VOLUME 20, ISSUE 2 FALL 2020

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.

UF IFAS UNIVERSITY of FLORIDA

Soil & Water SCIENCES

High Impact Research

A Message from the Chair

As 2020 comes to a close, a bit of reflection is appropriate. Certainly, the past 12 months have been unprecedented and at times difficult for many. The COVID-19 virus did not discriminate, as it affected members of the campus community, including some of us in the department. Still, our faculty did an excellent job of teaching online and our students continued learning, whether they came to campus or stayed at home. Our amazing staff in the offices and the labs continued to keep things running smoothly. While there seems to be a light at the end of the tunnel as far as a vaccine is concerned, we will continue to practice all safety precautions during the spring semester, while offering more of our classes in person.

At the same time, faculty and students alike continued earning honors and awards throughout the year, as you will see later in the newsletter. Our Extension faculty were able to continue their outreach efforts in traditional and innovative ways. In some cases, virtual trainings, workshops, and presentations reached more of our clients and stakeholders. Research grant dollars flowed in as well. As of mid-November, SWSD faculty have been awarded nearly $2.4 million in grants.

In this issue, we are proud to feature two of our high-achieving students. Amanda Rodriguez found us through her undergraduate environmental science degree program. Her experience conducting research with Dr. Vimala Nair led her to pursue a master's degree in soil and water sciences. Undergraduate Madelene Clark transferred into soil and water sciences after completing her A.A. degree at nearby Santa Fe College, which is a common path for many of our SWS undergrads. We catch up with alumna Sue Newman as well. Sue has kept in close contact with the SWSD since receiving her Ph.D. in 1991. As the cover of the Myakka shows, we also learn about the high-impact research conducted by undergraduate student Rebecca O'Connell and Dr. Ann Wilkie. We are proud that the UF/IFAS Dean of Research Office selected their work out of hundreds of published articles for special recognition.

In this issue, we also welcome our newest faculty member, so to speak. Dr. Scott Angle is UF's new vice president for agriculture and natural resources and the head of UF's Institute of Food and Agricultural Sciences (IFAS). Scott is a soil scientist and his "tenure home" is in the SWSD. In an open letter to the department printed in this issue, he introduces himself and shares what he's learned so far of the department and its people.

All of us in the SWSD hope you enjoy your holidays and ring in the new year safely. We wish you a prosperous and healthy 2021. As always, we love to hear from our alumni and friends. Reach out to us anytime and you can contact me at mwhiles@ufl.edu.

UF IFAS UNIVERSITY of FLORIDA

Soil & Water SCIENCES

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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.

SWSD Launches Diversity and Inclusion Initiative

This summer, SWSD Professor and Chair Matt Whiles created a new departmental committee to strengthen efforts around diversity and inclusion. The move follows the June statement by UF President Ken Fuchs on another step toward positive change against racism. In it, Fuchs urged the campus community "to become part of a positive change against racism" following the death of George Floyd in Minneapolis, Minn.

"The reason we formed this committee is because we should do more," Whiles said. "We can do more to foster an atmosphere of inclusiveness in our department and community. We can do more to enhance diversity in our faculty and staff hiring as well as our student recruitment."

Diversity, Equity, and Inclusion Committee includes faculty, staff, and student representation:

- AJ Reisinger, faculty member
- Laura Reynolds, faculty member
- Davie Kadyampakeni, faculty member
- Kanika Sharma Inglett, faculty member
- Qudus Uthman, graduate student
- Precious Nyabami, graduate student
- Mike Loizzo, staff

Undergraduate students from the soil and water sciences major as well as the environmental management major will be added in January.

"I appreciate the willingness of these individuals to serve on this important committee and look forward to hearing about their ideas and plans for the SWSD," Whiles said.

The full scope of the committee is still being finalized but in general the focus will be on identifying areas of concern and creating solutions for these issues. Early discussions have also touched on the following topics for the committee:

- Increasing diversity among faculty, staff, and students through recruitment practices
- Encouraging everyone in SWSD to participate in diversity and inclusion efforts
- Hold departmental training sessions and seminars focused on diversity and inclusion

"The committee takes this effort very seriously and we, as members, are eager to help SWSD move forward in a positive, productive way," said Precious Nyabami, who is pursuing her master's degree.

Sue Newman's favorite place, on airboat 1029 conducting science, in a cattail dominated nutrient enriched zone in the Everglades. (photo provided)

In Sue Newman's Job, Everything Revolves Around Phosphorus

The 1991 Ph.D. alumna reflects on her time at UF and her career at the South Florida Water Management District. As a scientist with SFWMD, she has focused on restoring the Everglades for nearly 30 years.

Sue Newman's interest in science began in childhood. It led her to study at the University of Manchester Institute of Science and Technology in Manchester, England. There she earned a Bachelor of Science Honors degree in Management and Chemistry.

"As part of my undergrad degree, I did this course on alternative energy," Newman explained. "I got a lot of information from the University of Florida that talked about growing water hyacinth on sewage and converting it to biogas."

The environmental aspect of the subject and the chemistry involved was a perfect fit. She corresponded with the UF researchers involved and it led to her getting an assistantship in the Agronomy Department. Newman completed a master's degree with Dr. Bill Haller as her advisor.

"I looked at the mineral nutrition of water hyacinth," she said. "Dr. Ramesh Reddy was on my committee, because he did a lot of work with water hyacinth."

Reddy was a professor in the Soil and Water Sciences Department at the time. He first met Newman when she asked him to serve on her MS thesis committee.

"I was so impressed with her thought process and curiosity in asking me questions related to aquatic plants and their role in the environment," Reddy recalled. "She wanted to do something unique and different in her research and she did in identifying nutrient deficiencies in aquatic plants."

"What I realized in doing my master's was that I loved science," Newman said. "I like to do experiments. I love to do research. I like to ask questions and answer them. And so, I wanted to do a Ph.D."

She looked at different doctoral programs in the United States and Australia. Newman also talked with Reddy about the possibility of doing her doctoral work with him. She thought it would be a good opportunity to link the two things she liked – chemistry and the environment – with the research his lab was undertaking.

"When Sue asked me if she can work in our lab for her Ph D. I did not hesitate a bit and asked her when she can start," Reddy said. "During a few meetings after that, she asked me several insightful and out the box questions to find out a theme for her dissertation. Subsequently, her research resulted in establishing a new program to study the role of enzymes in aquatic ecosystems."

Doctoral Program

Dr. Reddy's research lab was up and running before Sue Newman started her doctoral studies. Still, it was growing in size and broadening its wetland biogeochemistry research. Newman remembered the lab research was nutrient-related, with the primary expertise

being in nitrogen cycling. She was interested in phosphorus, but her background was in chemistry.

“I'd become familiar with Lake Apopka from the water hyacinth perspective (during her master’s studies). And so, we ended up coming up with a project that looked at phosphorus cycling in Lake Apopka for my Ph.D.,” Newman explained.

Measuring the effects of plant density on water velocity. (Photo provided)

She says that is how she evolved from being a chemistry major interested in the environment to studying chemistry in the environment.

Newman remembers working in the lab as a highlight of her Ph.D. experience. At the time, there were several postdocs and many graduate students. They came from different countries, both men and women. She said there was great diversity, but they all became like a family.

“I felt that I was very much a part of something in that lab. The atmosphere was incredible,” she said. “People were with you all the time; it didn't matter the time of day. It could be 10 p.m. on a weekend and you wouldn't be the only one who was there.”

With her family in England, Newman felt her lab family provided a lot of support. That came in the form of listening to her concerns and socializing. It also helped to have someone to aid in her field work. In turn, she helped out her lab mates, some of whom she still stays in contact.

“Another nice thing about Ramesh’s lab is that everybody was working on big projects,” Newman said. “He had a very large Lake Okeechobee project at the time, and also a large Lake Apopka project. He had both lakes and wetlands projects ongoing and so we were aware of a lot of different things that people were doing.”

Newman remembers her doctoral program as running smoothly. She took interesting and relevant classes. Her minor was in environmental engineering studies, which complimented her major studies. She said the physical process of writing the dissertation was the most difficult.

“The last few months were grueling in terms of getting everything done,” she said. “Computers were so expensive that most of us didn't have our own, so you always have to be in the lab. You couldn't sit in quiet at home and write your dissertation.”

At the same time, Newman was considering what to do next. She was considering post-doctoral positions, because she wanted to continue to do research. But then she saw a position with the South Florida Water Management District. Its focus was on using constructed wetlands to remove phosphorus in an effort to protect the Everglades. She applied for it.

“I didn't find out that they'd even receive my application, other than Ramesh, called me into his office one day and said, ‘Oh, by the way, there are some water management district people having a meeting on campus and they're wondering if they could interview for that job that you applied for.’”

Newman got the job. She started in April 1991 having already successfully defended her dissertation earlier that spring.

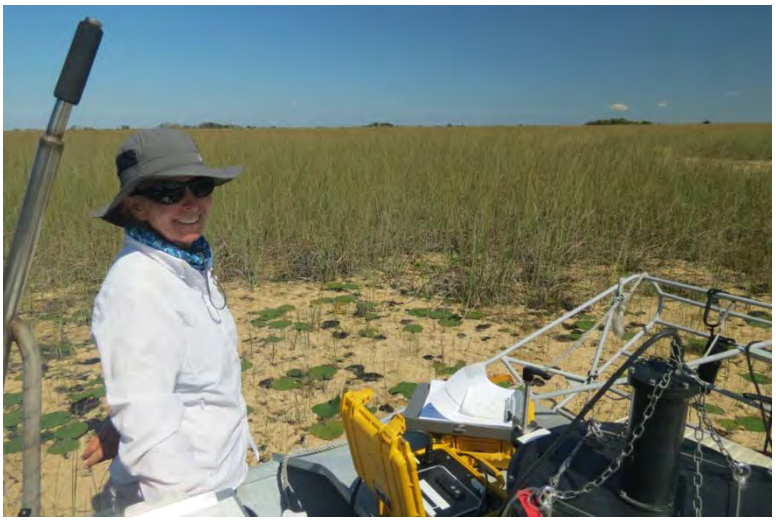
"For the next three decades, I have seen Sue continuously maintain her passion and focus in developing an internationally recognized program at the South Florida Water Management District. It has helped to advance our understanding of phosphorus dynamics in wetlands and aquatic systems,” Reddy said. “I am very proud of her accomplishments. Her research contributions made a significant difference in current efforts to implement restoration strategies in the Everglades."

Helping the Everglades

During her nearly 30-years with the SFWMD, Newman has worked on several projects aimed at restoring the Everglades. The first task was to establish a research program for the prototype 1544 ha constructed wetland. It was called the Everglades Nutrient Removal Project, now combined within over 23,000 hectares of stormwater treatment areas (STA).

“They needed someone to help design the research program to figure out how to optimize phosphorus removal within a certain area and what type of things to expect,” she explained. “We did plant competition experiments to look at how different plants grew and how they took up nutrients. We worked with engineers to help build some testing components within the project.”

> *“Scale was a big change to me. I was doing bench top scale experiments with soil cores, flasks, and container studies at university. At the District, we're talking about hands-on, in the landscape manipulations that are at a landscape-scale and it’s just pretty amazing.”*



Setting up a benthic flume to examine sediment resuspension in response to increased water flow. (Photo provided)

The next team project Newman worked on did research to establish the phosphorus criterion in the Everglades. She conducted phosphorus dosing experiments.

"We did *in situ* manipulative experiments and monitored nutrient enrichment gradients to try and understand what level of phosphorus would be protective of the Everglades ecosystem," Newman said. "We did that for about a decade."

The information would be used to set a phosphorus standard for the Everglades. Her team representing the state was not the only working on that. A team from Florida International University was conducting research on behalf of the federal government, while agricultural interests funded Duke University's work. Newman and colleagues presented data at hearings on the matter. SFWMD data were the primary source used by the Department of Environmental Protection when proposing the phosphorus rule that policymakers subsequently supported.

"That's kind of a big deal," she explained. "Our data held true and basically our recommendations were the ones that were accepted."

Having that acceptable level of phosphorus specified led Newman to the next challenge.

"There was a recognition that we needed to do something about restoring the Everglades areas that were already impacted by nutrients and that it would likely take decades, if it was even possible, for them to fix themselves, but maybe there is something that we can do," she explained.

Cattail Habitat Improvement Project

Cattails covered tens of thousands of hectares of the Everglades at the time. They were growing rapidly because of legacy phosphorus in the soil. The Cattail Habitat Improvement Project (CHIP) proposed removing the dense cattail stands to create open water areas. The idea is open-water habitat improves ecosystem structure.

"Almost immediately the water became re-oxygenated and submerged aquatic plants began to grow," Newman recalled. "Fourteen years later, we have found the surface soils

being created in these plots have reduced phosphorus levels, suggesting we might be able to reverse decades of eutrophication."

Wildlife populations have also increased, such as fish, wading birds, and ducks. They also made a discovery about alligators in the area. A colleague compared 1940s aerial imagery of one of the CHIP areas that had been treated. It showed one of the alligator trails in a restored site was the same in the 1940s. The same turned out to be true of other treated areas.

"Our hypothesis is alligators had been living in cattail for 60 years or more and we didn't think they really were in that area because it's really dense with cattail," said Christa Zweig, a UF alumna and SFWMD ecologist who works with Newman.

Clearing away some cattail and exposing the alligators showed the reptiles are more resilient than first thought. It is an area of research Zweig hopes to pursue with Newman's help and encouragement.

"Sue wants to help everybody develop skills, whether it's building on something they already know or new skills," Zweig explained. "She really cares about people developing their scientific skills and I think that's impressive."

Creating open water habitat by burning cattails in nutrient enriched areas of the Everglades. (Photo provided)

Plenty of Projects

The work Sue Newman does with the different SFWMD teams varies, but each is interconnected. How can we restore flow through the Decompartmentalization Physical Model (DPM) project and not cause local nutrient enrichment of the Everglades? How does backfilling canals influence their dynamics? What strategies can we use to actively improve the marsh? Impacts on flora and fauna? The list goes on and on.

“We're kind of moving forward with – how do we continue to learn from this project in terms of an adaptive management strategy?” Newman said. “We continue to learn and influence the operations and design of other aspects of restoration. We feel like we've accomplished so much because we can actually help people make decisions about how to restore the landscape.”

And for Newman, it all connects to phosphorus.

“I’m working on a lot of different large-scale projects,” she said, “basically measuring all different components of the ecosystem with my role being the phosphorus aspect of it.”

Setting up the GoPro camera to document the site response. (Photo provided)

“I was at the right place at the right time,” Newman said of her hiring at SFWMD. “They were building the Everglades program when I first arrived, so I was very fortunate that we had a lot of questions that needed to be answered. And we still do.”

Sue Newman works with graduate students with a courtesy faculty appointment at UF and an affiliate faculty appointment at Florida Atlantic University. She offers this advice to those pursuing a career in the environmental sciences:

> *Know the literature in your field and seek out the scientists that you respect. Interact with them at conferences. Don't be apprehensive about approaching them, because often people like to talk about what they're doing, and they want to know what you’re doing too.*
>
> *Learn about things outside your immediate field while you're a graduate student or an undergrad. Expand your knowledge as much as possible, because you might find something that you enjoy more, or you may develop some new ideas based on some tangential topic.*
>
> *Before you pick a thesis or dissertation project (if you have the choice of picking a project), get exposed to as many different projects as you can before finalizing your own topic.*
>
> *Recognize that you can be a research scientist, both inside and outside academia.*
>
> *Find a good job where you feel you make a difference, whether that be in academia or outside academia, because it is going to be hard. But when it gets hard and difficult, you will stick it out because you know you're making a difference.*

Graduate Student Research Spotlight

“Calibrating Mehlich 3-Phosphorus Recommendations Using FeO-strip Phosphorus and Mehlich 1-Phosphorus”

Amanda Rodriguez (Soil and Water Sciences M.S. 2021)

Topic

In 2013, Florida’s soil test was changed from Mehlich 1 to Mehlich 3. From this point, Mehlich 3-phosphorus fertilizer rate recommendations were based on the linear relationship between these two soil extractants. However, recommendations based on this relationship have not consistently resulted in desirable yields for landowners. Therefore, adjustments to Mehlich 3-phosphorus fertilizer recommendations are needed. Iron oxide strips are an alternative method of measuring bioavailable phosphorus that simulates absorption mechanisms occurring at the soil and root surface interface.

Research Question

We propose that iron oxide strips will provide a better assessment of bioavailable phosphorus as its results are independent of soil type. Our objectives include testing the relationship between iron oxide extractable phosphorus and Mehlich-3 extractable phosphorus for U.S. soils with varying textures to test this calibration.

“Mehlich 3 uses the acid dissolution of phosphorus, so many people don’t view it as an accurate reading,” said Amanda Rodriguez, Soil and Water Sciences graduate student.

Mehlich 3 for phosphorus often results in lower yields based on current recommended values for "low," "medium," and "high" categories. However, the iron oxide method shows this inaccuracy with Mehlich 3 but it is tedious to perform.

“We're trying to create a calibration between the two methods, so you could perform Mehlich-3 extraction, receive a value for phosphorus, and then plug it into an equation that would hopefully give you a more accurate phosphorus fertilizer recommendation,” Rodriguez explained.

Amanda Rodriguez, SWSD master’s student, preparing the iron oxide (FeO) strips. (Photo provided)

An interesting point is that the Mehlich 3-phosphorus reading was created based on the Mehlich 1 method, so this iron oxide method is updating a previous calibration. The study will also evaluate the Mehlich 1-phosphorus/Mehlich 3-phosphorus relationship using data obtained across soil types under identical lab conditions; results will be related to crop yields in a field setting.

Research and Early Results

Rodriguez is using soil samples taken for an earlier study she did with her advisor, Dr. Vimala Nair, a research professor in the Soil and Water Sciences Department. While that saved some time, making the iron oxide strips was time consuming and a lengthy process. There is not a standardized method to create the strips. That is another goal of her research, so that they can be prepared and implemented on a wider scale. The effort put into creating the strips was worth it.

The final preparation step causes FeO strips to become a brown color. (Photo provided)

FeO strips are protected in fiberglass mesh for soil P extraction. (Photo provided)

“When we first tested it for the quality control with a known concentration of phosphorus, we found that it extracted very accurately and pretty consistently,” Rodriguez said. “It was a very exciting day in the lab, after a year and a half of researching them.”

With the accuracy of the strips (recovery of phosphorus of known concentration in solution), Rodriguez began testing the soil samples. That included not only Florida soils, but those from Arkansas, Georgia, Maryland, and Pennsylvania.

“It's very interesting to see how the strips can read the phosphorus and how accurate it could be in these different soils and all these different properties and textures,” Rodriguez

said. “So far, they follow the linear relationship that we expected. It does show that this could be an effective way of estimating or providing recommendations for phosphorus application.”

Implications

The iron oxide strips are considered by some experts as the gold standard for measuring phosphorus. Unfortunately, their laborious nature hinders widespread use. Another issue is that they only measure phosphorus and not the entire suite of elements measured in a Mehlich 3 solution. Rodriguez hopes her formula based on the readings from iron oxide strips will lead to a better assessment of phosphorus in soil.

Protected FeO strips are placed in a glass bottle for P extraction. (Photo provided)

“The strips don’t provide a fast turnaround for getting results, so that's why it would be most effective to create this calibration,” she said. “They don't actually have to even perform the iron oxide strip test. If our research proves this calibration of Mehlich-3 is accurate enough, hopefully it can be implemented on a wider scale.”

There is interest in a better method for determining phosphorus in the soil. The Florida Department of Agriculture and Consumer Services (FDACS) is funding the research.

“What we hope to recommend is a better Mehlich 3-phosphorus recommendation based on iron oxide (or Mehlich 1) and Mehlich 3-phosphorus relationship,” Dr. Nair said. “The FDACS contract which supports this research expires in June 2021, so we are moving quickly.”

“If we achieve the calibration, we hope to expand it to other parts of the United States where Mehlich 3 is the test for those soils,” Rodriguez added. “To help farmers reach the desired yields for food and other products they're trying to grow.”

You can watch Amanda Rodriguez’s presentation on her research to the ACS Joint Conference last month here: https://youtu.be/CZQrLZ58DeU

Amanda Rodriguez grew up in Fort Lauderdale, Fla., and came to UF as a microbiology major. She switched to environmental science and was introduced to the Soil and Water Sciences Department when her undergraduate advisor suggested she meet with Dr. Vimala Nair, research professor of environmental soil chemistry. That led to a position in Dr. Nair's lab over the summer and the opportunity to conduct research on soil phosphorus sorption characteristics.

"I really loved what I did there and she gave me the opportunity to be a master's student," Rodriguez remembered. "I very quickly accepted because I really enjoyed the research she was doing."

By earning her master's degree, she hopes to combine science and policy with a focus on agronomic and environmental risks.

"I love the concept of science influencing policy," Rodriguez explained. "That's what I find very interesting and the research that I'm doing now has the ability to do that."

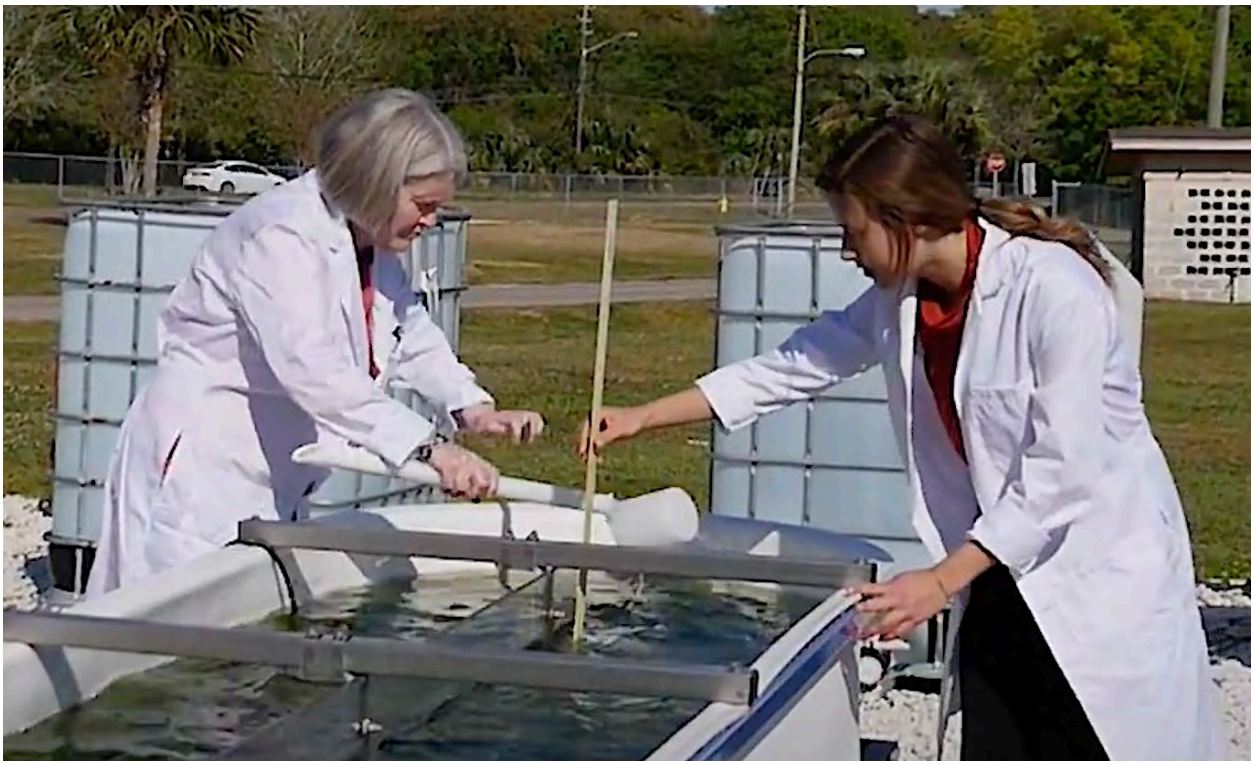

Amanda Rodriguez

"She's such a sincere person who wants to give back," Dr. Nair said. "She's from Florida and she's excited that this research can help producers in Florida improve their crop yields."

In addition to her studies, Rodriguez is involved in the SWSD Graduate Student Association. She says fostering a supportive community among the graduate students is important both in the lab and classroom, but also on a social level.

"Being able to bounce ideas off other students, being able to go to lunch with them and discuss what you're doing and have them share their research with you is helpful," Rodriguez said. "It's a very collaborative environment."

SWS undergraduate study recognized for high impact among UF/IFAS research



Dr. Ann Wilkie (left) and Rebecca O'Connell collect algae samples from a raceway pond. (Photo provided, 2019)

The UF/IFAS Research Dean's Office is recognizing former undergraduate student Rebecca O'Connell and Soil and Water Sciences research professor Dr. Ann Wilkie for their research paper. The article they co-authored, "Comparing Harvest Productivity of the Filamentous Alga *Oedogonium* with Microalgae," was selected as a 2019 high impact paper. Their work is one of eight selected earlier this year from among more than 1,500 articles published by IFAS researchers in 2019. The recognition celebrates the very significant and important impact UF/IFAS research is having on advancing science and addressing important societal needs.

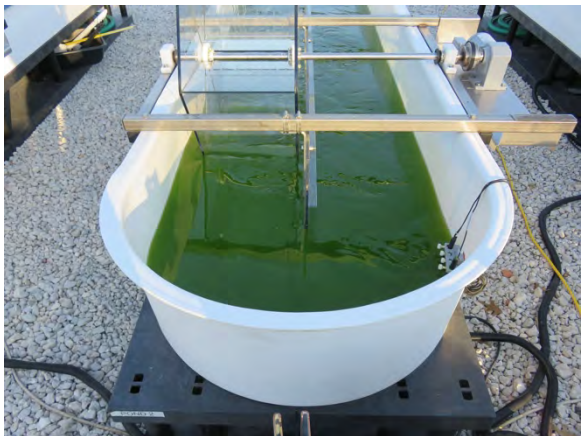
"This is a great honor for Ann and Rebecca," said Dr. Matt Whiles, chair of the Soil and Water Sciences Department. "It also showcases the variety of research we do as a department that stretches across all ecosystems. I am particularly excited about this paper because the primary author was one of our undergraduate students at the time."

The research examines the opportunities filamentous algae present as a "fixer" for the environment and how they can be a resource in many other ways.

“Photosynthetic algae have exceptional potential for remediating waste resources and transforming solar energy into vital carbon-based resources, including foods, fibers, feeds, fertilizers, pharmaceuticals, and biofuels,” said O’Connell, who earned a B.S. in environmental science from the UF/IFAS School of Natural Resources and Environment in May 2019.

Algal cultivation is not restricted to arable land or potable water. That allows creative use of marginal lands, saline aquifers, wastewaters, and oceans for bioresource production. Using waste resources decreases environmental burdens and eliminates the need for adding synthetic nutrients to produce algae.

“The growth rate of algae greatly exceeds that of other photosynthetic organisms,” O’Connell added. “Cultivation of algae also has significant potential to capture CO_2 and reduce greenhouse gas emissions.”



Filamentous algae show promise as an optimal species for cultivation due to the relative ease of harvesting their long thin filaments compared to the smaller cells of microalgae. This research project compared the harvest productivity of the filamentous alga *Oedogonium* with two established microalgae cultures. The algae were cultivated in three open raceway ponds, with the addition of CO_2. *Oedogonium* harvest productivity exceeded both microalgal ponds by approximately 45 percent. The research demonstrates that *Oedogonium* is efficient at carbon capture and biomass production due to its high productivity rates relative to microalgae.

The published research is catching the eyes of others interested in the environmental promise of algae. A startup CEO in Hawaii recently contacted O’Connell, because the company is interested in growing algae for sustainable purposes.

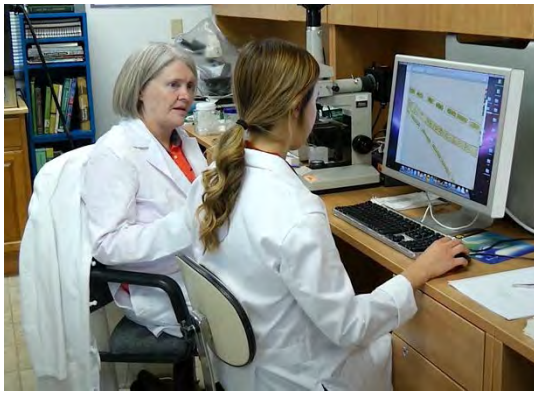
“It looks like our research is making an impact!” O’Connell said.

Wilkie said their paper has high impact not only because of the scholarly quality of the research, but because the paper and the research were the result of an undergraduate research experience. "Supervised research benefits undergraduate students by helping them learn how scientists think, discovering how to overcome challenges, and learning about careers in science," Wilkie added.

“During this research, Rebecca learned new lab skills in sampling and microscopy, successfully performed a series of experiments, compiled and analyzed the data, wrote an honors thesis, presented posters at research symposia, and published this quality article,” explained Wilkie.

The article was published in the UF Journal of Undergraduate Research (JUR). You can find the full article HERE. The research was conducted as part of the College of Agricultural and Life Sciences’ University Scholars Program (USP) and the experiential learning course SWS 4911: Supervised Research in Soil and Water Sciences. The studies took place at Wilkie's UF/IFAS Bioenergy and Sustainable Technology Laboratory.

O’Connell is one of many undergraduates who have conducted research under Dr. Wilkie’s guidance. Through the USP, Wilkie has guided 15 undergraduates in the development of their research skills and abilities. In the past six years, all of her USP mentees have published their research in JUR.


Wilkie and O'Connell discuss an algae sample. (Photo provided, 2019)

“It is always amazing to see the transformation that supervised research engenders in the students,” Wilkie said. “Undergraduate research contributes significantly to the learning and development of the student, building self-confidence and fostering initiative, creativity, and accomplishment.”

She gives credit to the College of Agricultural and Life Sciences and the Center for Undergraduate Research (CUR) for continuing to offer research opportunities to undergraduate students. Wilkie thinks such an experience has significant impact on student learning and engagement.

“The best way to study science is to learn by scientific experimentation,” Wilkie added. “Research projects give students a much deeper experience, involving students with actively contested questions, empirical observation, cutting-edge technologies, and the sense of excitement that comes from working to investigate important topics.

You can hear Rebecca O’Connell discuss her research experience with Dr. Wilkie in this YouTube video: https://youtu.be/dHCDSXooEP0

Undergraduate Spotlight: Madelene Clark

As a transfer student coming into UF, Madelene Clark had her academic plan pretty well mapped out. She already earned her A.A. degree in biology from Santa Fe College. In fact, Madelene is enrolled in the Soil and Water Sciences Department's Combined B.S./M.S. Degree Program. She is on track to complete her undergraduate degree this semester and hopes to fully enter her graduate degree work in spring 2021. In 2019, she was the recipient of the Soil and Water Sciences Department's Frederick B. Smith Scholarship.

Madelene Clark (Photo by Mackenzie Goode)

Myakka: Why did you choose Soil and Water Sciences as a major?

Madelene Clark: I have a strong passion for microbiology and the environment. Soil and Water Sciences allowed me to combine these interests. It connects the micro scale to the landscape. I really love how you can physically touch and see how in class concepts affect the world around us.

Myakka: Do you have a favorite class or experience during your time in the department?

MC: I greatly enjoyed Dr. Allan Bacon's Environmental Pedology class. It further shaped my understanding of soils as a means to tell a story and how to better communicate scientific findings.

Recording soil pit observations during Dr. Bacon's Environmental Pedology class.
(Photo by Allan Bacon, 2019)

Soil sampling a fallow field in Nanyuki, Kenya. (Photo by Mackenzie Goode)

Myakka: What extracurricular activities have you been able to participate in at UF?

MC: I went to Kenya for an internship and study abroad experience my junior year. This was a great opportunity because it changed my perspective on agriculture and the impact of soil quality and nutrition. I knew soil only from a scientific standpoint. Until this experience, I couldn't visualize how it affected lives and it opened my eyes as to how necessary soil scientists are in the future of agriculture and environmental issues.

Myakka: Have you had any research experiences in addition to the work in Kenya?

MC: I've had more research and work experience on campus than I can count, but my most significant experience was I working in Dr. Gabriel Maltais-Landry's Soil Fertility Lab. Partnering with Field and Fork Gardens, I was able to get my feet wet in soil research and data analysis. It was a foundational opportunity which helped me grow as a student and future researcher.

Myakka: What are your career plans after graduating from UF?

MC: After graduate school, I hope to go into academic research. I'm interested in extreme environments and how life interacts in soil systems.

Myakka: What would you like others to know about Soil and Water Sciences?

MC: If you're interested in how the natural world works, Soil and Water Sciences is one of the best ways to understand it. As I reflect on my time at UF, I know that without the

A soil profile from created during a field visit during Dr. Bacon's Environmental Pedology class. (Photo by Madelene Clark)

faculty and staff of the SWS department I would not be even half as successful as I am today. It's a great community and support system that goes beyond academics.

There are several undergraduate work, scholarship, and internship experiences I would not have had if I didn't major in SWS. The department caters to experiential learning on top of classroom settings. Undergraduates are set up for success with a variety of interdisciplinary opportunities.

Everyone has a bit of them that wants to save the world, but with soil science you can actually achieve it. Soil science isn't the flashiest thing, but I believe that soil makes a huge impact on our quality of life now and in the future. Whether it is feeding the world, climate change, water quality, or wetland remediation, soil is going to make a difference. It's the most exciting thing because you get to immerse yourself in nature as you train and work to solve some of the world's biggest problems.

An Open Letter to the UF/IFAS Soil & Water Sciences Department

from Dr. J. Scott Angle
Vice President for Agriculture and Natural Resources, University of Florida
and administrative head, UF Institute of Food and Agricultural Sciences

My relationship with soil has changed over the years. I'm much more likely to be tossing soil with a ceremonial silver spade than I am to be analyzing its chemical composition these days.

But when I was hired to lead UF/IFAS this summer, there was no question in my mind that Soil and Water Sciences would be my faculty tenure home. I spent 12 years (24 total at the university) as a full professor of soil science while rising through the scholarly and administrative ranks at the University of Maryland.

I'm an accidental soil scientist. My turf science advisor left in the middle of my master's program, and he bequeathed me a soil scientist as a replacement. As aggravated as I was by the sudden departure at the time, it was a stroke of great fortune.

Soil science launched me into meaningful work that allowed me to play a role in one of the great environmental triumphs of our time, the restoration of Chesapeake Bay. Part of that success meant restoring the Bay while assuring that farmers remain profitable and in business. My job now is to support you in addressing Florida's most grand challenges, from restoration of the Everglades to providing the science behind water quality best management practices.

I was recently asked what my hobbies are. I said I don't really have any, but when on vacation I like to catch up on what's in the *Soil Science Society of America Journal* and the *International Journal of Phytoremediation*. While you in Soil and Water Sciences may see the appeal, I have to tell others that I'm serious, this is what I read for pleasure.

You've seen my C.V. So, here's a bit of what's not on it: Moved around as a kid for dad's work but mostly grew up in Baltimore. Loved being outdoors and catching critters. Even had a pet skunk! Aspired to be a pro golfer, but when it became clear that wasn't going to happen, I aspired to be a golf course superintendent.

Picking a university was easy: My dad informed me that I'd be going to the state school, in our case the University of Maryland. Ended up spending decades there, then a decade at that school we meet on the gridiron in Jacksonville each October (Hello, Dr. Place!). Then I learned about the grind of poverty in developing nations as well as the grind of traveling in Africa and Asia working for the International Fertilizer Development Center. Two years ago, I got the proverbial offer you can't refuse, and I moved to DC. Wasn't looking for another job. I was looking for THIS job. So here I am.

I work for you. I don't teach, do research or extend knowledge. My job is to support you so that you can do it to the best of your ability.

I consider myself a servant leader, and that means coming to you. I'm recently back from visiting Ashley Smyth's new lab. Kelly Morgan and I have talked BMPs both via Zoom and mask-to-mask. When I asked Ona faculty if they'd rather be in Gainesville, I was impressed when Maria Silveira told me the Range Cattle REC offers invaluable resources that Gainesville doesn't have, including a living laboratory suited to her science.

I hope I'll eventually get to meet each of you. Until then, let me know how I can serve.

J. Scott Angle
jangle@ufl.edu
@IFAS_VP

Adding Biochar to Biosolids Applications in Florida Pastures

By Dr. Maria Silveira, Professor of Soil Nutrient Management and Water Quality, Range Cattle Research and Education Center

Biosolids represent a viable alternative to supply nutrients and organic matter to perennial forage crops while reducing the dependence on inorganic fertilizer. Recycling biosolids in perennial pasture systems is an environmentally friendly option of disposal as it reduces landfill space demand and minimizes human exposure to various contaminants. Although biosolids have clear agronomic benefits, concerns over nutrient accumulation in soils and subsequent impacts on water quality can limit land application in Florida. Biochar, a byproduct of biomass pyrolysis, has the potential to be used in combination with biosolids to improve nutrient use efficiency and thus, reduce nutrient losses.

A field trial was established in 2016 to evaluate the agronomic and environmental impacts of various biosolids sources applied to bahiagrass pastures at the Range Cattle Research and Education Center in Ona. Our principal hypothesis was that most biosolids applied to pastures convey significant agronomic benefits as they behave as “slow release” nutrient sources with minimal negative environmental impact.

During the four-year study (2016 to 2019), one Class A biosolids, two Class B biosolids materials, and one wood biochar were annually applied to the experimental area and compared to nutrition provided with inorganic fertilizers. Biosolids sources were applied either alone or in combination with biochar to correspond to UF/IFAS high nitrogen (N) option for established bahiagrass. It is also the most common application rate used by commercial cow-calf operations in Florida. Control treatments included plots receiving inorganic commercial fertilizer (ammonium nitrate + triple superphosphate alone and in combinations with biochar) and pastures receiving no biosolids, fertilizer, or biochar. Forage, soil, water quality, soil moisture, ground water levels, and gas emissions were monitored during the four-year study.

Results

More detailed information about the study can be found at Lu et al. 2020 a, b, and c.

Bahiagrass Responses

- Bahiagrass total annual herbage accumulation was similar for biosolids and inorganic fertilizer treatments in 2017. However, inorganic fertilizer and aerobically digested Class B biosolids increased total annual herbage accumulation by as much as ~29% relative to other sources in 2018.
- Biosolids and inorganic fertilizer increased bahiagrass crude protein concentration by as much as ~22 and ~39% in 2017 and 2018, respectively, compared to unfertilized bahiagrass.
- No treatment effects were observed on in vitro digestible organic matter (IVDOM) concentration in 2017. In 2018, however, biosolids resulted in greater IVDOM than inorganic fertilizer.
- Data suggested no benefit of biochar on bahiagrass responses. Bahiagrass tissue mineral concentrations in both biosolids and inorganic fertilizer treatments were generally within sufficient range for optimum plant growth.
- Biosolids can be a viable alternative for sustainable bahiagrass production while reducing the dependence on inorganic fertilizer.

Soil Responses

- The majority (64%) of applied N accumulated in above-ground bahiagrass biomass, while ~ 63% of applied phosphorus (P) was retained in subsurface soil layers (<20 inches).
- Neither soil N or P concentrations were affected by repeated annual application of biosolids or inorganic fertilizer.
- Despite the relatively high annual P loads that far exceeded agronomic recommendations, repeated application of biosolids or inorganic fertilizer showed no effects on soil total P concentrations at any soil depth.
- At the end of the study, soil P decreased by ~ 15% in the top 12 inches depth followed by an associated increase in the 24 to 36 inches depth. These data suggested potential vertical redistribution of P within the soil profile. Phosphorus vertical transport is highly influenced by fluctuating water table commonly experienced in Florida Spodosols.
- Biochar had no impacts on soil N or P dynamics. Despite the significant annual P loads, biochar did not increase soil P levels or reduce P solubility. This result contradicts previous studies that suggested that biochar can affect soil P availability by changing soil pH and P sorption capacity.

Water Quality and Greenhouse Gas Responses

- Results demonstrated significant temporal variability in leachate N and P, with larger pulses generally occurring during periods of high water table levels or following intensive (> 1.5 inches) rainfall.
- Inorganic fertilizer generally resulted in greater leachate N and P losses than biosolids.
- No differences in leachate N and P losses between biosolids and control were observed. Approximately 1% of applied N was lost via leaching from biosolids treatments vs. 16% for inorganic fertilizer. Regardless of the P source, negligible (0.1 to 0.2% of applied P) cumulative P leaching occurred during the three-year study.
- Biochar had no effect on P leaching, but reduced N leaching from treatments receiving inorganic fertilizer by 60%.
- Nutrient source had no effect on soil CO_2 and CH_4 emissions, but annual and cumulative (three-year) N_2O emissions increased with biosolids (7 lb. N_2O/A/yr)

compared with inorganic fertilizer (5 lb. N_2O/A/yr) application.
- Data suggested that environmental conditions played a more important role on GHG fluxes than nutrient additions. Biochar reduced CO_2 emissions modestly (<9%) but had no effects on N_2O and CH_4 emissions. Data suggested that prudent nutrient management is possible even on biosolids-amended Spodosols with high water tables.

Summary and Conclusions

During the first four years of this project, significant resources and efforts were committed to two main priorities: 1. documenting soil, forage, water, and gas emissions baseline data, and 2. instrumenting the experimental area. However, several biotic and abiotic factors (e.g., rainfall, temperature, and timing of fertilizer application) can affect bahiagrass responses to biosolids application. Thus, multi-year research is necessary to confirm and validate the data.

Pastures represent the major cropping system for biosolids recycling in Florida, but multi-year field data to support the sustainability and safety of the practice are scarce. Most previous studies were conducted in greenhouses or laboratories. The agronomic and environmental impacts must be demonstrated in the field to credibly promote environmentally-sound biosolids land applications in livestock production systems.

Acknowledgements:

H&H Liquid Disposal assisted with obtaining and hauling biosolids materials to the study site. The Florida Cattle Enhancement Board provided the funds to support this project.

Future Direction

In 2020, new treatments were imposed onto the experimental area to evaluate the impacts of reduced biosolids application rate (to meet new proposed biosolids regulations) on agronomic and environmental responses. Among many changes, proposed new biosolids rules require that, in some circumstance, biosolids have to be applied at P-based rate. However, pastures fertilized with biosolids at P-based rates would need additional N application in order to achieve reasonable yields. The current experimental area offers a unique scenario where science-based information regarding the benefits of land application of biosolids can be generated and disseminated.

Questions? Contact Dr. Maria Silveira at mlas@ufl.edu.

Publications from this research:

Lu. Y., Silveira, M.L., Cavigelli, M., O'Connor, G.A., Vendramini, J.M.B., Erickson, J.E., and Li, Y.C. 2020a. Biochar impacts on nutrient dynamics in sub-tropical grassland soil: 2. Greenhouse gas emissions. *Journal of Environmental Quality*, DOI: 10.1002/jeq2.20141.

Lu. Y., Silveira, M.L., O'Connor, G.A., Vendramini, J.M.B., Erickson, J.E., Li, Y.C., and Cavigelli, M. 2020b. Biochar impacts on nutrient dynamics in subtropical grassland soil: 1. Nitrogen and phosphorus leaching. *Journal of Environmental Quality*, DOI: 10.1002/jeq2.20139.

Lu. Y., Silveira, M.L., Vendramini, J.M.B., Erickson, J.E., Li, Y. 2020c. Biosolids and biochar application effects on bahiagrass herbage accumulation and nutritive value. *Agronomy Journal*, 112, 1330-1345.

Congrats!

Summer 2020 Graduates

Advisor(s) in parenthesis

Ph.D.

Carla Gavilan (Harris)
Hanh Nguyen (Meyer & Reddy)
Sara Phelps (Osborne)
Tracey Schafer (Osborne & Reddy)
Xiaoping Xin (He & Judy)

M.S. (Thesis)

Eduardo Esteves Velez (Kadyampakeni and Maltais-Landry)
Audrey Goeckner (Lusk)
Kalani Henshaw (Judy)
Steve Hohman (Reisinger)
Qianyao Si (Lusk)

Summer 2020 Graduates

B.S. Soil & Water Sciences

(Advisor: Bonczek)

Wenny Cruz-Lopez
Lindsay Mikell

Soil & Water Sciences Minor

(Advisor: Bonczek)

Thomas Burnes
Soleil Lobato

B.S. Environmental Management in Agriculture & Natural Resources

(Advisors: Curry & Enloe)

Mary Lemons
Soleil Lobato
Nicky Macias
Mariya Petrova
Morgan Romero
Jennifer Ronderos
Heather Surratt

Best of Luck!

SWSD WELCOMES OUR NEW STUDENTS!

Summer 2020

Graduate Students

Advisor(s) in Parenthesis

Ph.D.

Jay Capasso (Sharma)

M.S.

Precious Nyabami (Lin)
Benjamin Tubbs (Sharma)

Interdisciplinary Studies - Environmental Management in Agriculture and Natural Resources B.S.

Advisors: Curry & Enloe

Erin Downey
Shannon Gray
Jessica Salter
Cayla Shirley
Anthony Shiver
Bryce Tawil

Fall 2020

Graduate Students

Advisor(s) in Parenthesis

Ph.D.

Audrey Goeckner (Reisinger)
Casey Harris (Reisinger)
Francisca Hinz (Wilson)
Amanda Muni-Morgan (Lusk)

M.S.

Emma Broadbent (Judy)
Barbara Cory (Deitch)
Kaitlyn Kleinatland (Deitch)
Devin Leonard (P. Inglett)
Valerie Mendez (Liao)

Fall 2020

M.S. (Non-Thesis)

Cassandra Bonds (Mylavarapu)
Christopher Cappiello (Bacon)
Matthew Chesser (Reddy)
Mary Christie (Osborne)
Katelyn Clark (Bacon)
Kristen Deason (Deitch)
Hannah Flynn (Smidt)
Jonathan Francis (Fujimoto)
Chelsea Frazer (Reddy)
Aubrey Frye (Reynolds)
Daniel Gorsten (Reddy)
Alexander Griffel Dalager (Clark)
Steven Krupka (Osborne)
Michelle Leonard-Mularz (Smyth)
Gretchen Maldonado (Strauss)
Alexandra Mauer (Lusk)
Chad Raimer (Reddy)
Christine Russo (Osborne)
Jared Schwab (Bhadha)
Erica Shannon (Osborne)
Samantha Steffen (Reddy)
Benjamin Sweeney (Wilson)
John Sydney, Jr. (Grunwald)
Joris Daniel Van Zeghbroeck (Li)

UF IFAS
UNIVERSITY of FLORIDA

Soil & Water SCIENCES

Fall 2020

Soil & Water Sciences B.S.

Advisor: Bonczek

Sterling Lester

Interdisciplinary Studies - Environmental Management in Agriculture and Natural Resources B.S.

Advisors: Curry & Enloe

Chelcie Baca
Christelle Beauboeuf
Isabella Brush
Amanda Castaing
Ian Claudio
Kassandra Coulsey
Audra Crowley
Katie French
Paula Sanchez Garzon
Lauren Geiss
Merina Ingram
Dili Li
Charla Markesteyn
Michael Maynard
Lindsey Miller
Roberto Ortez
James Prescott
Caroline Pride
Jordan Sanchez
Angelica Sandulescu
Zachary Santiago
Savita Singh
Lindsay Solano
Elisabeth Stelwagon
Eric Stinson
Rourke Stubna
Jonathan Turner
Erica Urbanovitch
Nicole Vafiadis
Cody Villarreal

Awards, Honors, & Recognition

STUDENT HONORS

Kaile Zhang (Liao & Maltais-Landry) received a Southern Sustainable Agriculture Research and Education (SARE) graduate student grant of $16,144 for determining how the ubiquitous fungi Mortierella regulates belowground nitrogen dynamics under different crop rotation systems. He is conducting the researcher with his co-advisors, Dr. Sunny Liao and Dr. Gabriel Maltais-Landry.

Audrey Goeckner (Reisinger) received the 2020 Stormwater Scholarship from the Florida Stormwater Association and the 2020 Roy W. Likins Scholarship from the Florida Section of the American Water Works Association.

Clayton Nevins (P. Inglett & Strauss) was elected treasurer and **Kira Sorochkina** (Strauss & P. Inglett) was elected secretary of the Southwest Florida REC Graduate Student Organization for the 2020-21 academic year.

Nan Xu (Bhadha & Mylavarapu) won 1st Place-Oral Presentation in the Soil and Water Management and Conservation Division of the SSSA at the 2020 annual meeting.

Leandro Vieira (Silveira) won 2nd Place-Graduate Student Poster Competition in the Soil and Water Management and Conservation Division of the SSSA at the 2020 annual meeting.

Samuel Kwakye (Kadyampakeni) won 2nd Place-Graduate Student Oral Competition of the Florida State Horticultural Society annual meeting.

Gretchen Stokes (Smidt) completed a global survey of inland fisheries experts with the preliminary work being included in the 2020 State of Fisheries report through UN-FAO. She also presented the work at a UN-FAO roundtable event. Gretchen also had a PNAS publication on the "COVID-19 pandemic impacts on global inland fisheries."

Trista Brophy (Smidt) is currently participating in the NASA Develop program focusing on remote imagery to improve flood prevention/resilience for a region in Kansas with plans to duplicate the efforts in Florida. Trista also earned Geology and Society Division Best Student Presentation Award for the 2020 GSA Annual Meeting; runner-up Graduate Division Student Poster for the Governor's Conference on the Future of Water in Kansas; and received the American Water Works Association Florida Section Roy W. Likins Scholarship and Florida Stormwater Association Scholarship.

The following students received the CALS Doris and Earl Lowe and Verna Lowe Scholarship:

Bella Brush (Curry & Enloe), **Cordelia Collinson** (Curry & Enloe), **Adesuwa Erhunmwunse** (Liao & Ogram), **Katy Frey** (Curry & Enloe), **Clayton Nevins** (P. Inglett & Strauss), **Erika Sakers** (Curry & Enloe), **Zoe Spielman** (Curry & Enloe), and **Gretchen Stokes** (Smidt). **Hannah Moore** (Curry & Enloe) and **Matthew Phillips** (Curry & Enloe) received the Florida Rural Rehabilitation Corporation Scholarship.

J.P. Prescott (Curry & Enloe) received the Bill Gunter FFA Scholarship.

FACULTY HONORS

Dr. Jango Bhadha received the 2020 Seymour Goldweber Extension Professional and Enhancement Award. This award provides a term professorship to outstanding state or county Extension faculty members who has developed an educational program that contributes to making the Florida Extension Service the best in the nation.

The American Society of Agronomy (ASA) named **Dr. Samira Daroub** an ASA Fellow for her contributions to agronomy through education, national and international service, and research.

Dr. Zhenli He was named a University of Florida Research Foundation Professor for 2020 for his distinguished current record of research and strong research agenda. The professorships run for three years.

Dr. AJ Reisinger was selected as the 2020 UF Water Institute Early Career Faculty Fellow. It is in recognition for his "outstanding contributions to interdisciplinary water research, extension, and education programs as well as strong support of UF Water Institute Programs."

Dr. Maria Silveira began serving a five-year term as chair of the multi-state project "W4170: Beneficial use of residuals to improve soil health and protect public, and ecosystem health." This research group has a more than 45-year history of biosolids research used to support the regulatory community for promulgation of Title 40 CFR Part 503 – Standards for the Use or Disposal of Biosolids and other science-based state and federal guidelines and regulations.

Dr. Sarah Strauss is co-principal investigator on a $10 million federal grant, led by the University of California-Riverside. It involves working with Florida commercial citrus growers to explore the efficacy of using cover crops and soil amendments and the interaction with rootstock to improve soil and root health in newly planted and established groves. The project will also examine the impact of cultural practices like herb-icide application on soil health and tree productivity.