after a major assist from some supportive faculty, BIOL 497F, Science Outreach and Communication, a 1 credit class was born! Of course, we also needed actual students for our class. We made up flyers, spammed listservs, and asked our friends and professors for the emails of students they would recommend to take our class. By August, we had 13 enrolled students—10 graduate and 3 undergrads—with a mix of backgrounds, including neuroscience, biology, entomology, anthropology, and, of course, ecology.

The first portion of our class focused on teaching a core set of skills: how to tailor activities to different age levels and audi-

ences, how to design and plan effective outreach, and how to evaluate learning. We collaborated with professional educators from different University entities, including the Eberly College of Science Outreach Office and the Schreyer Institute for Teaching Excellence, to bring their expertise to our class.

Our students worked in small groups to build their own lesson plans for an initial outreach activity, and then presented those to the rest of the class for feedback. We worked as a group to provide constructive criticism and refine these activities to increase their focus and effectiveness. In the midst of this, we included several classes focused on other important science communication topics, including writing for a general audience, the importance of outreach in grant-writing, and a panel discussion with professional scientists who are successfully incorporating outreach into their research and careers.

At last, after much practice, cutting out of small paper shapes, tasting Starbursts,



Left: Emilia Sola-Gracia, an ecologist extraordinaire, shows a youngster the best way to “disperse” a seed he’s just constructed. Below: Kids collaborate with Ecology student Christian John to design organisms adapted to their habitats using a smorgasbord of limbs and structures. (Photos by Chris Thawley)



and wrangling stick insects, the first outreach program (and major grade!) of the class arrived on November 10 as our students presented their own outreach activities at Exploration U at the Bellefonte Area High School.

Exploration U is a biannual science fair in which Penn State scientists and community groups present short, interesting activities about their research or other scientific topics for community children and their parents (hundreds of them at each event!). Five groups from our class spent the evening discussing various aspects of science with the crowds, including lessons focused on:

- Understanding how insects see differently from humans using filtered glasses, including “secret messages” such as targets or directional signals on flowers that are not visible to our naked eyes.
- Exploring how seeds are dispersed via an activity where kids made their own seeds (with the aid of a little Velcro) and attempted to disperse them by tossing onto a passing fuzzy felt dog.
- Constructing a habitat and an organism adapted to survive in it to learn how animals’ limbs are

adapted for the environments that they inhabit.

- Discussing how traits in our DNA are passed between generations by having families test-taste sweet and bitter substances together and talking about inheritance.
- Learning how insects are adapted for different environments via camouflage by matching bugs to their natural backgrounds and finding hidden, camouflaged insects, including live Vietnamese stick insects.

All in all, our class' outreach night was successful as an educational experience both for the families who attended and the students in our class. Moving forward, these students are designing and conducting their own independent outreach activities. Examples from current Ecology students include an interactive lesson at State College High on the use and importance of photography, including drones, in biological research, and a scientist-in-the-classroom visit via Skype to a Philly elementary school to discuss how awesome ants are! I'm proud of the creativity and dedicated work that our students have put in over the semester, and am excited to see them continue to do outreach in the future. For me, this class has provided great

Ecology student Christian John explains how the skeletal structure of a shark allows it to thrive in an aquatic environment. (Photo by Chris Thawley).



experience: in designing a class from the ground up, learning to navigate bureaucratic pitfalls, and co-teaching a class with two other dedicated instructors. It's also been inspirational to see the impact that a small but dedicated group of students can have in advancing scientific education. Looking forward, we hope to make this class a yearly offering in the Eberly College of Science to encourage a growing culture of scientific outreach in the graduate student community.



Will Miller and a team of volunteers are collecting tissue samples from white-tailed deer for genetic analysis. Will is studying patterns among eastern white-tailed deer populations in order to predict potential transmission pathways for chronic wasting disease. (Photo credit: Lacey Williamson)

New ecology student introductions

Ismaiel Szink



I'm a first year Ph.D. student working in Dave Eissenstat's lab. I received a

B.S. in Biology from BYU focusing on plant and fungal microbial ecology. My dissertation will be looking at how different types of bedrock can affect below ground microbial community interactions with tree roots.

David Muñoz



Originally from North Carolina, David came to Penn State two years ago to pursue a M.S. in Wildlife and Fisheries Science with David Miller.

Now, he is expanding the work from his master's as a Ph.D. student in the Ecology program, aiming to understand the impacts of climate change on amphibian populations and the mechanisms in which they might adapt. Outside of research, David enjoys reading, playing outside, and delicious food.

Melanie Kammerer



I'm originally from Gettysburg, Pennsylvania, and am pursuing a Ph.D. after finishing my M.S. in the Ecology program at Penn State in 2013.

During pursuit of my M.S. degree, I worked on apple pollination in south-central Pennsylvania, and generally, I'm interested in ecosystem services provisioning in agricultural landscapes and the interplay between crop and non-crop habitats. I really enjoy quantitative projects, and am struck by the potential of models and statistical tools. When not working, I enjoy hiking, gardening, music, ballroom dance, and ballet.

Sarah Isbell



I am a new Ph.D. student in Dr. Jason Kaye's lab working on nutrient cycling in organic cropping systems. I

moved from the Hudson Valley, New York, where I have been working on diversified organic vegetable operations for the past several years. I received a B.S. in Biology from Dickinson College and am originally from Annapolis, Maryland.

Warren Reed



As a native Pennsylvanian, I am happy to consider myself home again here

at Penn State. I received my B.S. in Geography here in 2010. I then worked on research projects in South Africa with the Landscape Ecology Lab at Penn State; all over California with the USGS Sequoia-Kings Canyon Research Station, as well as the USFS Pacific Southwest Research Station; on a tropical deforestation project in Berlin, Germany, with the Biogeography lab group at Humboldt-Universität; and also have spent some time in the southeast U.S. My master's work was in Forestry at Virginia Tech, and I am generally interested in working in forested ecosystems. Currently, I am in pursuit of a Ph.D. in Ecology, working with Dr. Margot Kaye. My research will focus locally on the effects of bedrock (sandstone and shale) on forest development at the Shale Hills Critical Zone Observatory and also more regionally.

New ecology student introductions



Tim Gould

I am a first-year Master's student studying with Dr. Robert Brooks in the Geography department. I graduated from the

Schreyer Honors College at Penn State in 2013 with a B.S. in Geobiology, and worked for two years as an Assistant Research Scientist with L.F. Lambert Spawn, before choosing to return to Penn State to pursue ecology. My current plan is to pursue a career in conservation and wildlife/land management following graduation. When not actively reviewing my ever-growing pile of reference literature, I enjoy birding, hiking, and playing bass guitar.



Kelly Durham

I am coming to Penn State from Western Kentucky University where I

earned my Master's researching elephants and their impacts to trees in South Africa. Finding my love for trees there, I decided to switch gears and research forests in the United States for my Ph.D. I am working with Dr. Laura Leites, and I'm excited to see what Pennsylvania forests and Penn State have to offer!

Courtney Davis



Courtney Davis is a familiar face to the program, as she just completed her M.S. in Ecology this summer.

She is continuing research and work on ecological modeling with David Miller. Outside of her research, she enjoys volunteering for local organizations and spending time with her crazy, yet adorable, pup.

Matt Toenies



I am in my second semester of the Ecology program. I grew up in central Minnesota, where my interest in wildlife

(especially birds) led me to pursue an undergraduate in wildlife management. Now, I am studying how the decline of eastern hemlock is affecting bird communities associated with hemlock forests.

Colbie Reed

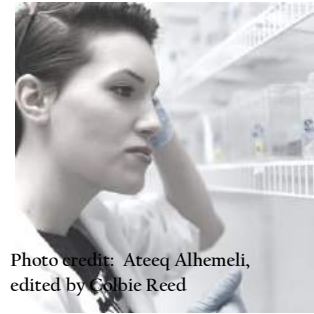


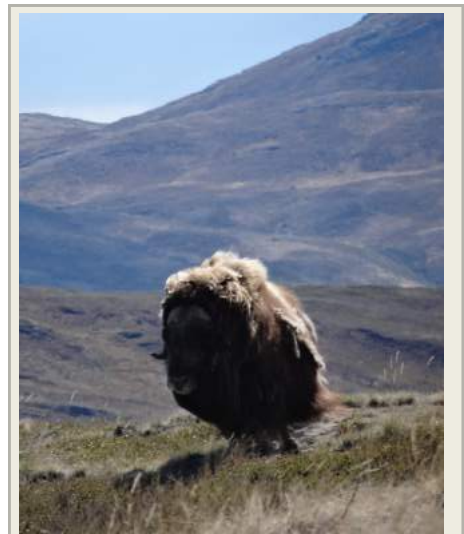
Photo credit: Ateeq Alhemeli, edited by Colbie Reed

Originally from a small, rural town in north central Florida, Colbie

arrived at Penn State sporting a personal and academic background in agriculture and engineering. During her undergraduate studies, she majored in biology with a neuroscience option, which focused on both the intricacies of behavioral psychology and the biochemical mechanisms behind it. Continuing her undergraduate research for Dr. David Hughes regarding intra-nest hygiene and social networks of carpenter ants, she remained at her alma mater to pursue a Ph.D. in Ecology.

Recent Publications

- Amsalem, E., Galbraith, D., Cnaani, J., Teal, P. and C.M. Grozinger. "Conservation and modification of genetic and physiological toolkits underpinning diapause in bumble bee queens" *Molecular Ecology* (in press).
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Above: Muskox in southwestern Greenland (Photo by Laura Radville).

Recent Publications, continued

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- McCormick G.L., Shea K. and Langkilde T. 2015. How do duration, frequency, and intensity of exogenous CORT elevation affect immune outcomes of stress? *General and Comparative Endocrinology* 222: 81-87
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A young arctic hare rests in a sunny patch amongst some glaucous willow. (Photo by Christian John)

Fellowships, Awards, Grants, and Achievements

Tracey Langkilde was featured on the cover of the Penn State Science Journal for [Exploring the Nature of Stress](#).

Jennifer Macalady's work on microbial ecology in the Dominican Republic was featured in Eos. See ["Cave-Dwelling 'Slime Curtains' Cycle Nitrogen and Iron"](#)

Courtney Davis received a Penn State Academic Computing Fellowship.

William L. Miller was awarded graduate student travel awards from the Penn State College of Agricultural Sciences, the PSU Department of Ecosystem Science and Management, and The Wildlife Society to attend the Society's 22nd Annual Conference in Winnipeg, Manitoba.

William L. Miller won the award for best student presentation at the 2015 Annual Conference and Workshop of the Pennsylvania Chapter of the Wildlife Society.

William L. Miller won 3rd best Ph.D. student research-in-progress poster at the 22nd Annual Conference of The Wildlife Society.

William L. Miller was named a graduate fellow of the Au Sable Institute of Environmental Studies.

Ismaiel Szink received a Bunton-Waller Graduate Fellowship.

Matthew Thomas and others received over four million dollars in funding (R01 NIH NIAID, NSF EEID, and R21 NIH NIAID) to better understand how environment and drivers of environmental change affect the capacity of mosquito vectors to transmit disease and our ability to stop them.

Linking Penn State with the marine environment: A generous donation by Peter and Ann Tombros has funded a proposal by Wren Patton and Victoria Braithwaite to facilitate a new research relationship between the Maritime Aquarium at Norwalk and Penn State. We look forward to this collaboration generating useful data about fish in captivity, and we are excited to include educational components and exhibit development for aquarium visitors as well.

Recent Program Graduates

Warm congratulations to all of the Ecology Program's summer and fall graduates!

- Jenny Tennessen (Ph.D.)
- Emily Almburg (Ph.D.)
- Christy Grettenberg (Ph.D.)
- Anjel Helms (Ph.D.)
- Katie Gaines (Ph.D.)
- Jackie Harth (Ph.D.)
- Danelle Laflower (M.S.)
- Jeff Kerby (Ph.D.)
- Jen Berkebile (M.S.)
- Sean Cahoon (Ph.D.)
- Courtney Davis (M.S.)
- Gail McCormick (Ph.D.)

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Above: A young caribou munches on grasses in Greenland, late August. (Photo by Christian John)



Left: Three yearling caribou curiously approach the photographer after being interrupted from some early season grazing. (Photo by Christian John)