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NOTES FROM THE FIELD

The Biannual Newsletter of the Intercollege Graduate Program in Ecology

The Pennsylvania State University

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Meet the 2021 graduate student cohort!

Katherine Altamirano (she/her) Katherine is a first-year M.S. student in the Watershed Ecohydrology and Biogeochemistry lab with Dr. Jonathan Duncan in the department of Ecosystem Science and Management. In 2020, she earned her Bachelor's of Science in Environmental Science from Dickinson College in Carlisle. PA. Her research at Penn State is part of an Urban Critical Zone Cluster Network widely exploring the effects of urbanization on the Critical Zone. She is currently studying riparian nitrogen biogeochemistry in Baltimore, Maryland. Beyond her current research, she is interested in working within a variety of aquatic ecosystems to meet the needs of these systems and the communities that rely on them.

Eva Barr (she/her) I am pursuing my M.S. in Dr. Duane Diefenbach's lab as a contributor to the Deer-Forest Study. I will be investigating the effects of various biotic and abiotic factors on phyto-indicator plant species occurrence in PA northern hardwood and central oak-hickory stands. I received my B.S. in Environment and Natural Resources with forestry and wildlife management specializations from The Ohio State University in Spring 2021. I grew up in Appalachian Ohio in a Latino household, making my cultural background quite the mixing pot. In my free time, I enjoy reading, playing guitar and singing, hiking, and cooking. I look forward to my time in State College!

Sydney Bird (she/her) After getting my B.A. in Biology and Geography at Colgate University in 2019 I came to Penn State as a research assistant; this year I began my M.S. in Margarita Lopez-Uribe's lab. My current research uses genetics to challenge the assumption of monogamy in primitively eusocial and solitary bees. When I am not genotyping bees, I enjoy spending time with my two cats and snake.

Luana Bresciana (she/her) I'm a Ph.D. student advised by Dr. Francisco Andreote, and interested in microorganisms' interactions. For my Ph.D., I intend to further understand the ecological traits of microbial dispersal and microbial community coalescence. I'm from Brazil, where I've completed my bachelor's in Agronomy and master's in Soil and Plant Nutrition, both at the University of Sao Paulo. Since my undergrad, I've been studying microbial ecology and become a quite enthusiastic microbial person. I have a background in soil microbial science in forest and agricultural systems, including greenhouse gases emission and nitrogen/phosphorus cycles. In my free time, I like to go run, hike and have some good music. I am also excited about the weather here in Penn State, which is quite different from Brazil. I'm looking forward to experiencing some (or a lot) of snow!

Karen Beatty (she/her) Karen is a M.S. student advised by Dr. Franny Buderman in the Department of Ecosystem Science and Management. She earned her Bachelor of Science degree in Zoology from Michigan State University in 2013, where her undergraduate research utilized molecular ecology techniques to support population studies. Originally from Chicago (the best city!), she was most recently living in the warm and beautiful Carolinas. She worked as a field technician and an environmental consultant, primarily navigating protected species policy and conducting mammalian and avian species surveys. Her thesis research will evaluate habitat selection and movement of Canada geese in response to hunting pressure in Pennsylvania.

Lily Cao (she/her) I am a first year M.S. student in Dr. Terrence Bell and Dr. Michela Centinari's labs. I am from Orlando, Florida and earned my bachelors in chemistry and biology from the University of Florida. I previously did research at the USDA in Gainesville studying abiotic and biotic stress on maize. At Penn State, I am studying how below ground competition between grapevine and cover crop roots influence soil microbiome and root health. Some of my favorite things to do are practicing piano, playing video games, drinking tea, and spending time with my cat.

Alberto Carlos Cruz (he/him) I am a Ph.D. student in Tomas Carlo's lab. I'm interested in reptiles, amphibians, avian ecology and conservation, particularly how abiotic and biotic factors affect the population dynamics of some species. I did my bachelor's degree in Wildlife Management at the University of Puerto Rico, where I studied the behavioral ecology of the Puerto Rican Parrot and the climate impact on amphibian communities. During my transition to my master's degree at the same institution, I researched the natural history of some reptiles in Puerto Rico. Then, I focused my master's research on identifying the habitat use of a generalist and opportunist avian species before and after the impact of Hurricane Maria in Puerto Rico to improve the success of the Puerto Rican Parrot conservation project. And now, my PhD research in general is how pollination processes influence subsequent frugivory processes.

Francesca Ferguson (she/her) I am a Ph.D. student co-advised by Drs. John Tooker (Entomology) and Heather Preisendanz (Ag. Bio. Engineering) that began January 2021. I am broadly interested in understanding the fate, transport, and ecotoxicological influence of emerging contaminants in freshwater ecosystems, with a focus on aquatic benthic macroinvertebrate communities. Prior to coming to Penn State, I earned my B.S. in Environmental Chemistry at Juniata College in 2019, where I investigated the influence of endocrine disrupting contaminants on smallmouth bass populations and quantified the presence of a contaminant in groundwater sources. I then worked in industry as an Associate Production Scientist where I synthesized stationary phases used in gas chromatography columns at MilliporeSigma. Now at Penn State, I'm excited to research aquatic systems again! In my free time, I like to go on bike rides, hike, knit, or sew.

Darcy Gray (she/her) I am a M.S. student in Dr. Christina Grozinger's lab and my research focuses on landscape and weather effects on African honey bee health and migration behavior. I graduated in 2018 with a BS in Environmental Biology from Tulane University in New Orleans. After graduation I worked for a sustainable development organization in Madagascar on a beekeeping project, and then worked as a Fellow for the NASA DEVELOP program for a year and a half. I'm interested in integrating satellite remote sensing data with ecological and socioeconomic data to assist beekeepers in their decision-making.

Grace Gutierrez (she/her) I am a M.S. student working with Dr. Margarita López-Uribe. I originally got my bachelor's degree in Environmental Science and English from the University of Virginia. After taking a year to work as a research technician studying an underwater crustacean, Daphnia pulex, I decided to move from water to the air when I began my masters at Penn State working with in the López-Uribe lab studying the thermal tolerance and species distribution of two non-native bee species. Outside the lab, you can usually find me in a bookstore or hanging out with my dog and two cats.

Jaedyn LaLonde (they/them) I am a first year M.S. student in the Millery and Avery Lab. I graduated from Binghamton University with a BSc in Biology and Environmental Science. I am currently studying the impacts of seasonal variation on wood turtle eDNA. In my free time, I enjoy flow arts, rock climbing, and reading tarot cards.

Avehi Singh (she/her) I am a first year Ph.D. student and a J. Lloyd Huck Graduate Fellow working with Dr. Margarita López-Uribe in the Department of Entomology. I am originally from Bangalore, India and moved to the US to study for an undergraduate degree in Biology from Reed College in Portland, OR. I then moved to Penn State to work as a research technician in the López-Uribe lab. After working for a year, I began a master's program in the Department of Entomology. I was excited to expand on my master's research and decided to transfer into the Ecology program a year in. I am currently working on understanding the evolution of sensory systems in specialized pollinators, using genomic, electrophysiological, and behavioral methods. Outside the lab, I am generally found hiking, making elaborate meals, and trying to keep my plants alive.

Tyler Walters (he/him) I am a first-year M.S. student in Dr. David Walter's lab. I earned a dual B.S. in wildlife ecology and management as well as applied ecology and environmental science form Michigan Technological University in 2014. Since then, I have worked as a research technician for a variety of universities, organizations, and agencies around the country with the common thread among these positions being the ecology of wildlife diseases. My Masters' is a continuation of pursuing that interest and I am investigating the role avian scavengers, specifically American crows, play in the movement and distribution of infectious chronic wasting disease prions. I am hoping to enjoy the natural beauty of Pennsylvania while it is my home with fishing and paddling at the top of my to do list.

Michelle Zavala-Paez (she/her) I am a Ph.D. student in the Hamilton Lab. I am originally from Ecuador; I got a bachelor's degree in Biology at Universidad Central del Ecuador. After that, to study phylogenomics in orchids I decided to moved to Brazil to get my M.S. in Ecology at the Universidade Federal do Parana. Now, I am excited to be part of the Ecology program at PennState, where I am having the opportunity to study how plants adapt to new environments. When I am not working, I enjoy watching comedy movies and hiking.

EGSO yearly update

By: Maisie MacKnight (she/her)

As always, the Ecology Graduate Student Organization is committed to supporting our graduate students. As we transition back to in-person events, the officers are focusing on building relationships within the program and community engagement. The 2021 officers are Maisie MacKnight (President), Emily Gagne (Vice President/Treasurer, Jess Brown (Secretary), Olivia Trase (Co-social Chair), Miranda DePriest (Co-social Chair), Madeline Luthard (DEI Representative), Chris Custer (Webmaster), Christina Harden (Curriculum Committee Representative), Marissa Kopp (Program Chair), and Sarah Richards (Anderson Award Representative). We are excited to share what we've done over the last year!

We wanted to focus our efforts on improving the culture of inclusion within the program. As a result of COVID, our two newest cohorts are only now getting the opportunity to socialize in-person with other program members. Providing opportunities for safe in-person socializing has been a priority for us during this transitionary period. In addition to our regular program-wide "welcome back" picnic, we hosted a kayak social at Lake Perez. The EGSO covered boat rental fees for all participants. Kayaks were rented through the Office of Student Recreation at Lake Perez. Continuing with our objective of building inter-cohort relationships, the EGSO officers have been working on ways to improve the Program's Peer Mentoring program. In the spring, we worked alongside Fiona Lunt, an Ecology Service Assistantship recipient, to match mentors with first-year students. We are working to incorporate more guidance and structure into the peer mentor/mentee program, including formal opportunities for mentors and mentees to interact.

In addition to strengthening relationships within the program, we have also continued to prioritize community service. Since our last yearly update, the ESGO has now officially adopted a 2-mile strip of highway through PennDOT's Adopt a Highway Program. We have since had two clean-up events, and we plan to have another in early November. We are also excited to resume volunteer clean-up projects through Millbrook Marsh Nature Center. The EGSO officers are excited to have the opportunity to serve our graduate students and the local community during the transition back to in-person activities.

This year we also added a new officer position to the EGSO. The diversity, equity, and inclusion (DEI) representative position was created to facilitate communication between the EGSO and the Ecology Program's DEI Committee, led by Drs. Sara Hermann and Jared Ali. The EGSO and DEI Committee are working to create a culture of inclusivity through the streaming of *Picture a Scientist* and hosting informal coffee hour chats about DEI topics. We are very excited to work alongside the DEI Committee to build a supportive community and better serve all members of our program. ▲

Andersen Award reflection

By: Makaylee Crone (they/them)

This year I was granted the Andersen Award to attend the Entomology Society of America annual meeting in Denver, Colorado. I was particularly excited for this conference as this is the first academic meeting I have attended since COVID-19 closures began in 2020. The meeting was also special for students who started their graduate program during the pandemic and were attending their first national meeting. Though attendance was lower than in previous years, this made the meeting more intimate and encouraged attendees to shift away from their usual groups of friends and meet other people.

Crone presenting their work on Osmia cornifrons nutrition and plant preference.

This conference was also the first time I organized a symposium, which would not have been possible without Penn State co-organizers Dr. Gabriela Quinlan (Ecology postdoc) and Erin Treanore (Entomology PhD candidate). Our symposium, titled "Trade offs of Adapting to a Changing World: From Physiological to Behavioral Transformations", featured speakers from a wide range of research areas, including insect thermal tolerance, eusocial insect diapause, and bee nutrition. This also gave us the opportunity to network with colleagues we would like to work with in the future, and I would encourage any other students looking for postdoctoral positions to consider organizing a symposium as well. I would like to thank Dr. Frank A. Andersen and the Ecology program for this opportunity. Symposium organized by Crone, Treanore, and Quinlan. ▲

Osmia cornifrons, bugguide.net

Panning for pink gold

By: Jennifer Harris (she/her)

Harris searching for pink gold at the Russel E Larson agricultural research farm.

A few days every fall and summer, the Burghardt lab spends hours searching through soil in the alfalfa fields. I look carefully at the soil for seams of pale pink like strings of pearls. Each gem is so precious I shudder to lose one in the grass. At the end of the day, my back aches from the hard work, but I'm grateful for the bountiful harvest. These are not gold or rare earth stones, but nodules!

Pea plant with nodules

Legumes are able to fix Nitrogen because of their nodules. Legumes themselves can't fix nitrogen. Instead, they form a symbiotic relationship with rhizobia, or nitrogen fixing bacteria. Plants form nodules to serve at a haven for these nitrogen fixing bacteria. Nodules are where the N- fixing magic happens in legumes. The plant also rewards the rhizobia with sugars in exchange for the nitrogen. Inside the nodule, the plant constructs a very specific set of conditions to promote N fixation. The plant controls the amount of oxygen with legumohoglobin, a red oxygen carrying compound, giving the nodules their warm pink color.

The relationship between legumes and rhizobia is great system for our lab to explore questions about how mutualisms form and how they are maintained. As legumes form associations with rhizobia there are different levels where the plant can choose to stop forming the relationship. For an organism, allowing microbes to form a cyst on them and giving those microbes resources is

costly. The plant would want to be sure that the microbe is actually helping them by fixing nitrogen. Our lab is fascinated by these levels of control by the plant.

The plant can choose which microbes it wants to support at the strain level, which is finer than species. Through this process the plant picks the microbial traits it wants. This influences the evolution of the rhizobial strains because rhizobia that can form these associations get more resources and can reproduce more. Our lab is interested in what traits are being selected for by the plant over time.

Lily Cherry, Plant Biology PhD student

We have been searching for pink gold every spring and fall since 2020 in the alfalfa variety trials plots at Rock Springs research farm. These plots are maintained by Tyler Rice, and are great study system for our lab. These fields were planted with alfalfa in 2015 and again in 2020. Alfalfa is a perennial legume so the same stand can grow for many years. Sampling the nodules over years allows us to explore long term selection on the rhizobia. With sequencing we can learn more about what traits are being chosen by the plants over multiple years. We also can compare traits that are chosen over seasons (Fall, Spring, Summer).

Gina Bledsoe of the Burghardt lab and Gwen Fry anthropology and biology undergraduate

Over time plants could become worse at picking good symbiotic partners. Likewise, these rhizobia could become good "cheaters", able to get resources from the plant without making nitrogen. Both of these outcomes would be bad for farmers because the plant won't get the nitrogen it needs. By exploring the long-term patterns of selection in rhizobia traits we can learn more about the stability of this mutualism. If rhizobia that are good nitrogen fixers are always selected for that would mean the mutualism is more stable.

Our lab is also looking for outreach and education opportunities. We are always exciting to talk about legumes, microbes and mutualisms. If you have any ideas or want to come panning for gold at Rock Springs email me at jeh6121@psu.edu. ▲

How welcoming is your workspace?

By: Lilly Germeroth (she/her)

Graduate students spend a significant amount of time in the lab.

The times in which I've felt at my most scientifically creative and productive have been when I've felt safe and supported in my lab community.

I believe the setting in which we work can have significant impact on our well-being. Though there is a certain charm to a dingy but well-loved space, there are many tangible ways to make a lab space feel more open and inviting.

Ways to make your lab feel safer and more comfortable

- Develop a safety stash for your lab (pictured).
    - We were inspired by this Tweet from Tera Levin at the University of Pittsburgh. Ours has pain medication, cough drops, Tums, toiletries, granola bars, hair ties, soups (vegan, gluten free), and (most importantly) chocolates (note – ours is housed outside the actual labspace because of there being food).
- Take a Safer People Safer Places Foundations workshop, information can be found through studentaffairs.psu.edu.
- Post stickers, posters, or notes that reflect the values of your lab (some of ours are pictured)
- Share information between lab members – labeling the lab well and digital repositories
    - This helps lessen the knowledge gap between new and senior members of the lab, as well as keep the lab organized and high functioning.
    - How does your lab communicate? We have found Slack to work well, with channels set for storing lab protocols, ordering information, colony care, etc.
    - Consider making a lab directory with pictures and contact information if you have a large group. ▲

Understanding how a fungal pathogen is impacting Pennsylvania newts

By: Jim Lor (he/him)

In the palm of my hands lay an olive-green newt, speckled with black dots and occasionally red spots. My advisor, David Miller, was introducing me to the field site and the newts that I would be dedicating the next 2.5 years of my life to. I had never seen or held a newt before this project, but little did I know that I would be bestowed the title of "Best Newt Catcher" by the time my fieldwork finished. This journey begins not with the newts, but a much smaller organism called *Batrachochytrium dendrobatidis*.

Batrachochytrium dendrobatidis (*Bd*) is a fungal pathogen that can cause a skin disease called chytridiomycosis in amphibian species. It was first discovered in the late 1990s by Lee Berger and has since then been attributed to the worldwide decline of over 500 species and extinction of at least 90 species. *Bd* has two life stages: the mobile zoospore and the sessile sporangium. *Bd* zoospores can infect susceptible individuals through direct contact from an infected host or from a zoospore in the water. Once the zoospore contacts a host, it will mature under the skin and develop more zoospores that can be shed into the aquatic environment to infect other susceptible individuals or the same individual. *Bd* is a multi-host pathogen with varying effects on different host species. In extreme cases, *Bd* can cause cardiac arrest by disrupting the ion transport function of the skin and result in mass mortalities. Because of the range in species that *Bd* can infect, we still do not know how each species helps in pathogen transmission.

Eastern red-spotted newts (*Notophthalmus viridescens*) have a complex life history, are common and widespread across the eastern United States, and are susceptible to *Bd*. Newts have a distinct juvenile stage called "efts". These efts are a bright red-orange in coloration and remain terrestrial until they transition into the olive-green adult stage. As adults, newts can inhabit various bodies of water that range from ephemeral vernal pools to more permanent ponds. In vernal pool habitats,

adult newts can transition into a more terrestrial form with rougher skin and a reduced tail fin when pools dry up in the warmer months of the year. Previous studies show that newts are susceptible to *Bd*, but are more resistant compared to other more vulnerable species. Knowing how *Bd* varies spatiotemporally in the newt population can help determine how newts are potentially spreading *Bd* to other species and among the landscape.

To determine how *Bd* infections vary within a newt population, we captured and swabbed newts from 16 ponds in central Pennsylvania. These 16 ponds varied in shape, size, hydroperiod (the duration in which ponds hold water), and amphibian species. We captured newts using dip newts and funnel traps and placed them individually in plastic bags to avoid cross-contamination. The first step in processing newts is to check for marks while newts are still in the bags. Individuals may have up to 6 Visual Implant Elastomer (VIE) marks of 4 different colors (blue, orange, red, and yellow) so that we can identify unique individuals. Next, while wearing gloves, we swab the newts 5 times each at the inner thigh region, inner arm region, alongside the stomach, under the chin, alongside the back, and on each side of the tail for a total of 35 times. Once swabbed, we then determine their sex to account for any possible differences in physiology or behavior that may affect disease susceptibility and transmission. In addition, we obtained total length and snout-vent-length (SVL) measurements. Not only can SVL account for size differences, it also allows us to approximate the age of the newt and consider differences in age classes with disease. The last thing we do is mark new individuals with VIE before releasing them back to approximately the same area of the pond we captured them. We then disinfect our boots and equipment before moving on to the next pond.

Between March and July from 2018 and 2020, we caught and processed over 7,500 newts and swabbed around 3,000 animals. The data from the newts will be paired with temperature data to determine how and if *Bd* infection within the newt population varies according to changes in temperature within a season and between different years. Understanding when, where, and how newt infections are changing can help in understanding newt's role in how *Bd* infections spread and persist throughout the landscape and in amphibian populations. ▲

Ecology graduate students can now earn a dual title degree in International Agriculture and Development (INTAD)!

All of the following information is pulled from agsci.psu.edu/global/intad. For more information or if you're interested in pursuing this opportunity, contact Melanie Foster: mjm727@psu.edu.

Students benefit from the program through

- Knowledge, training, and academic achievement in their primary discipline.
- Understanding that agriculture has interlocking relationships with all sectors of the economy; functions within a socio-, cultural, economic and political milieu; and can be a vital resource to directly address issues of hunger, poverty, and health, throughout the world.
- A greater capacity to link knowledge with action to promote international agriculture and development.
- The global competency and skill set needed for leadership positions in research, nonprofit organizations, government agencies at all levels, and corporations.
- Intercultural communication skills, plus competence to work in diverse settings.
- A budding network of contacts in the academic and international development communities that will increase access to employment and international research opportunities and internships.
- Increased opportunities for publication in a growing field of professional journals.

The INTAD dual-title degree will enable students to

- Describe and analyze changing global systems (political, economic, social, and environmental) that affect world food systems
- Identify key social, cultural, economic and political influences and their impact on agriculture and development in local, national and international contexts.
- Explain the history, impact, resources, and constraints of international agricultural institutions.
- Apply research, extension, education, and evaluation tools for both collaborative development and technology transfer/adaptation, particularly in resource-poor situations.
- Understand, apply, and develop teamwork and leadership skills designed for work within and across multicultural institutions.

The International Agriculture and Development (INTAD) program does not require previous international experience. The program is appropriate for students who have an interest in working to solve international issues related to agriculture and development. The INTAD dual-title degree program is designed to help students gain international experience through coursework, research, and opportunities abroad offered by the College of Agricultural Sciences. ▲

Fieldwork highlight: urban birding in Puerto Rico

Julissa Irizarry (she/her), a second year Ecology PhD student advised by Dr. Tomás Carlo, has an eye for birds in potentially underappreciated places. Her research focuses on birds in urban areas, usually not the first place that comes to mind when considering conservation of Caribbean birds.

Julissa I. Irizarry uses a rangefinder to measure distances during a bird survey in Levittown, Puerto Rico. Credit: Tomás Carlo

People's gardens provide a major source of vegetation in the urban landscape, and Julissa is hoping to better understand how people's preferences and values impact the green spaces they create, and thus the resources available to these beautiful birds.

Alberto Cruz (also an Ecology student, FS21) counts the fruits from a citrus tree in a neighbor's front yard in San Juan, Puerto Rico. (Photo by Julissa I. Irizarry)

An urban field site in Bayamón, Puerto Rico.
(Photo by Julissa I. Irizarry)

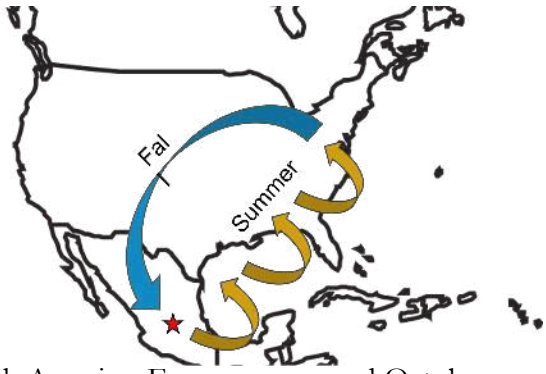
Fiji Fan Palm is an example of an introduced, yet common palm in residential areas, and is potentially an important fruiting resource for urban birds.
(Photo by Julissa Irizarry)

The Bananaquit (*Coereba flaveola*) is a ubiquitous songbird found across the Caribbean, and is highly adaptable to human environments.

The Puerto Rican Spindalis (*Spindalis portoricensis*) is endemic to Puerto Rico, and is an important member to the ecosystem as a seed disperser.

Monarch butterflies: migrants versus non-migrants

By: Kaley Hallmark (she/her)



Monarch butterflies (*Danaus plexippus*) are an iconic insect that have captured the attention of citizens and scientists alike over the last several decades. They are a relatively large species with a vibrant orange color that makes them easy to notice, but it is more than just their beauty and elegance that make them lovable and interesting. Monarchs also have a fascinating and complex life-history including a generational migration every fall that spans most of North America. Every year around October, one generation of monarchs fly up to 3,000 km from Northern parts of the United States down to central Mexico to spend the winter. The following spring, these same individuals leave their Mexican overwintering grounds and begin recolonizing northward, but at a much more leisurely pace -- it takes 3-4 generations of butterflies to again reach the Northern US before the next fall pushes them south again.

Since Monarchs are such an iconic study system, much work has been done to understand this migratory behavior, including how the animals "know" when they should continue north or when it's time to head south and how the migratory individuals differ from non-migratory populations. The main drivers of phenotypic differences of monarchs (I.e. migrants vs. Non-migrants) are thought to be controlled by seasonal changes in temperature and day-length (photoperiod), with decreasing temperatures and shortening photoperiod in the fall serving as cues to induce monarch migration. These environmental cues cause subtle changes in the butterflies' physiology and morphology, most notably suppressed reproductive development and elongated forewings, which is thought to better equip migrants to successfully complete their long, southward journey. Suppressing reproduction is beneficial because it allows migrants to retain abdominal fat as energy stores, rather than converting them into eggs or sperm. Longer forewings provide a higher surface area for gliding on wind currents or producing more powered thrust in flight. Large gaps surrounding our knowledge of flight performance and efficiency of migratory monarchs still exist, however. For example, what are the energetic costs of flight? What factors influence flight success and efficiency? How do migratory and non-migratory populations differ in

this efficiency, if at all? My research with Drs. Jared Ali and Ruud Schilder aims to answer these questions by testing and comparing in-flight respiration rates of migratory and non-migratory monarchs. Following the notion that migrants should be more efficient fliers than non-migrants because they fly much longer distances, we expect to see lower respiration rates, which we equate with higher efficiency, in migrants when compared to non-migrants.

Last winter (Dec. 2020- Feb. 2021), we began a series of controlled laboratory experiments to address these questions. Monarchs were reared from egg under two separate growing conditions using controlled treatment chambers to induce phenotypic expressions of migrants and non-migrants. One chamber was set to mimic fall-like conditions with a daily decreasing photoperiod and temperature and another chamber was set to mimic summer-like conditions with a constant photoperiod and temperature. Once adults emerged from their pupae, we recorded adult wing lengths to compare forewing sizes between treatments, number of mature and immature oocytes in females to evaluate reproductive development, and performed respirometer flight tests to analyze respiration rates of each phenotype on both sexes.

The preliminary findings from our first test showed the two growing conditions successfully induced physiological differences, with the fall-raised individuals having migrant-like suppressed reproduction and longer forewings while summer-raised individuals were reproductively active and had shorter forewings. Surprisingly, however, no differences in respiration rates were observed. This null result could stem from the confined and sedentary lifestyle of the adults up until they were flown in the respirometer or from a bias of the experimental procedure that causes stress on the individual. Follow-up experiments and further analysis is ongoing to assess flight efficiency and performance of migratory monarchs. ▲

We aren't alone in these alone-feeling thoughts

By: Lilly Germeroth (she/her)

Ecology is a discipline of connectivity, a study of interactions. When connectivity and interactions are interrupted, the results can be disturbance and disruption. I began my graduate education, with many others, during the pandemic, and there certainly has been a sense of irony of studying the interconnectedness of insects and plants in a time when we are so disconnected from each other.

An ecology grad student organization game night

In times of struggle, I feel detached to how others are experiencing it, particularly within the academic realm with its stigma of pandemic productivity. This feeling of disconnection, and the frustration and depression it leads to, is what inspired me to write this article and share it with the Ecology program at large. I seek to highlight both the feelings of graduate students at this point of the pandemic, but also the efforts being made to connect during this time of distance. Below are selected quotes from Ecology and Entomology graduate students collected this semester. If you have had these thoughts, I hope you know that many of us are feeling similarly.

"While I understand the desire and motivation to resume to the 'business-as-usual' flow, the transition into fall semester has been quite difficult, and I am unsure whether this is the new normal."

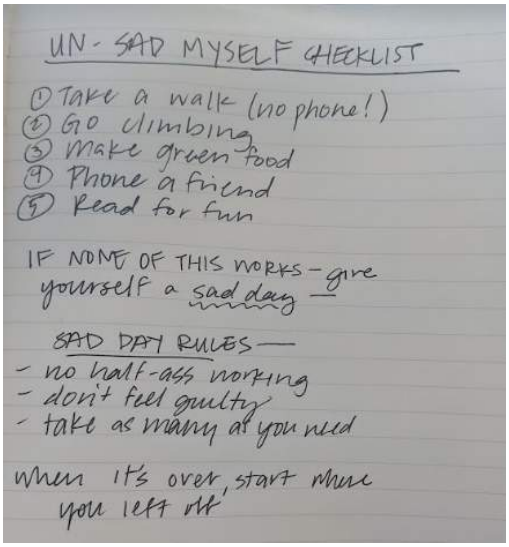
"I told my advisor how much I was struggling, and they said, 'you seem fine.' They only see me during specific times: lab meetings, individual meetings. The other 99% of my life is a real struggle."

"I know that grad school will always be challenging and stressful, but it feels like there are quite a few very heavy additional layers weighing on all of us right now."

"I graduated with my bachelor's during the pandemic, started grad school during the pandemic, and am now beginning my first teaching assistantship during the pandemic. The common theme between all these events is a simple one: isolation from my work and from my community."

"we're all trying our best, but it is stressful and emotionally draining, and it will catch up to us eventually"

These sentiments are challenging to read, but I know that I find solidarity in learning of these shared experiences. Additionally, I have gained a sense of unity in seeing the efforts of my fellow students trying to connect. These include Zoom game nights, coffee hours, happy hours, and book clubs. Though we all know Zoom fatigue well, I hope we can appreciate the efforts that have been made by our colleagues to forge connections during this time of disruption.



Earlier this year, I wrote out a checklist of how to "un-sad" myself. Here is that list (pardon language). I encourage readers to consider what coping mechanisms work for them, while recognizing that the larger experience of the pandemic is largely out of our control.

Your peers are here for you, and my inbox is always open (lzg5389@psu.edu). Your program chair, Jason Kaye, wants your well-being to come first and is here for you as well (jpk12@psu.edu).

Counseling and Psychological Services | 814-863-0395 | Monday – Friday, 8:00 a.m.-5:00 p.m.

24/7 Penn State Crisis Line | 1-877-229-6400, 24/7 Crisis Text Line | Text "LIONS" to 741741 ▲

Remembering Dr. Victoria Braithwaite through memorial student award

By: Lilly Germeroth (she/her)

The Braithwaite Award is named for a beloved Penn State faculty member and researcher who died in 2019. Dr. Victoria Braithwaite is remembered as an inspiring mentor, a much-loved colleague, and an ambitious leader in the field of animal cognition.

The Braithwaite Award will recognize the student who is lead author on the best ecology paper published in the previous year, as determined by a committee of faculty and students. The Ecology Interdisciplinary Graduate Program is still seeking to grow the endowment for this prestigious award. Donations can be accepted here (raise.psu.edu/BraithwaiteAward).

Dr. Braithwaite's legacy lives on in the science she inspired. In April 2021, the program faculty organized the Victoria Braithwaite Memorial Symposium to celebrate her impact on the field of animal behavior and to highlight the current cutting-edge research in the fields of animal cognition and welfare. In this symposium, there were talks from friends, collaborators, past students and postdocs who all continue to be influenced by Dr. Braithwaite's work. A component of the symposium was sharing memories and thoughts of Dr. Braithwaite in online posts (kudoboard.com/boards/qGXjqbkL). Below are selected quotes from friends and colleagues.

"Your work was always thoughtful, careful and precise... Your passion for animal behavior will always inspire me and your curiosity was very contagious."

"I will always be grateful for her resilience and kindness in helping me complete my degree, especially while she went under treatment."

"From you, I learned what kind of researcher I want to be, in everything from how to care for the lab animals to how I interact with my fellow researchers. I will keep these wisdoms in mind throughout my career."

"You welcomed me and my husband with open arms when we arrived for my postdoc stay at Penn State and you just blew us away with your enormous generosity, humor and intelligence. And as highly as I value our scientific discussions, I value our discussions on life, love, art, food, music, dreams and what not, over countless dinners at your house and walks..."

"You leave us with a legacy of Love, Courage, Tolerance, Joy of Living, Happiness, Altruism, Availability, Finesse, and Wisdom." ▲

Fall Awards and Publications

Publications from Google scholar August-December. Only in included if a Penn State Ecology Faculty 1st through 4th author or last author. Apologies if anyone was missed! Bolded authors are affiliated with the Ecology IDGP as faculty or students.

Awards

Dr. Marc Abrams has been named one of the most highly cited researchers in the field of Applied Sciences - Agriculture, Fisheries & Forestry. Dr. Abrams ranks 5th out of 24,000 researchers in total career citations to his published research.

Dr. David Hughes awarded nearly $40M over five years to establish the Feed the Future Innovation Lab for Current and Emerging Threats to Crops at Penn State.

Dr. Laura Leites has been selected as an Equity Leadership Fellow in the Office of the Vice Provost for Educational Equity for the academic year 2021-2022.

João Vitor S. Messeder's 2021 Biotropica publication was awarded the Peter Ashton prize for the best student paper published in the journal.

- Messeder J.V.S., Guerra T.J., Dáttilo W., Silveira F.A.O. 2020. Searching for keystone plant resources in fruit-frugivore interaction networks across the Neotropics. *Biotropica.* 52(5): 857-870

Publications

Abrams M.D., Nowacki G.J. 2021. Examining the heritage and legacy of Indigenous land management in oak and pine forests of northeastern United States. *International Journal of Ecology and Environmental Sciences*, 47(1),27-36.

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Davidson-Lowe, E., Ray, S., Murrell, E., **Kaye, J., Ali, J.G.** (2021). Cover Crop Soil Legacies Alter Phytochemistry and Resistance to Fall Armyworm (Lepidoptera: Noctuidae) in Maize, *Environmental Entomology*, Volume 50, Issue 4, August 2021, Pages 958–967.

Besozzi, E., Chew, B., **Allen, D.C**., Contina, A. (2021). Stable isotope analysis of an aberrant Painted Bunting (Passerina ciris) feather suggests post-molt movements. *The Wilson Journal of Ornithology*. Vol. 133 Issue 1, p151-158

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