VOLUME 19, ISSUE 2 FALL 2019

Myakka

Myakka ('my-yak-ah' - Seminole word for "big waters") gives a special identity to our department, as it is also the name of Florida's State Soil, Myakka fine sand. The State of Florida has the largest total acreage of Myakka fine sand (sandy, silicous, hyperthermic Aeric Alaquod) on flatwood landscapes.

Researching Stormwater Ponds

A Message from the Chair

As I write this message, the last push of the Fall 2019 semester is underway, as students complete their projects and study for exams, and faculty prepare to grade assignments and send off new graduates. As the end of the year approaches, we have time to reflect on 2019.

Personally, I am completing my first year of service as SWSD chair. The time has gone quickly as I have learned new processes and procedures, met with countless stakeholders across UF and the State of Florida, and forged new relationships with students, faculty, staff, and colleagues in other UF departments. I want to take this opportunity to share with you some of my thoughts on the year.

First, I am encouraged by the interactions I have had with everyone I have met with about the SWSD. Our students – graduates and undergraduates – are obviously happy with the experiences they are having in our programs. This is true both in the classroom and in the field, whether it is conducting their research or getting hands-on experience through internships. Our graduate students have some natural leaders who have undertaken an effort to build community by hosting informal gatherings they call “Pop Talks” and increasing social events. I was able to have lunch with our Soil and Water Sciences majors in the spring and our Environmental Management of Agriculture and Natural Resources (EMANR) majors this fall. I am impressed by the enthusiasm they have for their chosen fields and career goals they plan to pursue.

As far as academics go, SWSD faculty members and advisors have been working to strengthen the water science concentration for the undergraduate program. The goal is to make it align better with what the soil science concentration requires. Similarly, work is wrapping up on a curriculum review of the EMANR program. For the department as a whole, we are performing a course mapping project. With recent new faculty hires, we have added some interesting and sought-after courses, but we want to make sure students are receiving comprehensive training with no gaps between the existing and newer courses. This involves a review of course objectives, but we are also reaching out to stakeholders who hire our graduates. We want to know what they are looking for when they bring on a new scientist. If you would like to take part in this process and provide feedback, please contact us.

We have collaborative efforts with other departments underway as well. Like SWSD, the Agronomy Department has a new chair, Dr. Diane Rowland. She and I have been brainstorming ways our two departments can achieve like-minded goals. This ranges from a joint faculty “coffee room” to foster collegiality and promote partnerships, to reinvigorating the student’s Agronomy-Soils Club. We are discussing a shared facilities manager position to handle our space needs. Similarly, SWSD, Agronomy, and the Wildlife Ecology and Conservation Department are working together to enhance our use of facilities and space.

I am confident the initiatives we have outlined will bring positive results in 2020. Finally, we cannot do it alone. We invite your input on sustaining our success and improving our operations. Please contact me with any thoughts or concerns. I wish you a happy and prosperous 2020!

UF IFAS UNIVERSITY of FLORIDA

Soil & Water SCIENCES

Dr. Matt Whiles | mwhiles@ufl.edu
Chair, UF/IFAS Soil and Water Sciences Department

2181 McCarty Hall A, Box 110290
Gainesville, FL 32611-0290

Phone: (352) 294-3151
Website: soils.ifas.ufl.edu

Contents

The mission of the UF/IFAS Soil & Water Sciences Department is to provide knowledge and science-based solutions for addressing food security, public health, and protection of natural resources and environment in Florida, the nation, and the world.

Soil & Water Sciences Department Welcomes Three New Faculty Members

Drs. Lakesh Sharma, Heather Enloe, and Yang Lin are the newest members of the Soil and Water Sciences Department's faculty. The appointment of the three was approved earlier this year after a lengthy hiring process, which began in the summer of 2018. Their expertise in the areas of teaching and research expands upon and complements SWSD's existing strengths in soil health, soil fertility, and water science and policy.

"Each of the three positions attracted a well-qualified pool of candidates and we invited the best of the best for on-campus interviews," said Dr. Matt Whiles, chair of SWSD. "I'm happy to say the candidate that the department's faculty, students, and staff viewed as the top choice for each position accepted our offer."

Sharma and Enloe are in their new roles now. Lin arrives in January 2020.

Dr. Lakesh Sharma

Education:

Ph.D., Department of Soil Science, North Dakota State University, Fargo, ND

M.S., Horticulture, Punjab Agricultural University, Ludhiana, India

B.S., Agriculture, Guru Nanak Dev University, Amritsar, India

Most Recent Employment:

Assistant Professor, Extension and Sustainable Agriculture, University of Maine Cooperative Extension

Dr. Lakesh Sharma joins the Soil and Water Sciences Department as an assistant professor of soil fertility and sustainable nutrient management. The position has several main responsibilities. The first is to develop a statewide extension education program in soil fertility and nutrient management.

"The goal is to address critical issues such as crop nutrient requirements, soil and tissue testing, nutrient sensors, and nutrient-related environmental concerns," Sharma said.

Emphasizing Best Management Practices (BMPs) to county extension agents, agricultural producers, and those in related industries as well as state and federal agencies is also part of his duties. That includes the 4Rs principle – the right type of fertilizer at the right rate at the right time in the right place.

"I'm excited to have the opportunity to help producers improve their systems in an environmentally-friendly way in terms of nutrient management," Sharma said. "My research focus is to mitigate the nitrogen and phosphorus issues from Florida water."

He is visiting and working directly with UF/IFAS Extension agents throughout the state – his "hands and shoes on the ground" – to get a better understanding of their needs and those of producers.

"There are needs for precision agriculture team development and I am organizing an in-service training in early 2020 for county agents to learn precision agriculture's role in Best Management Practices (BMP)," Sharma said. "A state-level BMP conference is in the works for the end of March or early April 2020."

Dr. Heather Enloe

Education:

Ph.D., Forestry & Wildlife Sciences, Auburn University, Auburn, AL

M.S., Soil & Water Sciences, University of California-Riverside, Riverside, CA

B.S., Environmental Sciences, University of Houston, Houston, TX

Most Recent Employment:

Adjunct Lecturer, Soil & Water Sciences Department, University of Florida

Dr. Heather Enloe begins a new role with SWSD, as lecturer of water science. She previously served as an adjunct lecturer since 2017 and was a research assistant professor two years prior to that. Her new position is responsible for teaching two new SWSD courses: Introduction to Water in the Environment and Water Management. She will also co-teach Environmental Soil and Water Monitoring Techniques with Dr. Todd Osborne.

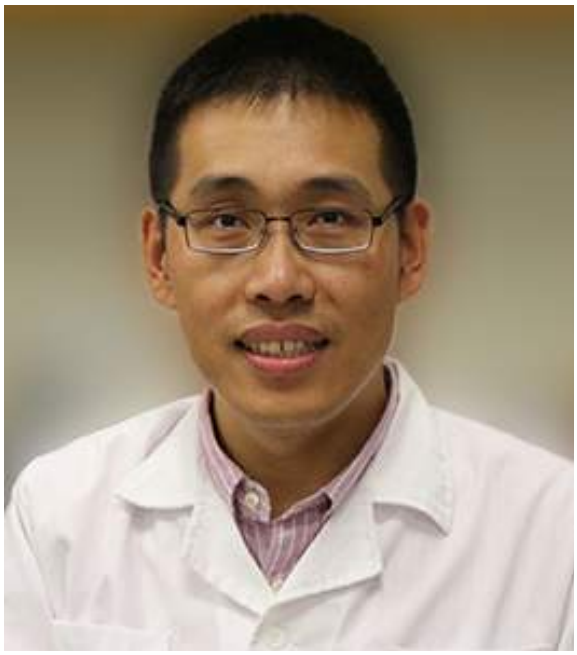
“These courses are upper division courses with a smaller class size to promote class discussion and active learning opportunities,” Enloe said.

Introduction to Water in the Environment will be offered in Spring 2020. Enloe said the course is about making connections between soil and water, water challenges and solutions, and this course and other water science courses offered in CALS.

She will continue to serve as of the advisors for undergraduate students in the department. This includes the online, interdisciplinary studies program Environmental Management in Agriculture and Natural Resources.

“I enjoy seeing the progress our students make as they work towards graduation. We have a great group of undergraduate advisors in our department that are dedicated to meeting our undergraduate students where they are,” Enloe said.

“For instance, what course plan works best for the student’s current situation? How can we connect a student to UF faculty, staff, and students based on that student’s goals?” she said. “Our students work with UF or their local community by completing an internship during their degree. I enjoy helping students get ready for this requirement and hearing their amazing stories when they are done!”



Dr. Yang Lin

Education:

Ph.D., Geography, University of California-Santa Barbara, Santa Barbara, CA

M.S., Soil Science, University of Alberta, Edmonton, Canada

B.S., Biological Sciences, Zhejiang University, Hangzhou, China

Most Recent Employment:
Postdoctoral Scholar, Department of Environmental Science, Policy, and Management, University of California-Berkeley

Dr. Yang Lin is SWSD's newest assistant professor of soil health and integrative soil scientist. The majority of the position involves teaching – Introduction to soils in the Environment and Forest Soils Ecosystem Services. He will also develop a new course focused on training students in quantitative tools science and application of soil health principles.

"I'm looking forward to getting back into the classroom to teach," Lin said. "These courses are important for foundational knowledge and for use in our students' professional careers after graduation."

Lin's research focus includes soil carbon persistence and decomposition, coupled carbon-nutrient cycling in terrestrial ecosystems, redox dynamics in upland soils, and biogeochemical implications of climate change and land use. He conducts his fieldwork in a wide range of ecosystems, including arid grasslands, sub-tropical forests, and agricultural landscapes.

"We are happy to have Lakesh, Heather, and Yang as part of our team," Whiles said. "We know they will be successful at UF and a great resource for our students and stakeholders."

Congrats!

Summer 2019 Graduates

Ph.D

Rosemary Collins (Mylavarapu)
Andressa Freitas (Nair)
Claire Friedrichsen (Daroub)
Peng Gao (Ma & Wilson)

M.S. (Thesis)

Franky Celestin (Mylavarapu)
John Santiago (Strauss & Ogram)
Qudus Uthman (Kadyampakeni & Nkedi-Kizza)
Shiji Wang (He & Harris)

M.S. (Professional Non-Thesis)

Kelly Mahan-Percivall (Bhadha)

B.S. Environmental Management in Agriculture & Natural Resources

(Advisors: Curry & Enloe)

Dalton Bodie
Elizabeth Fleck
Donna Kaminski
Liam MacLean
Breanne O'Neill
Vitaliya Repina

Soil & Water Sciences Minor

(Advisor: Bonczek)

Vitaliya Repina

Fall 2019 Graduates

Ph.D

Katie McCurley (Jawitz)

M.S. (Thesis)

Theresa Gruninger (Reynolds & Osborne)
Cayla Sullivan (Reynolds)

M.S. (Professional Non-Thesis)

Juhi Chaudhary (Clark)
Kelsey Krueger (Smyth)
Jennifer Shirley (Mackowiak)

B.S. Environmental Management in Agriculture & Natural Resources

(Advisors: Curry & Enloe)

Corrina Adams
Shelby Grafton
Robyn Guy
Carmen Hernandez
Arjuma Khandakar
Daniel Lambert
Chance McLeod
Olivia Miserandino
Sothom Son

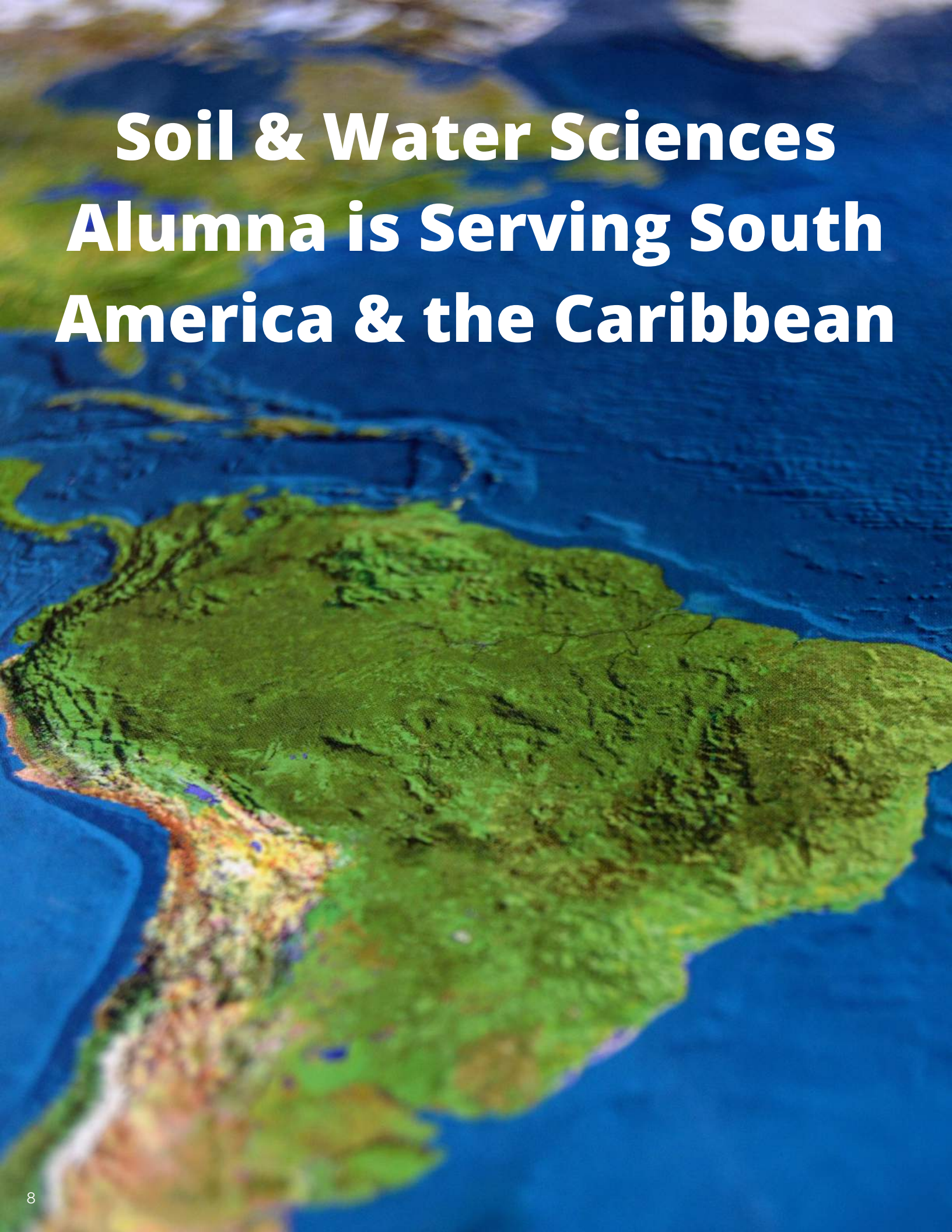
Soil & Water Sciences Minor

(Advisor: Bonczek)

Haley Cox
Nathan Kyle
Chance McLeod
Gillian Palino

Best of Luck!

Soil & Water Sciences Alumna is Serving South America & the Caribbean



Growing up in Puerto Rico, Bethzaida "Betzy" Colon had no idea she would one day be supporting development programs in the Caribbean. Not only does her work focus on her home region, but a large portion of the Western Hemisphere. She currently works for the United States Agency for International Development (USAID) as a Regional Environmental Advisor for South America and the Caribbean. We talked with Betzy about her time at UF, her work experience, and how her path from undergraduate to the present helped her along the way.

Myakka: You earned your bachelor's degree in geology at UF. How did you enter the SWSD master's degree program?

Betzy Colon: I was working as a field geologist in Gainesville for a consulting company and I was conducting environmental assessments throughout Florida and Puerto Rico. A lot of what I was doing was essentially finding soil and water contamination either from industrial or agricultural activities, so that was the inspiration for me to a pursue my master's degree. Geology was great, but I wasn't really very focused on looking at the shallow soils – particularly the plant growth zone – so I wanted to learn a little bit more about it.

I did some research and I saw that the SWSD offered a certificate program for professionals and there were some classes that I thought were very relevant to the work I was doing in the field. That's what initially led me to the SWSD. Then, I took my very first class with Dr. Mary Collins – Soils for Professionals – and I was hooked after that! I absolutely loved it and it made me realize that in order to really understand the environmental quality issues I was seeing in the field, there needed to be this very close relationship between geology and soil science.

Myakka: So, you were just planning on getting a certificate? Did you do that online or in person?

BC: I was just going to do the certificate program, but I decided to continue, so I signed up to do the master's degree online. I did the courses for the certificate program, and some of those were in person, because I was still living and working in Gainesville.

BC: But once I applied for the graduate degree program, I had already moved to Washington, D.C., so those I did online. That was another reason for applying, because I felt the distance education program offered a lot more flexibility and I could do it while still keeping my full-time job.

Myakka: How did that work for you?

BC: I did about two courses a semester. There may have been one or two semesters when I took just one course, but I tried to do at least two courses. It was challenging at times, but it was definitely worth it. I saved a lot of time doing it online and not having to go to campus. Also, since I was already in D.C. when I started the online degree program, it offered a lot more flexibility.

Myakka: The SWSD master's degree program offers a thesis and a non-thesis option for professionals. Which one did you choose?

BC: I did a non-thesis degree. One of the primary reasons I did that was because I already had five years under my belt working in the environmental consulting field and I was really happy there, but I wanted to augment my knowledge and have a better foundation, technically.

Myakka: Even though you did the non-thesis degree program, you still were required to do a major project. What was your project?

BC: One of the things that my advisor (Dr. Gurpal Toor) really pushed me to do was to select a topic that I really like, and I wanted to learn more about. He also pushed me to do something that I could get published, even though I wasn't going to do the thesis option. This was kind of an added pressure, but I'm so glad he pushed me to do that because it made me… it really increased my abilities and my technical skills and even my research skills in the workplace. The number of literature searches and articles that I had to review in order to develop this literature review paper (A Review of Uptake and Translocation of Pharmaceuticals and Personal Care Products by Food Crops Irrigated with Treated Wastewater) was very valuable to me and it still is to this day in my job.

USAID helped fund a Zika project to provide support in Latin America and the Caribbean that included entomological monitoring and using biopesticide to help reduce the number of Zika cases in countries with an outbreak. This photo shows Betzy Colon (second from right) in Honduras in the field ensuring that best practices were being implemented under the environmental compliance plan.
(photo provided)

BC: When I selected this topic about pharmaceutical and personal care products, I was working for a consulting company and I was primarily supporting the U.S. E.P.A., working in various technical areas and this happened to be one of them – pharmaceutical and personal care products – and other emerging contaminants so I decided to make this a focus of my research paper. The other part to this is that I knew nothing about plants and plant uptake of contaminants. That was part of my research paper as well – to look at the uptake of these types of contaminants and food crops. It's something that I didn't really know anything about, so I thought this would be a good way to push myself and to learn more about plant uptakes and how contaminants behave in the soil and as they're taken up by a plant. For me, it was a challenging topic and it was that added pressure of developing something that could be published. And it was published in 2016 and again I'm so happy that my advisor really pushed me to do that.

Myakka: You started working with USAID in the past year. How has it been, so far?

BC: It's a wonderful place! I actually had the opportunity in my previous job, at Tellevate, to provide support to USAID, so I was familiar with the agency before I took the position and I had just an amazing opportunity to work with USAID and travel and look at some of their projects. When the opportunity came up for this position, I absolutely jumped on it. It's a wonderful agency to work for. Its goal is to help save lives and provide support to people during disasters and humanitarian crises, so I'm so very proud to be part of this agency from that perspective. The actual environmental work that I get to do is amazing and I was very lucky to get the job.

"I know people who have worked in this position before me. They said it is probably one of the best jobs in USAID. I agree and feel so very fortunate to be in this role."
Betzy Colon

Myakka: It seems like you do a variety of environmental work, ranging from helping communities prevent the Zika virus to environmental compliance.

BC: Yes, the agency supports projects in various sectors and that includes education, health, food security, environment, democracy, so in terms of the technical areas that I help support it's very diverse, which is wonderful. My actual job is to help ensure that environmental and social safeguards are being implemented in these projects. I get to go out in the field and see a health project or an agricultural project and not only get familiar with that specific activity, but also see it with an environmental compliance lens.

Myakka: Working for USAID's Latin America and Caribbean geographic area, it seems you travel quite a bit, is that right?

BC: Yes. I was traveling before as a contractor, but now it's more consistent traveling. It varies, but I average about a trip per month – a one-week trip per month. I work with the local staff in the country to help make sure we're complying with USAID's environmental regulations and policies. Also, that we're providing training and helping build local capacity.

Myakka: Did you ever think, growing up in Puerto Rico, that you would be doing this much traveling or that you would even be doing this type of job?

BC: No. It's actually been a really amazing job for me, personally. Being from the Caribbean, we share a lot of the same traditions or similar cultures as our neighbors in the Caribbean and also in South America, so I have that personal connection to who we serve. It's really wonderful to travel and see the similarities or the differences and it's wonderful. It also gives me an opportunity to speak Spanish and use my native language skills more. I'm also expanding my Portuguese language skills and learning French, which has been an interesting challenge for me.

Myakka: Is there anything else you want people to know about your SWSD experience?

BC: I think one of the things that I feel very lucky about is that I know I would not be in this position right now if it wasn't for the University of Florida. It holds a really special place in my heart. Growing up in Puerto Rico, my family didn't really know much about college. I was the first in my immediate family to go to college and get a bachelor's degree. Then getting a master's degree, it was kind of icing on the cake! Through that journey, starting at UF to my professional career, it's been an amazing experience. I know it would not have happened if I didn't go to such a great school. The positive impact it's had in my personal and professional life is just wonderful.

Betzy Colon in Guatemala, visiting the site of a water supply project that helped distribute water to homes that lacked the necessary infrastructure.

"That was a need the community identified," Colon said. "USAID worked with a local partner to build the water supply system and provided them some technical assistance on how to maintain it." (photo provided)

Alumni, keep in touch: soils.ifas.ufl.edu/connect-with-us

- Dr. Liz Hodges Snyder (Ph.D. 2009) launched her campaign for Alaska state representative. The University of Alaska-Anchorage associate professor of public health came up short by fewer than 200 votes in the District 27 race during the 2018 election.

- Dr. Biswanath Dari (Ph.D. 2015) will lead the American Society of Agronomy's Biochar: Agronomic and Environmental Uses Community. The main purpose of the group is to facilitate scientific data exchange, improve collaborations, and provide a forum to share and extend the impact by coordinating multi-location research efforts among its members. Dari is a postdoctoral fellow at the University of Idaho Aberdeen Research and Extension Center.

- Ethan Weinrich (B.S. 2019) completed training and was sworn in as a volunteer with the Peace Corps in November.
  "I have been learning a dialect of the Pulaar language called Fulakunda," Weinrich said. "I practiced the local language by staying with a host family in Mbour for the past month or so. My family in Senegal has been so welcoming and quickly incorporated me into the family dynamic."
  His permanent volunteer site is in the region of Kolda where he will be working in the Casamance (area of Senegal south of the Gambia) for the next two years.

Weinrich with his host family sisters.

UF|IFAS UNIVERSITY of FLORIDA

Soil & Water SCIENCES

Graduate Student Spotlight: Audrey Goeckner

(M.S. 2020)

Thesis: "Carbon Dynamics of Urban Stormwater Ponds: Burial, Gas Flux, and Dissolved Organic Matter Composition"

Permanently wet stormwater ponds are engineered control systems that are increasing in number on the landscape. Their purpose is to relieve flooding and filter out materials such as nutrients, particulates, and contaminants that are delivered through stormwater runoff. However, their morphologic and chemical conditions allow them to potentially play a significant role in altering biogeochemical cycles on the landscape, especially that of carbon. Although individually small in size, stormwater ponds collectively are estimated to make up just under one percent of Florida's land area and remain under-researched. The goal of this study is to understand how small constructed aquatic systems intercept water from the landscape and transform carbon where it can either be stored, emitted to the atmosphere as a gas, or altered molecularly and sent downstream to naturally occurring streams, rivers, or wetlands.

Research Question:
How do urban stormwater ponds impact regional carbon cycling, specifically related to carbon burial rates, greenhouse gas flux (CO_2, CH_4), and the composition of dissolved organic matter (DOM)?

"We are looking at five ponds over an age gradient," Audrey Goeckner said. "Each one has no vegetation, so we can focus on inputs based on stormwater runoff and precipitation. They also do not include aeration systems – no fountains or bubblers – which is common."

The ponds are located in Lakewood Ranch – a large, master planned community that sits in the southeastern corner of Manatee County and northeastern Sarasota County. Each community development district there was set up one after the other over a span of about 20 years. That allows an age gradient of the ponds from 14 to 34 years.

"The reason that we're doing that is to see if the rates of carbon accumulation or gas fluxes, differ as these systems age," Goeckner explained. "We hope by doing this we can make suggestions or inferences on how pond management can be handled as these human engineered systems get older."

"When Audrey and I first talked, I had this idea that her thesis should have some focus on stormwater ponds," said Dr. Mary Lusk, assistant professor of urban soil and water quality in the Soil and Water Sciences Department. "My research focuses on the ecology of what's going on with these stormwater ponds everywhere in the Tampa area. Other than that, I was pretty open to her ideas. She designed this and she has owned this project since the beginning."

A Path to the University of Florida

Goeckner came to UF after earning two bachelor's degrees from the University of South Florida. She majored in anthropology as well as environmental science and policy. That allowed her to work in the archeology lab and conduct excavation work at Weedon Island Preserve in St. Petersburg. But an internship with Tampa Bay Water in its drinking water lab piqued her interest for further studies.

"That was the first time I was able to have any water chemistry type lab experience, which is what I was looking for," she said. "That was a good segue for me to start looking at master's programs where I could do more lab work and ask more questions about impacts to Florida's water resources."

As she considered graduate school, Goeckner thought she would try it out first by taking one class at USF. She enrolled in a wetland biogeochemistry course taught by Dr. Joseph "Donny" Smoak, professor of environmental science. She turned out to be the only student enrolled.

"That was my first exposure to biogeo-chemistry and because it was just the two of us every week, we'd pick a journal article, read it, and discuss it together." Goeckner recalled. "It was amazing, because I got to ask all of the most ridiculous, wide-eyed questions of him. So that got me really interested in the topic."

"My raw desire to get into environmental science and water research was simply because of my love for water and those water bodies in Florida. I spend a lot of time outside, hiking and kayaking. When I was only studying anthropology as an undergrad, I learned about the human perspective of environmental interaction, but I felt like I wanted to contribute more to something I love. I decided to begin an environmental science degree because I thought making changes environmentally would leave a legacy of which I could be proud. I hope whatever work I move into next will contribute to management decisions for Florida's aquatic ecosystems."

Audrey Goeckner

Smoak, whose work is related to coastal wetland ecosystems and carbon cycling, now serves as a member of her thesis advisory committee.

“I was extremely pleased when Audrey decided to examine the biogeochemical cycling in these retention ponds as the focus of her thesis,” Smoak said. “It is important to understand how these constructed aquatic systems produce, accumulate, and transform organic matter as well as the role they may have in the production of greenhouse gases.”

Conducting the Research

Goeckner admits the scope of her research is ambitious. While a typical master’s student would focus on one aspect of stormwater ponds, she is examining three: carbon burial, gas flux, and dissolved organic matter quality.

“It’s been very stressful, but a great experience for me,” she said. “There were a lot of times I thought ‘I have no idea how to make this work.’ The growing experience was maintaining positivity and being persistent about finding alternatives or modifications to put everything together.”

One example of a challenge was collecting sediment cores from the stormwater ponds to measure carbon sequestration.

“Audrey is doing something, that really, I don’t know anyone in Florida has done before in these ponds,” Lusk said. “It’s sediment in a pond in Florida – it’s sand! Imagine trying to drive a core down into the soil, and bring it back up, and it just went everywhere.”

Persistence with the piston corer paid off.

“It was a very frustrating experience,” Goeckner admits, “but I just buckled down and said, ‘We’re going to do this!’ and I got all that I needed.”

She said she could not do the field work without the help of Kylie Chapman, who is the lab’s environmental science technician.

“Kylie has gone out with me for every single field day and I would not have been able to get any of this work done without her,” Goeckner said.

The carbon burial portion of the research is done, but she is still collecting readings on gas fluxes, DOM, and a few other water quality parameters on a two-to-three-week basis. Those began in June 2019 and will end in February 2020. That will show water quality behavior over time and through a wet and a dry season.

Future Plans

At the end of her research and after successfully defending her thesis, Goeckner hopes her findings will have an impact on the future of stormwater ponds and their role in regional carbon budgets. She and Dr. Lusk plan to make recommendations for reversing the impacts coming from artificial ponds.

“Fresh inland waters are typically known to be sources of greenhouse gases to the atmosphere, but to change a natural system because we don’t like it, seems unethical to me,” Goeckner said. “But stormwater ponds are human-engineered aquatic systems, which means we have a lot of power to change the ways that these are built.”

Ideally, the changes to stormwater ponds would also reduce the amount of reactive organic matter going downstream, which can impact the metabolism of receiving water bodies, Goeckner said.

The potential recommendations will come after the results are analyzed, but she is already considering some, which are as simple as planting vegetation in ponds, which commonly have none, and the addition of aeration systems.

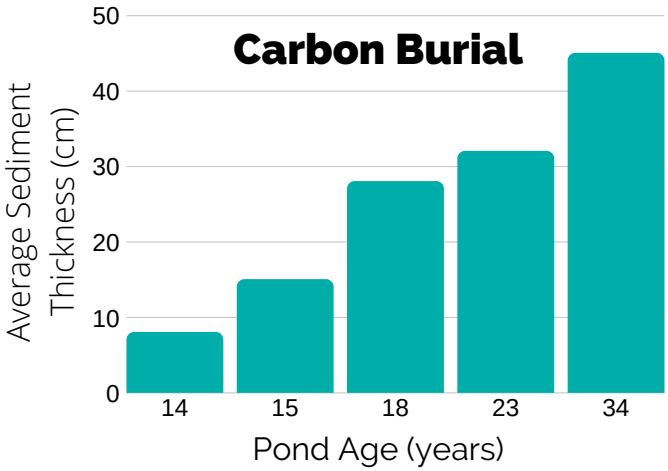
After she earns her master’s degree, Goeckner plans on pursuing a Ph.D. and research hydrologically connected urban and wetland ecosystems. That would allow her to better understand changes in carbon and organic matter composition and nutrient transport.

“I really love the field of biogeochemistry and talking about it, so I would love to get involved in teaching related subjects and participating in public outreach and education,” she said. “Humans drive changes to biogeochemical cycles and I think it is so important to communicate to local residents their impacts on the landscape and how we can improve our practices which will in turn improve the state of our water resources.”

She has begun applying to different programs, including the Soil and Water Sciences Department. She has also applied to a few fellowships, including the NSF Graduate Research Fellowship Program, which supports outstanding graduate students in NSF-supported STEM disciplines.

“I think she’s a great candidate for that,” Lusk said. “If she gets that, she can take that to a doctoral program anywhere in the country.”

“I grew up in Florida and the outdoors lifestyle is important to me,” Goeckner said. “I feel compelled to work in water resources and protect our water resources.”



"The early results show there are distinct differences in organic matter composition, where the older the pond, the higher the degree of humic materials present," Goeckner explains. "This could be related to organic carbon burial as well, where older ponds have also accumulated more material up to this point."

In addition to her thesis research, Audrey Goeckner is participating in a Mangrove Monitoring Research Project. The Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI) is heading up the effort, led by FWC scientists Dr. Kara Radabaugh and Dr. Ryan Moyer. The goal is to assess the impacts of Hurricane Irma (September 2017) to coastal wetland habitats of southwest Florida.

"The project does periodic assessments of the mangroves in the Lower Florida Keys and Ten Thousand Islands," Goeckner said. "We're looking at mortality and regrowth response to the hurricane. It is completely different to urban work!"

As the project begins to wind down, the research group already has one journal article published. Some of the results show mangrove canopy cover was reduced to 30-to-50 percent with a tree height reduction of approximately 3.9 feet. Although mangrove forest recovery showed signs of slow regrowth, mangrove seedling density significantly increased in the six months post-Irma. You can read the findings of the article here.

"Those assessment trips are so much fun," Goeckner said. "It's a bit of physical labor, going on these small mangrove islands where nobody usually goes. We have to crawl around the mangroves' prop root systems and we're up to our waist in mud sometimes."

"The mangrove project has been a great experience for her," Dr. Mary Lusk said. "She was able to be a co-author on a journal article related to that research – what a great opportunity for a master's student!"

Awards, Honors, & Recognition

Soil & Water Sciences Department Scholarships

George J. Hochmuth Education Enrichment Award – Undergraduate - $500
Katy Frey (Curry & Enloe)

George J. Hochmuth Education Enrichment Award – Graduate - $500
Nan Xu (Bhadha & Mylavarapu)

V.W. Carlisle Fellowship – Graduate - $1000
Julio Pachon (Bacon)
Yanyan Lu (Silveira)

Sam Polston Fellowship – Graduate - $1000
Clayton Nevins (P. Inglett & Strauss)

William Robertson Fellowship – Graduate - $1000
Eduardo Esteves-Velez (Kadyampakeni & Maltais-Landry)
Michael James (Maltais-Landry)
Adam Siders (Whiles & Reisinger)

Ben Skulnick Fellowship – Graduate - $1000
John Allar (Maltais-Landry)
Tanyaradzwa Chinyukwi (Kadyampakeni)
Steve Hohman (Reisinger)

Biogeochemistry Graduate Fellowship - $1500 - Non-Cash Awards
Jamila Roth (Reynolds)
Clayton Nevins (P. Inglett & Strauss)

Fredrick Smith Award – Undergraduate - $1000
Madelene Clark (Bonczek)

Donald A. Graetz Education Award – Undergraduate - $1000
Hannah Gutner (Curry & Enloe)
Serena Sakkal (Curry & Enloe)

Outstanding Undergraduate Award – Undergraduate - $1000
Sarah Birkmire (Curry & Enloe)

College of Agriculture and Life Sciences Scholarships

The following students received the **Doris Lowe and Earl & Verna Lowe Scholarship**: Graduate Students: Adesuwa Erhunmwunse (Liao & Ogram), Suman Raja Jumani (Deitch), Kalindhi Larios (Gerber), Clayton Nevins (P. Inglett & Strauss), Adam Siders (Whiles & Reisinger), and Kaile Zhang (Liao & Maltais-Landry).

Unergraduate Students: Cordelia Collinson (Curry & Enloe), Katy Frey (Curry & Enloe), and Zoe Spielman (Curry & Enloe).

Emily Gaskin (Curry & Enloe) and Hannah Moore (Curry & Enloe) received the **Florida Rural Rehabilitation Corporation Scholarship**.

Sarah Birkmire (Curry & Enloe) received the **Farm Credit of Central Florida Scholarship**.

Carmen Hernandez (Curry & Enloe), Erika Sakers (Curry & Enloe), and Serena Sakkal (Curry & Enloe) received the **SHARE Scholarship**.

Luke Pidgeon (Bonczek) received the **Suwannee County Conservation District & W.B. Copeland Scholarship**.

Eduardo Esteves (Kadyampakeni & Maltais-Landry) earned 2nd Place and Clayton Nevins (P. Inglett & Strauss) earned 3rd Place for their presentations at the South Florida Graduate Student Symposium.

Jamila Roth (Reynolds) is the inaugural recipient of the Coastal and Estuarine Research Federation (CERF) Legacy Fund Scholarship for her research of seagrass species diversity.

Leandra Gonzalez (Bhadha) received the UF Diversity Enhancement Award.

Evandro Barbosa da Silva (Ma & Wilkie) received the Excellence in Graduate Studies Award – Ph.D. Dissertation Level.

Jay Capasso (Bhadha) received the Excellence in Graduate Studies Award – M.S. Thesis Level.

Emily Taylor (Reisinger) received the Jim Robertson Scholarship from the National Association of Environmental Professionals.

Katy Frey (Curry & Enloe) was named a UF Anderson Scholar of Distinction for outstanding academic achievement by an undergraduate.

Caleb Gravesen (Judy) received the CALS Davidson Graduate Student Travel Scholarship.

Samuel Kwakye (Kadyampakeni) and Eduardo Esteves (Kadyampakeni) each received a UF/IFAS Travel Grant.

Brett Higgins (Wilkie) had his undergraduate research published as part of the 2018-19 CALS University Scholars Program. Screening Fecal Methanogens in Five Orders of Mammals.

ACS Annual Meeting Awards

Clayton Nevins (P. Inglett & Strauss) received the Clark Soil Biology Graduate Student Scholarship from the Soil Science Society of America.

Daniel Colopietro (Bacon) – 1st Place Graduate Student Oral and Poster Presentation in the Pedology Division

Julio Pachon (Bacon) – 3rd Place Student Oral Presentation in the Pedology Division

Zijing Liao (Lusk) – 1st Place Graduate Student Oral Presentation in the Urban & Anthropogenic Soils Division

Audrey Goeckner (Lusk) – 2nd Place Graduate Student Oral Presentation in the Urban & Anthropogenic Soils Division

Timothy Ayankojo (Morgan) – 3rd Place Graduate Student Poster Presentation in the Global Climate Change Division

Andressa Freitas (Nair) – 2nd Place Graduate Student Oral and Poster Presentation in the Biochar: Agronomic and Environmental Uses Community Competition

Andressa Freitas (Nair) – 3rd Place Graduate Student Poster Presentation in the ACS Diversity Committee Competition

Faculty Honors

Rao Mylavarapu is the inaugural chair of the International Governing Council of the International Soil and Plant Analysis Council.

Davie Kadyampakeni was awarded a 2019 UF Water Institute Faculty Fellowship.

Andrew Ogram was awarded a UF University Term Professorship.

Laura Reynolds and Sarah Strauss completed the CALS Mentor Academy. Samira Daroub was a co-facilitator for the academy with CALS Assistant Dean Heather McAuslane.

Heather Enloe completed the CALS Teacher's College program.

Susan Curry was selected as a participant in the UF International Center's Spring 2020 Global Learning Institute.

Studying the effect of aboveground community structures on underground microbial activities

Two Soil and Water Sciences Department faculty members are teaming up to research forage systems – both above and below the soil's surface. Dr. Sunny Liao, assistant professor of soil microbial ecology, and Dr. Cheryl Mackowiak, associate professor of nutrient management, work at North Florida Research and Education Center in Quincy, Fla. Both are interested in soil health and want to help producers improve the quality of their soil to make it sustainable and productive. They plan to tackle a major issue facing forage systems: soil degradation.

"Specifically, the nutrient and biological fertility of the soil is degraded due to the monoculture situation," Liao said. "We believe that if there is an increase in plant diversity, we can bring more diverse and functional microorganisms to the soil."

If their hypothesis is correct, then increasing diversity by incorporating legumes into grasses will improve soil function and be a net positive for the overall plant system. The USDA's National Institute of Food and Agriculture (NIFA) is funding the four-year research project with a $483,000 grant.

The dominant monoculture in southeastern US pastures is bahiagrass. Liao and Mackowiak will test the impact of mixing in perennial peanut.

"We have bahiagrass grown as a monoculture or mixed with perennial peanut, with or without grazing," Mackowiak explained. "The soil types are different too – a spodosol, an ultisol that's almost an entisol because it's pretty sandy, and then a true ultisol."

"These are functioning, working ranches, so we're getting real-world information," she added. The ranches are in Jackson, Highlands, and Citrus Counties.

Plant species harbor different soil microbes that serve different ecological functions. Growing perennial peanut with bahiagrass will set up a situation of competition or enhancements among these microbes.

Dr. Cheryl Mackowiak (left) and Dr. Sunny Liao at North Florida REC.

If the legume-grass mixture is able to enhance the population of microbes that fix N2 and stabilize soil carbon, these "nutrient-fixers" will compete for resources with other microbes that facilitate soil respiration. Such an antagonistic relationship might potentially lead to a reduction in greenhouse gas emissions, compared to N fertilizer applications.

We aren't sure about the neighboring effect," Liao admitted. "When we have two plant species growing together – are they really a benefit to each other or does one sacrifice production that helps the other one? How does nutrient flow happen in the forage system?"

"What's unique about this is that we have two perennial systems – one that doesn't rely on symbiotic nitrogen fixation and the other that does. Even though it's not on a grand scale, there are enough differences, even within the state, that we can get a good feel of how much variation is reflected among the microbial communities, under real-world conditions. Basically, we have to start somewhere."

Cheryl Mackowiak

Research Methods

The research team will conduct field sampling of plants, above- and belowground, along with soil fertility and other indicators (the composite soils to 15 cm depth). Forage will be removed from 0.25 m2 area, followed by inserting a 12 cm diameter golf hole cutting tool set to a 15 cm depth. The goal is to remove a whole plant sample or plug.

Upon returning to the lab, the rhizosphere soil and root samples will be processed for Raman imaging. This will help identify and quantify the nutritional compounds in rhizosphere and trace their allocation. Lab work also involves separating the plant into shoot stubble, roots, rhizomes, and nodules. The rhizosphere soil will be obtained after manually separating the root system. Then the nodules will be counted and sized.

"Separating the roots is really hard," Liao said. "You have to look at the nodule on the roots and also decide which is perennial peanut and which is grass, but the nodules are so tiny."


Photo credit: Sunny Liao


Photo credit: Chih-Ming Hsu

Soil collections for DNA sequencing and biogeochemical analysis.(left) Soil cored from bahiagrass field.

Soil analyses will include total carbon, pH, organic and inorganic N, and Mehlich-3 extractable nutrients. DNA/RNA extraction and sequencing are planned to understand the dynamics of the microbial community composition.

“We will also analyze gene expression in the soil and roots to try to understand what the molecular function these microbes perform – what kind of pathways do they use to break down or fix the nutrients – What types of carbon and other nutrients do they utilize? Are these nutrients mostly from bahiagrass, perennial peanut, or other soil biota?” Liao explained. “Technically, it’s really hard to process those samples and analyze those data because there are thousands and thousands of different microorganisms there.”

"We’re going to examine a lot of interesting microbes. Maybe we'll see microbes we don’t really think are important, but they’re always showing up associated with soil carbon or soil nitrogen. When we do some of the integrated data analysis, we will be able to learn which groups of the microbes are more associated with the soil fertility or plant community.”

Sunny Liao

Some of the emphasis is on nitrogen-fixing groups. Mackowiak said known nitrogen-fixers associated with specific plants are present, but so are other nitrogen-fixers.

“By measuring it temporally, by location, and also among cultivars, we’re getting a pretty broad perspective of what is real and what’s just a fluke in the system,” she said. “Is this really a characteristic of this kind of system or not? Then, who is it really coming from – is it the perennial peanut? There’s some reporting in the past of nitrogen-fixing associated with bahiagrass also, so we’re teasing some of that apart.”

Implications for Producers

For extension agents and producers, the terms “microbes” and “soil health” are good to hear, but what exactly do those terms mean? Liao and Mackowiak admit that they are all trying to learn that together. Hopefully, the research project underway now will fill in some of the knowledge gaps and provide more opportunities for researchers and producers to work together.

“We’re fine showing that perennial peanut in a grass system works, but there’s some fine-tuning, and they want to know why it works and how can it be made better,” Mackowiak explained. “We’re trying to learn how it becomes more of a resilient system because of climate change concerns. Is it more drought resistant? Can it handle flooding? What can it do?”

The establishment of the experimental site at Marianna, Fla., to study the effects of aboveground community structures (monoculture vs. perennial peanute/bahiagrass mixtures) on belowground microbial activities and their regulation over biogeochemistry.

The field studies are providing those different scenarios, from drought conditions during prolonged heat to saturated fields after heavy rains.

“At some point, they’ll ask the extension agent, how come this is dying, and the agent can say it’s because your water table is within an inch of the surface for a month and this cultivar of perennial peanut doesn’t like it, but we know of others that will tolerate it,” Mackowiak said.

She said producers want to raise livestock with the most meat and in the least expensive way. More than that, they want to know they are doing something good for the land. They want to be able to sustain their operation and leave a legacy of stewardship behind for whomever takes over next. Mackowiak says planting perennial peanut with bahiagrass can help do that.

Implications for Science

The research project’s holistic approach of examining the plants’ biomass – above and below ground – and the soil’s microbial community as well as the way all the parts interact is unique. The impacts of grazing and environmental changes are another layer of complexity. But even more unique is the effort to sequence the DNA and RNA.

“We are developing the method to explore the function of whole soil and root microbiome in situ. We think that sequencing RNA directly from the intact soil and roots is a promising approach; however, it is a challenge,” Liao said.

Instead of reinventing the wheel, she looks to other projects that are technically similar, such as a forest microbiome project with the Joint Genome Institute (JGI). The Institute has teams of scientists working on genome and soil RNA analyses, so adopting their systems is more practical.

“JGI teams are interested in the projects that study how plant-microbe-soil interactions have control over above-and below-ground nutrient flux. These are the key questions we would like to answer, not only in our forest system, but also in our forage system,” Liao said. “JGI has professional teams to develop the computational workflows to analyze big sequencing data generated from soil. In collaboration with JGI, I am learning a lot about how to process and interpret these data that were collected from the most complex ecosystem – soil!”

She admits that challenges still exist while trying to answer more questions from the soil system using molecular approaches. For example, it is hard to study soil microbiome living at deeper layers. Soil depth is a factor due to the varied chemistry as you go deeper beneath the surface. So far, there is no ideal extraction protocol for DNA and RNA collected from the deeper soil.

“DNA and RNA extraction will be the first step, if we would like to study who are there and what molecular functions these microbes perform in the soil,” Liao said, “Followed by the extraction, we have to amplify the target genes or whole genes, or target communities [so-called ‘amplicon libraries’] . Then we sequence those ‘amplicons.’ Finally, we assign these sequences to the databases, in order to identify the functions of the genes and microbial taxa that were sequenced. Each step has its own challenges.”

The scientific payoff will be worth the effort. Liao wants the data from the project to be publicly available.

“After we publish the research papers, we will upload the raw data, the sequence data, to the National Center for Biotechnology Information in the US National Library of Medicine at the National Institutes of Health, also the learning objectives and the experimental design for those data sets,” she said. “I think it’s really cool that the data will help this project, but also the broader community who are interested in soil microbiomes.”

And already, preliminary data is shedding new light on microbial communities. Liao has compared early results with a data set from a project she did with forest systems.

Cattle grazing on perennial peanut at the on-farm observational field. Photo credit: Luana M Dantas Queiroz

"I'm finding that some of what we call beneficial microbes, can adapt to different environmental conditions than what we thought. They could be everywhere in the soil," she said. "Some of these beneficial microbes may be restricted to only forest or forage systems, but others are more widespread. So, who are the ones who can really adapt better and help the plant the most?"

"There are all these doors we can go through with more research after we answer: What is it? What are we dealing with? How variable is it?" Mackowiak said. "Then it opens it up to all kinds of scenarios after that."

Several graduate students are working on the soil research, including Adesuwa Erhunmwunse. Dr. Sunny Liao and Dr. Andrew Ogram serve as her advisors. She is originally from Nigeria and has always been interested in agriculture and soil.

"As a little girl, I enjoyed planting vegetable, cowpeas, and plantains in my little garden," Adesuwa said. "Agriculture has always been an integral part of my life."

She earned a bachelor's degree in microbiology from the University of Benin and two master's degrees – soil science from Obafemi Awolowo University and plant and environmental sciences from Clemson University.

Adesuwa said she wanted to combine the knowledge from her previous degrees to pursue a Ph.D. at UF in soil microbial ecology.


Adesuwa Erhunmwunse, SWSD Ph.D. student.

"When Dr. Liao told me about the forage project, I was excited to be a part of it," she said. "The livestock sector is an underdeveloped industry in Nigeria and my knowledge from this project will help me work with farmers and the government in establishing sustainable livestock farms to reduce the mayhem and clashes between farmers and nomadic herdsmen in my country."

For the next three to four years, Adesuwa will be working in the field, greenhouse, and lab, using molecular, bio-chemical, and spectroscopy techniques "to understand the beauty and wonders of these 'key players' in soil and forage system," she said.

"I will articulate the findings from my study to farmers and educate them on Best Management Practices and environmental variables that will positively influence soil fertility and health in a bahiagrass and perennial peanut system," Adesuwa said. "These findings will help producers implement realistic and sustainable management practices to reduce the input of synthetic fertilizers and improve soil and forage productivity."

Protecting the Springs

Growing up next to a lake can instill certain things in young children. For one, it can make them fearless of water. It can also make them curious about water and how important it is to all the living things that depend on it for life.

Luke Pidgeon grew up in Live Oak, Fla., spending many days at the lake near his home. The senior majoring in soil and water sciences knew from a young age he wanted to study water science.

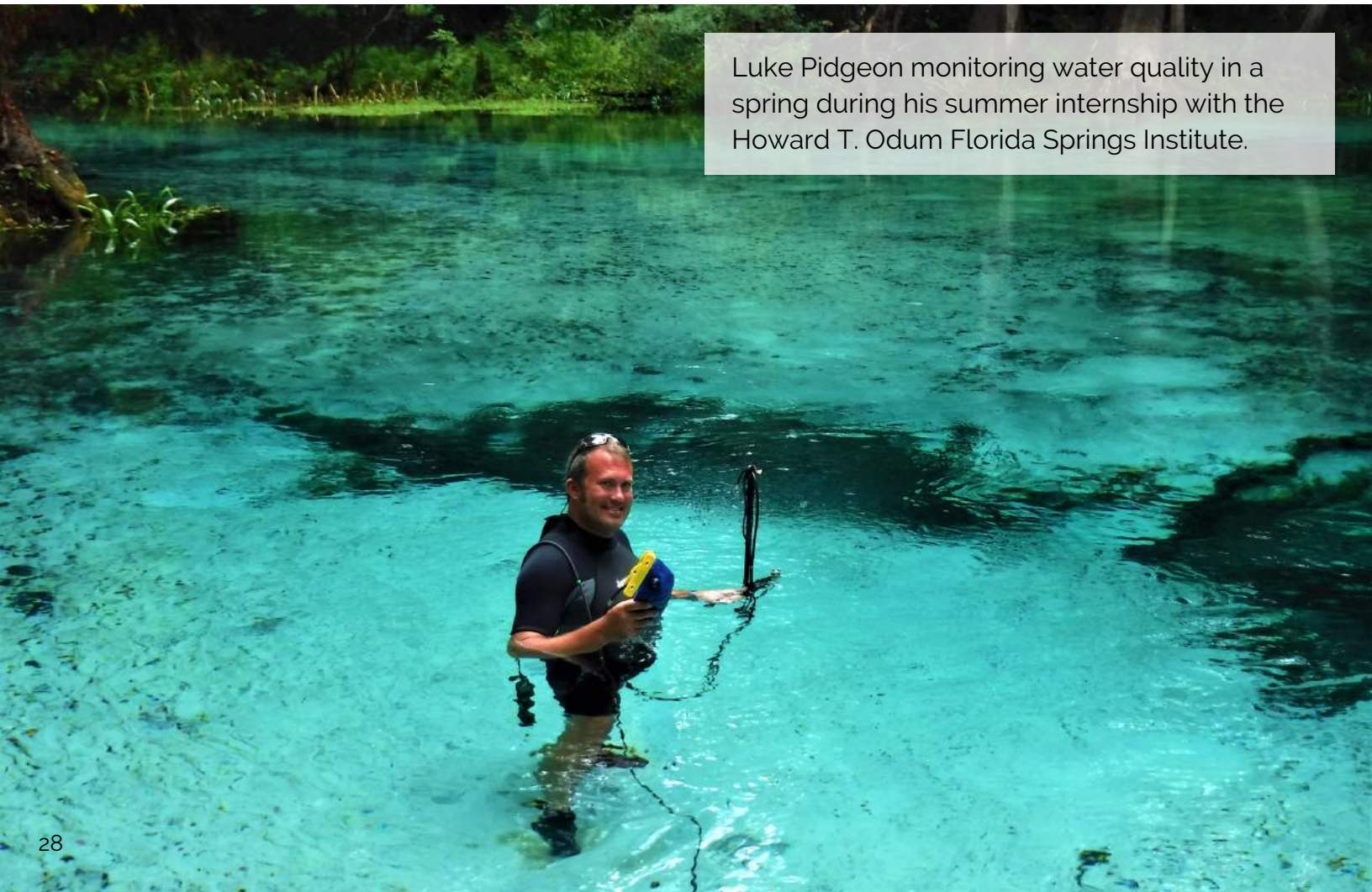
"I would see changes in the lake's ecosystem - algal blooms, changes in vegetation dominance, game wardens coming in and spraying herbicide," Luke said.

It was a living laboratory just a short walk out his back door.

"I had a microscope and I'd go out and take water samples to look at them," he said. "I had no idea what I was looking at, but there were cool, little microscopic things swimming. That was really neat, seeing different microbes and algae floating around."

Years later, Luke is winding down his time at the University of Florida. He has considered graduate school but thinks it might be better to start a career first.

"I want to work with water resource management in remediation of contaminants," he said. "For me, I'm really passionate about maintaining the quality of water in our aquifer, because nitrate pollution - pretty much, any pollution - is affecting it."



Luke Pidgeon monitoring water quality in a spring during his summer internship with the Howard T. Odum Florida Springs Institute.

The importance of Florida's springs is not lost on Luke. He grew up exploring and swimming in them. This past summer, he had an internship with the Howard T. Odum Florida Springs Institute. The work involved monitoring springs along the Santa Fe River.

"Any task given to Luke, was performed with enthusiasm," said Hillary Skowronski, environmental scientist at the Institute. "Luke came into the internship with extensive knowledge of water and water quality but was still e cited to learn specifically about springs and the Santa Fe River."

Luke assisted with field work and data collection, primarily. Samples they took from the springs were sent to the Florida Department of Environmental Protection for analysis.

"They were testing for pesticides, trace metals, herbicides, phosphorus, nitrates, dissolved inorganic carbons," Luke recalled. "Basically, they're concerned with the health of the springs and maintaining the ecosystem or preventing further degradation."

The spring ecosystem is a delicate one. A lot depends on the flow rate of water from the aquifer. If it is low and the level of nutrients, like nitrogen and phosphorus, is high, there is a greater chance for algal blooms, according to Pidgeon.

"That would crowd out the native vegetation," he said, "which will degrade the overall ecosystem, so fish and wildlife won't live there."

Educating the Public

As Florida's population continues to grow, so does the demand on its aquifer from which cities and towns draw drinking water and agriculture pulls irrigation water. That impacts the pressure and flow to the springs. Luke thinks not enough Floridians know the connection. During his internship with the Institute, fieldwork allowed him to interact with people around the springs.

"People saw a rope across the river run or the spring, and they'd ask what we were doing or if they could cross through," he said. "That gave us the chance to explain what we were doing and why, and how their activities could potentially impact the spring ecosystem or what they could do to protect the springs."

He estimates about one in ten people who approached them were really curious about their work. It turns out some of these people were involved in spring, river, or watershed protection programs. Luke thinks they appreciated knowing about the work.

"Then other people really have no understanding of what spring ecosystems are," he said. "They just know the water comes out and it's cold. So, the interaction with them is a chance to gain a little more knowledge about where they're at."

"For a long time, I wanted to be a cave diver, because growing up in Live Oak, cave diving was a popular thing. I remember Wes Skiles (American cave diving pioneer and underwater photographer) coming to the different springs and giving talks. I thought, 'I want to be like that guy. He's cool!' Then I got a little older and a little wiser, and thought, 'I can just look into the caves, without having to go in them.'" Luke Pidgeon

Assessing His Time at UF

Coming as a transfer student, Luke's time at UF is shorter than a traditional undergraduate's experience. Still, he said he has made the most of it.

"UF has always been a top-notch school in my opinion. Ever since I was a kid, trying to research into soil and water sciences and being a water scientist, I've thought that."

He feels the experience has been a great one, from the variety and quality of the classes to the faculty and staff.

"The faculty, and the care they show for the students, has really made a big impact," Luke said. "Before I came to UF, I was at a community college, and I felt the teachers were just there to teach you and move you out. Here, you build relationships and I feel really included in the university and the department. We're part of a family and a bigger purpose. It's really nice to see and feel that support."

Undergraduate Internships & Research Projects - Fall 2019

- Katy Frey worked on the Gleaning Project with UF's Field and Fork Campus Food Program. This included maintaining soil quality as well as water and pest management.
- Carmen Hernandez worked on water pollution and conservation in Puerto Rico, specifically the impact from Hurricane Maria.
- Ashley Pogue worked with Koncept Karma, Inc. in the area of environmental field inspections.
- Shelby Grafton worked land reclamation planning, including soil testing, planting and water systems, and water and nutrient management.
- Alexander Fast worked with Dr. Todd Osborne at the UF Whitney Lab for Marine Bioscience on mangrove CO_2 flux based on species, age, and a spartina control.
- Miranda Jackson worked with the UF/IFAS Phycology Lab on zooplankton, specifically gathering biomass counts in various bodies of water in Florida.
- Chance McLeod and Paisley Peyton worked on a seagrass restoration/chronosequence experiment with Dr. Patrick Inglett in the SWSD Wetland Biogeochemistry Lab.
- Regan Fox worked with the USDA's Insect Behavior and Biocontrol Research Lab specifically with Drosophila (fruit flies) and Plodia (aka Indian Meal Moth).
- Lars Bjorndal worked with Dr. Ann Wilkie researching the solar drying of algal biomass for feedstocks and fertilizer.

UF IFAS UNIVERSITY of FLORIDA

Soil & Water SCIENCES

Applied Soil Microbiology Training: Mycorrhizae

July 6–8, 2020 | McCarty Hall B, Room 3108 | University of Florida | Gainesville, FL

The *Applied Soil Microbiology Training: Mycorrhizae* is designed for for scientists, organic farmers, and others interested in the practical and theoretical aspects of using mycorrhizal fungi to enhance plant growth and nutrient cycling.

During the three-day course, participants will gain hands-on experience with recognizing, culturing and using mycorrhizae. By the end of the course, attendees will be able to isolate the spores of the fungi and use those as fertilizer. They will also be able to determine the efficiency at which those spores make associations and if they are working or not.

Now in its 15th year, the course is popular with organic farmers, land grant extension agents, scientists, both nationally and internationally.

Register Today!

Space is Limited

Register on or before June 1, 2020, to receive the E
arly Reduced Registration Fee of **only $500**. After June 1, the registration
fee increases to $600. Class size is limited in order to maximize individual attention and early registration is highly recommended. Register now at the link below:

http://conference.ifas.ufl.edu/soilmicro/