# ABE UPDATE

WINTER 2019/2020

# Algae, Water, and More

## HOW ABE IS TACKLING FLORIDA'S CHALLENGING ISSUES

AGRICULTURAL & BIOLOGICAL ENGINEERING

UF IFAS UNIVERSITY of FLORIDA

UF Herbert Wertheim College of Engineering UNIVERSITY of FLORIDA

# ABEUPDATE

Winter 2019/2020

UF/IFAS Agricultural and Biological Engineering Department

Kati Migliaccio
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Dear ABE friends,

**KATI MIGLIACCIO, PH.D.**
CHAIR AND PROFESSOR

The Agricultural and Biological Engineering Department enjoyed a half day retreat in early 2019 to identify a way to express our collective expertise. After some time and thought, we created the following description of our program:

> *"Our department is founded on developing, teaching, and applying engineering principles to improve and sustain agricultural and biological systems for current and future generations. Our programmatic expertise on these complex systems ranges from nano to global scales, integrating anthropogenic and sociological aspects to natural and managed systems. The UF/IFAS ABE department continually transcends disciplinary boundaries to create synergy among different knowledge areas for designing, quantifying, assessing, and managing engineering solutions for natural and managed systems."*

Thinking about this statement and the challenges regarding algal blooms, ABE expertise is an essential component for finding solutions. Not only is our expertise needed from the perspective of the negative impacts of algae in natural systems, but ABE expertise is also needed from the positive aspects such as the production of bioproducts using algae.

Algae is an aquatic plant – most of us can picture algae when we hear the word. However, the products from algae can be quite diverse and may not be obvious to everyone. Algae can be used for creating bioproducts such as pharmaceuticals, feed stock, biofuels, and bioplastics. While these uses are exciting and offer alternatives to more traditional sourcing, the term 'algae' often is heard in Florida in terms of its impact on our waterways and beaches. The occurrence of harmful algal blooms can impact property values and ecosystem and human health. Likewise, the blooms can create economic issues for the tourism and fishing industries in Florida.

This newsletter issue highlights department expertise and programs on algae in terms of best management practices, bioproducts, climate change, and monitoring. We also highlight collaborations through Centers and Institutes and statewide efforts. Please enjoy this update on how ABE is contributing to solutions for algal challenges and new products from algal sources.

**Kati Migliaccio**
*Chair and Professor*

@hydroKati

BY RAYCHEL RABON

# Blue-Green Algae Task Force

The Blue-Green Algae Task Force was established in April 2019 by Florida Governor Ron DeSantis with the appointments of five expert researchers and leading scientists to address Florida's algal blooms.

Algal blooms are an accumulation of algal cells caused by the combination of sunlight, slow-moving water, and nutrients. These blooms are a major environmental problem that can produce toxins, produce dead zones in the water, raise drinking water treatment costs, and hurt industries which rely on clean water.

"Florida's waters are plagued by nutrient enrichment, eutrophication and harmful algae blooms due to decades of mismanagement of nutrients on our landscape. The blue-green algae task force was appointed by Governor Ron DeSantis to advise the Florida Department of Environmental Protection (FDEP) on how to reverse this trend and fulfill its mission to protect the state's waters. Controlling nutrients on our landscape and their resulting impacts on our surface waters, groundwaters and springs is essential to Florida's economy and Floridians' quality of life," Wendy Graham explained.

**Wendy Graham**, ABE Carl S. Swisher scholar in water resources and UF Water Institute director, was among the researchers and scientists named to this task force. Her research focuses on understanding and quantifying the sources, stores, fluxes and travel times of water and nutrients as they move from the land surface to our water bodies.

"I hope to bring a systems view of the issue to the panel, and to help FDEP explore how to better use integrated hydrologic modeling and monitoring tools to understand, manage, and track the progress in solving this important problem," Graham stated.

This task force began by cataloging and understanding the sources of nutrients, the regulations and programs that are supposed to manage these sources, areas in which the regulations and programs have broken down, and areas where new science is needed to better manage the problem. A consensus document laying out specific science-based recommendations to expedite improvements and restorations of Florida's water bodies that have been adversely affected by blue-green algae blooms was produced in October 2019.

"I hope to bring a systems view of the issue to the panel, and to help FDEP explore how to better use integrated hydrologic modeling and monitoring tools to understand, manage, and track the progress in solving this important problem."

"We look forward to seeing the State of Florida take concrete actions on our initial recommendations. Over the next year the Task Force plans to conduct more detailed investigations into specific science, technology and policy programs that show promise for controlling harmful algae blooms in Florida's waters. We will also extend the focus, that has been primarily on South Florida systems, to important water bodies throughout the state," Graham explained.

*Dr. Wendy Graham is Carl S. Swisher eminent scholar in water resources in the Department of Agricultural and Biological Engineering and director of the UF Water Institute.*

Along with Dr. Graham, the task force includes Evelyn Gaiser, aquatic ecologist at Florida International University, Michael Parsons, marine science professor at Florida Gulf Coast University and director of the Coastal Watershed Institute and Vester Field Station, James Sullivan, executive director of FAU's Harbor Branch, and Valerie Paul, previous director of the Smithsonian Marine Station at Fort Pierce, Florida.

For more information on the Blue-Green Algae Task Force, visit protectingfloridatogether.gov. ■

***Wendy Graham**, wgraham@ufl.edu*
*@WendyDGraham*

BY RAYCHEL RABON

# Center for Land Use Efficiency

To take a more holistic approach to challenging Florida issues, the University of Florida Institute of Food and Agricultural Sciences has established the Center for Land Use Efficiency (CLUE) for researchers to share information on various topics surrounding water and land use.

This center combines faculty from a variety of disciplines, including agricultural and biological engineering; agronomy; horticultural sciences; family, youth, and community sciences; soil and water sciences; and others. Faculty from the Center for Landscape Conservation and Ecology (CLCE) and the Program for Resource Efficient Communities are also included in this center.

"We create that opportunity for [faculty] to work together," said **Michael Dukes,** CLUE Director.

ABE Professor Michael Dukes leads this new center, which includes agricultural best management practices (BMPs) and its Extension education and outreach efforts.

"Our researchers essentially conduct research on practices that are BMPs or might become BMPs and our extension faculty take that knowledge and do trainings on that," Dukes said. "Our goal is to facilitate trainings by our state specialists for our county agents who live in the communities with growers. They are on the forefront of [water and land use] education."

A subject of specific importance to this center is a comprehensive approach to nutrient management and how it impacts Florida's residents and environment.

"Blue-green algae and red tide are issues effected by all types of land uses and what we hope to do with the center is capitalize on the combination of subject areas," Dukes said.

**"We create that opportunity for faculty to work together."** - Michael Dukes on the Center for Land Use Efficiency

Dukes is an irrigation specialist whose research has focused on assessment of irrigation conservation program effectiveness, development of irrigation conservation programs in Southwest Florida, influence of irrigation and fertility Best Management Practices on nitrogen leaching on sandy soils, and education on efficient irrigation and water conservation potential of smart irrigation controllers.

For more information on the Center for Land Use Efficiency, visit clue.ifas.ufl.edu. ■

***Michael Dukes**, mddukes@ufl.edu*
*@mddukes*

*Michael Dukes on received the Florida Nursery, Growers & Landscape Association 2019 Friend of the Industry Award. This award is presented to individuals who have contributed to the advancement or improvement of Florida's nursery and landscape industry.*

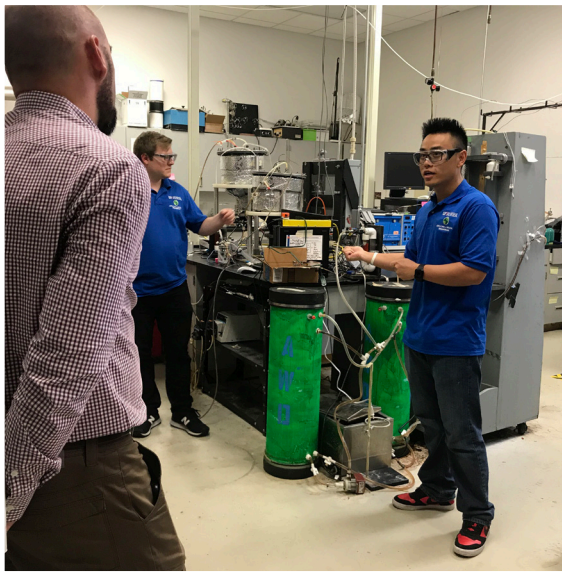
BY SHUNCHANG YANG, KYLE GRIFFIN, AND CAROLA SANCHEZ

# Bioprocessing and Algae

*ABE's Bioprocessing Laboratory houses postdoctoral research associate Shunchang "Jack" Yang and graduate students Kyle Griffin and Carola Sanchez. Under the direction of Associate Professor* ***Pratap Pullammanappallil****, these researchers conduct projects that focus on algae, bioprocesses, and how it can be used in the future.*

**Shunchang "Jack" Yang**
*Postdoctoral Research Associate*
*Bioprocessing Lab Manager*
*jack.shushu@ufl.edu*

My research interest focuses on waste management through microbial conversion and ecology, and environmental sustainability by nutrient recovery and algal farm bio-system.



*TOP PHOTO: Ph.D. student Kyle Griffin conducts research in the ABE Bioprocessing Laboratory. RIGHT PHOTO: Postdoc Jack Yang presents his research to department visitors.*

The algae are one of the most promising biomass sources. Besides the valuable product, Exopolysaccharide (EPS), it also has many advantages: small footprint requirement, high yield of production, and nutrient uptake from the wastewater. The challenge we have is to separate the algae biomass and the EPS product.

We can apply an anaerobic digestion technique to recover energy from the algae cell biomass. The anaerobic fermentation process produces a valuable product (renewable natural biogas) from waste like municipal sol-

id waste, wastewater, and agricultural residues, which could be used for generating electricity, heat, and other purposes.

Excess nutrients, such as nitrogen and phosphorus, released during anaerobic digestion could potentially cause environmental impacts, like eutrophication and harmful algal blooms. We use a sustainable way to recover these nutrients under optimized conditions and use this as fertilizer for land application.

**Kyle Griffin**
*Ph.D. Student*
*kgriffin2494@ufl.edu*

My research focuses on utilization of bacteria for production of biodegradable, bio-based products, as well as solar-powered anaerobic digestion for biogas production.

Anaerobic digestion is a popular bioprocess that converts organic matter to renewable natural gas. Because of the low prices of natural gas, there is interest to upgrade this renewable natural gas into a higher-value product. Methanotrophs are bacteria that subsist on methane gas, producing a biodegradable polymer internally.

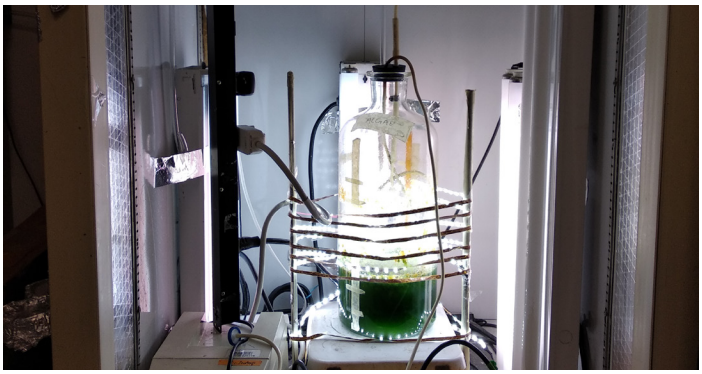
This polymer, polyhydroxybutyrate (PHB), has properties that rival, and in some instances are better than, those of polypropylene, that second-most produced commodity plastic in the world. Polypropylene is produced through the oil refining process and is not biodegradable, causing environmental issues in its production and disposal. PHB can either be recycled or disposed of in the landfill, where it will biodegrade, or used as a feedstock in the anaerobic digestion process.

Utilization of renewable natural gas from anaerobic digestion by methanotrophs for production of PHB is an attractive process for upgrading renewable natural gas to a higher-value product, while also substituting part of the commodity plastic production process and providing a closed-loop bioprocess.

**Carola Sanchez**
*Ph.D. Student*
*carolasanchez@ufl.edu*

My research strives to produce fuels from algae in an economically viable process by developing novel, efficient, and stable catalysts that will assist in the hydrothermal liquefaction (HTL) of algae-sourced biomass and subsequent deoxygenation of the organic HTL product.

One of the tasks of this project is “Algae growth and separation for optimum biomass production.” This task will optimize conditions for biomass production using a newly isolated and genetically characterized species of cyanobacteria saltwater algae, Cyanothece BG011, a nitrogen-fixating algae species which has high growth rates and the ability to produce an extracellular polysaccharides substances (EPS). The effects of growth conditions on the composition of the resulting biomass (EPS and the algal cells themselves) will be investigated, together with economical methods to extract EPS and cells (together called algal biomass). ■



*BioFlo and algae reactor used in the ABE Bioprocessing Laboratory.*

## ALUMNI SPOTLIGHT

### DANA ELLER

*President, MWI Pumps*

*B.S., Biological Engineering, Agricultural and Biological Engineering, 1995*

*MWI is a world leader in pump design, manufacturing, sales, and rentals. MWI Corporation began as an iron and steel equipment manufacturer in 1926 and MWI Couch Pumps has been developing pumps since 1917. MWI Pumps emerged as a pump rental company in 1968. Today, it continues to provide customers around the world with dependable hydraulically driven trash pumps, rotary wellpoint pumps, and self-priming dewatering pumps.*

***Why did you want to pursue an education and career in agricultural and biological engineering?***

I wanted to go into the family business at eight years old (MWI Pumps) building large water pumps for drainage, irrigation, and stormwater like my father, J. David Eller, P.E., University of Florida Agricultural Engineering class of 1964. He said being an agricultural engineer would provide me the necessary education to understand what we do and be qualified to run the business.

***What is involved in your role as President of MWI Pumps?***

Setting the overall strategy of our business, maintaining our corporate culture and values, product development, and marketing

***How did UF ABE help you prepare for your career?***

Not only do I understand how to design the mechanical aspects of our pumps, but I also understand the fundamentals that go into determining how to manage the water levels and runoff for different purposes the pumps are used for. The broad engineering fundamentals that I acquired in the ABE curriculum helps tremendously in interactions with all the engineering disciplines we come into contact with regularly, such as civil, mechanical, electrical and environmental.

***Why would you recommend the ABE department?***

I would recommend the ABE department to students that want to get into engineering, because I believe it equips you with the broadest set of engineering fundamentals out of any engineering curriculum. I believe that this help you to be a more creative problem solver, a well-rounded engineer, and a greater ability in understanding and designing complete systems, as opposed to singular aspects of a project.

## ALUMNI SPOTLIGHT

### JAMES "JIM" BOYER

*Director of Research Administration, Plant Science Research and Education Unit*

*B.S., Agricultural Operations Management, Agricultural and Biological Engineering, University of Florida, 1999*

*The Plant Science Research and Education Unit and its highly skilled staff serve faculty with the infrastructure needed to conduct diverse row and specialty crop research projects, facilitate hands-on classes and host thousands of visitors in outreach events. PSREU is a 1,086-acre farm located approximately 30 minutes south of Gainesville.*

*Jim Boyer, ja.boyer@ufl.edu*

***What do you do in your role as Director of Research Administration at the Plant Science Research and Education Unit (PSREU)?***

My job as Director of Research Administration is to provide leadership for the overall planning and development of the Plant Science Research and Education Unit. This leadership coordinates plans for land use, equipment and irrigation infrastructure, farm personnel management, Best Management Practices (BMPs), cultural practices, and all other farm operations.

***How did UF ABE help you prepare for your career?***

ABE helped prepare me for my career by offering courses in irrigation, pesticide application, power and machinery, and much more that created the foundation for a career in agriculture. The faculty are supportive and want you to succeed. The ABE curriculum was an important part of employer's interviews. Employers asked many questions about the specific classes and were impressed with the depth of the material. I continue to interact with ABE graduates on a regular basis that are successful in agriculture and natural resource occupations. Even after graduation, ABE faculty have continued to help with any questions as my career has progressed.

***Why did you want to work in this field?***

I grew up in Florida agriculture with my family in citrus, timber, sod, and cattle. ABE was a perfect fit for this type of background to continue in the agriculture business.

***Why would you recommend the AOM program?***

The AOM degree is well rounded degree that will allow you to go various directions with job opportunities after graduation. Its mission is to help promote knowledge that applies to the future needs of our society with respect to protecting agriculture and our natural resources.

**DR. SANDRA GUZMÁN**
*UF/IFAS Agricultural and Biological Engineering*
*Indian River Research and Education Center*



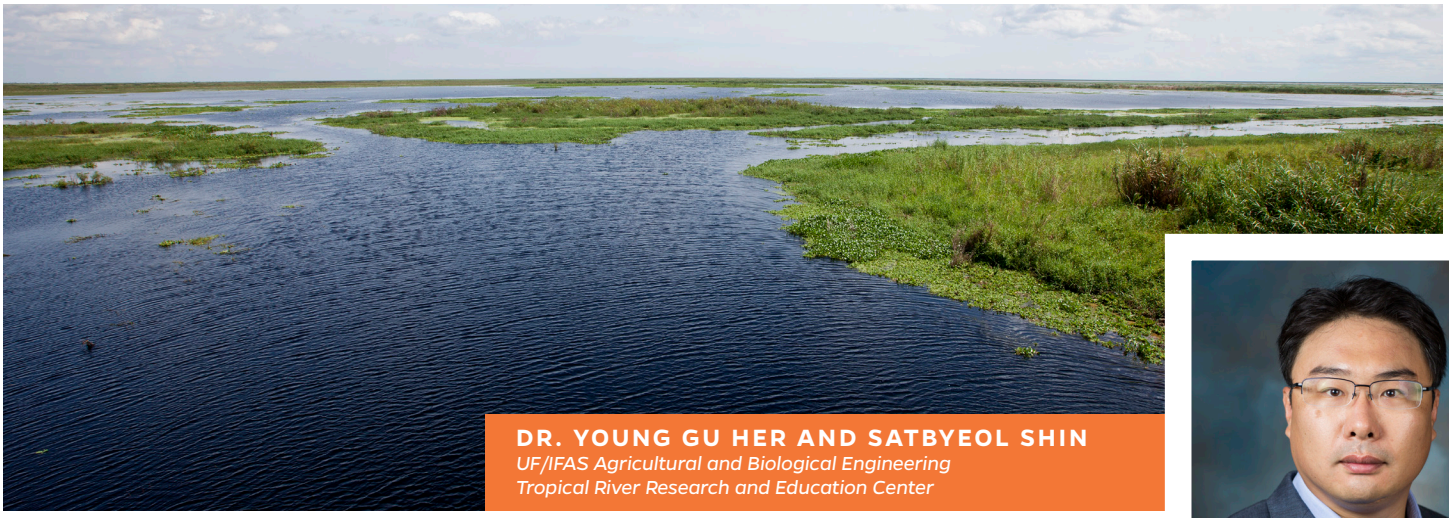
# Ultra-fine Bubbles in Agricultural Waters to reduce Algal Blooms

With the increase in toxic algae across the St. Lucie Estuary and the Indian River Lagoon, one of the major concerns is the management of water quantity and quality from farm practices. The public, researchers, and policymakers want to know what is causing algal blooms and how to manage estuary-lagoon dynamics. Currently, water farming, also called dispersed water management, is used as a Best Management Practice (BMP) to 1) reduce nitrogen, phosphorus and sediment loads releases into the lagoon and the estuary, and 2) retain surface water that comes from rainfall and inflows from drainage canals. These water farms utilize fallow lands that were previously used for citrus production, to serve as storage for waters that come from nearby drainage channels or by rain. Then, the waters are later released for either the estuary or irrigation. If carefully controlled, this BMP can deter algal blooms by providing a control mechanism over water quality entering estuary-lagoon systems.

One major problem that has not been solved with water farming is variable levels of dissolved oxygen in the water, an issue that is known to be associated with eutrophication. In many water farming practices, drainage waters have dissolved oxygen (DO) levels near zero parts-per-million (ppm). The relatively large volume of water from this process increases the likelihood of hypoxia in receiving estuaries/lagoons. One groundbreaking solution that is currently being tested by assistant professor Sandra Guzmán's lab, in collaboration with USDA-Horticultural lab in Fort Pierce, Florida, is a Nanobubble Oxygen Injection System (NOIS). The NOIS system employs a novel hydrodynamic system for oxygenating water while controlling bubble cavitation rate. Oxygen injection via nanobubbles on water farms can increase DO to saturation levels (upwards of 30 ppm) within minutes. Oxygenating waters before discharge to receiving estuaries could significantly reduce the effects of hypoxia in water ecosystems, and therefore reduce the chance of algal blooms. A preliminary study at USDA shows that after injection, DO levels can be higher than 15 ppm for around two weeks. Florida water management districts are looking for efficient solutions, backed up with data, that enhance water farm effluent quality. For this concept to be scalable, there is a critical need for a system to measure, analyze, and forecast the transport of oxygen nanobubbles from water farms to the receiving estuary. Recent advances in sensor technologies and machine learning open the door for innovative and cost-effective solutions that can be used to develop this centralized analysis and forecast system.

Guzmán's lab is currently evaluating the influence of ultra-fine bubbles on the quality of agricultural waters reaching the St. Lucie Estuary and Indian River Lagoon including, drainage from an agricultural field, rainwater and groundwaters. At the end of this project, the goal is to provide recommendations on agricultural water oxygenation in water farms for the environmental conditions of Florida. ■

***Sandra Guzmán**, sandra.guzmangut@ufl.edu*
*@watersan17*



**DR. YOUNG GU HER AND SATBYEOL SHIN**
*UF/IFAS Agricultural and Biological Engineering*
*Tropical River Research and Education Center*



# Evaluating Climate Change Impacts on the Greater Everglades

Lake Okeechobee is a "heart" of the Greater Everglades Ecosystem, providing a variety of ecosystem services including flood protection, flesh water supply, navigation, fishery and wildlife habitat throughout the Everglades ecosystem and the associated estuaries. The lake has major inflow from the Kissimmee River, two outlets to discharge through the northern estuaries via the Caloosahatchee Canal to the west and the St. Lucie Canal to the east, and four major canals to convey water supply to the south traversing the Water Conservation Areas (WCAs), which capture excess runoff from the Everglades Agricultural Area (EAA).

With the release of nutrient-laden water from the lake, water quality and ecological issues develop in downstream areas. These issues include algal blooms, low salinity, and loss of fisheries and coastal habitat in the northern estuaries.

As many multi-agency restoration projects are on-going to solve Lake Okeechobee's water quality and quality issues, the National Academies are concerned about the lack of holistic understanding of the interaction between the lake and its surrounding areas, the overall benefits of the combined projects at a system-wide scale, and the resilience in projects to sea-level rise and climate change.

In research proposed by Assistant Professor Young Gu Her and Ph.D. Student Satbyeol Shin, they aim to answer a few key questions concerning the sustainability of the Greater Everglades Ecosystem, including how will climate change influence water and nutrient loadings to Lake Okeechobee from its drainage areas in the future, how will projected changes in the water and nutrient loadings affect the hydrodynamics of Lake Okeechobee, where are the sources of water and nutrients loaded to the lake, what or who is most responsible for Lake Okeechobee's water quality issues, and how can negative impacts of climate change on the lake and its drainage areas be efficiently mitigated.

This study will create an integrated modeling tool capable of predicting the responses of the upstream Everglades hydrology and water quality to changes in climate, land use, and management practice. In this context, this study will focus on the northern Everglades system including Lake Okeechobee and Kissimmee River Basin and develop simulation models, which will be able to provide a holistic view of the upstream Everglades hydrology and water quality by describing water and nutrient transport process, reservoir operation, agricultural management practices, and hydrodynamics of the lake. ■

***Young Gu Her**, yher@ufl.edu*

BY RAYCHEL RABON

# Low-Cost, Real-time Water Resource Monitoring Platform

Assistant Professor Eban Bean's research focuses on urban water resources engineering and has worked in stormwater management and low-impact development over 15 years. Bean's research has focused on the design and evaluation of stormwater control measures for retention and pollutant removal.

Bean and Ph.D. student Piyush Agade have worked to develop a low-cost platform that can be carried by a water body in order to map its water quality called GatorByte.

Commercially available water quality monitoring systems are often cost-prohibitive for water resource professionals. The goal of this open-source project is to develop a low-cost, compact, robust, and mobile water quality data logging platform deployable for a short or long-term in water bodies.

The GatorByte was created to be placed in a body of water to be carried by the body in order to map the water quality. This can provide valuable information such as where water quality issues are occurring in a watershed and locations/sources of water quality problems should be addressed.

This system serves as an early warning system and provides valuable insight information that can provide a basis to make better decisions concerning improving infrastructure and addressing water problems.

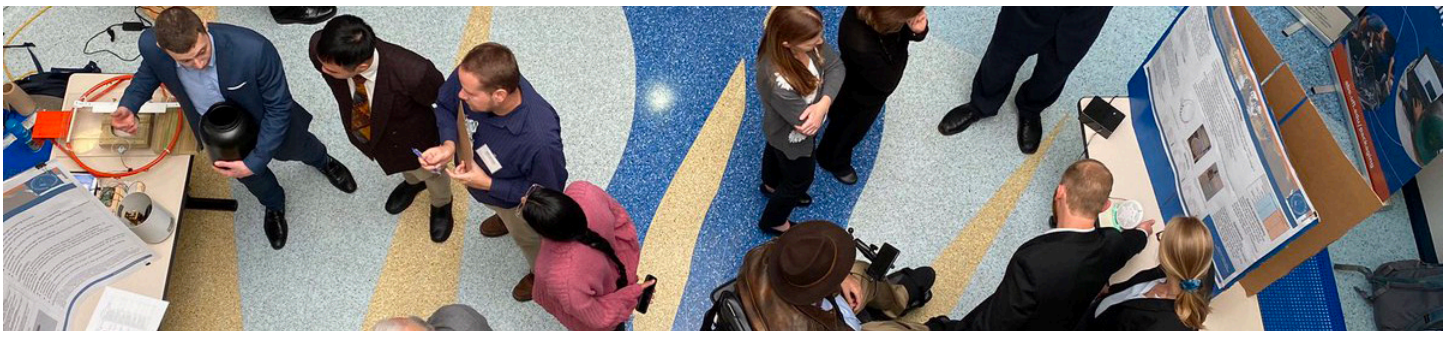
This water quality buoy was created by integrating GPS, a microcontroller, and real-time communications with water quality sensors.

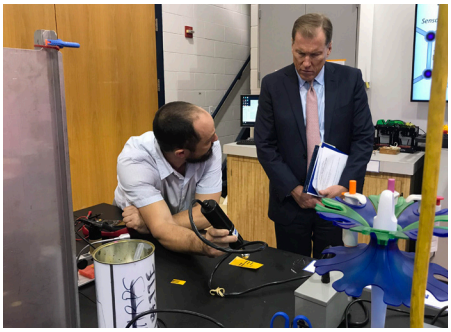
The GatorByte system is consistently in development and plans to make the hardware and software design modular, build a swarm of GatorByte buoys and stations, and add support for various brands of components and sensors are expected in 2020. ■

***Eban Bean**, ezbean@ufl.edu*
*@EbanBean*

*Assistant Professor Eban Bean releases the GatorByte buoy into a creek in Gainesville, Florida.*





*(From left to right, top to bottom) ABE Alumnus and Advisory Board Member Robert Horton receives the University of Florida Distinguished Alumni Award. | Dr. Melaine Correll receives the newly established ABE Citizen Award. | ABE Graduate Student Organization hosts is annual Halloween social and costume contest. | Alumnus Dana Eller presents the keynote at the 2019 ABE Recognition and Awards Dinner. | Associate Vice President Jeanna Mastrodicasa presents the welcome introduction at the 2019 ABE Recognition and Awards Dinner. | Biological Engineering Design 1 students present their final projects of the semester to the ABE advisory board, department leadership, and guests. | The ABE Advisory Board visits Depot Park to learn about its stormwater management and environment restoration. | Charlie Lydecker from the Board of Governors of the State University System visits the ABE department. Dr. Eric McLamore presented his work on Sensor Analytic Point Solutions.*

# AWARDS AND ACCOMPLISHMENTS

- ABE Alumnus and Advisory Board Member **Robert Horton** received the University of Florida's Distinguished Alumni Award.
- Professor **Senthold Asseng** was named a Fellow of the American Association for the Advancement of Science as part of the Section of Agriculture, Food, and Renewable Resources.
- Professor **Bin Gao** was named a Web of Science Group 2019 Highly Cited Researcher in the Engineering and the Environment and Ecology categories.
- Professor **Senthold Asseng** was named a Web of Science Group 2019 Highly Cited Researcher in the Cross-Field category.
- Professor Emeritus **Kenneth Boote** was named a Web of Science 2019 Highly Cited Researcher in the Agricultural Sciences category.
- Senior Lecturer **Wendell Porter** received the 2019 Faculty Fellow Award from Florida Climate Institute.
- Ph.D. Student **Raminder Kaur** received the UF College of Agricultural and Life Sciences International Student Outstanding Achievement Award.
- Ph.D. Students **Shirin Ghatrehsamani** and **Yulin (Patrick) Zheng** received the UF International Center Certificate of Excellence from Herbert Wertheim College of Engineering.
- ABE Alumnus **Dana Eller** received the ABE Distinguished Alumni Award.
- Professor Emeritus **Fedro Zazueta** received the ABE Distinguished Achievement Award.
- ABE Alumnus **David Still** received the ABE Distinguished Service Award.
- Pennsylvania State University Assistant Professor **Daeun Choi** received the ABE Outstanding Young Alumnus Award.
- Kansas State University Engineering Interim Dean **Gary Clark** received the ABE Agricultural and Biological Engineering Distinguished Alumnus Award.
- Postdoctoral Research Associate **Shunchang (Jack) Yang** and Ph.D. student **Victoria Morgan** received the ABE Graduate Student Mentoring Achievement Award.
- 2019 ABE Three Minute Thesis Results: First place to **Bhagatveer Sangha**, second place to **Jerrett Kandzer**, and People's Choice Award Video to **Lory Willard**.
- Ph.D. Student **Lory Willard** received the Ken and Cindy Campbell Graduate Fellowship.
- Undergraduate Student **Savannah Gross** received the Sun Fu "Tony" Shih Scholarship.
- Undergraduate Student **Ayla Sage** received the Sun Fu "Tony" Shih Scholarship.
- Undergraduate Student **Ryan Richardson** received the John B. Boy/U.S. Sugar in Agricultural Engineering Scholarship.
- Undergraduate Student **Bonita Trinter** received the John B. Boy/U.S. Sugar in Agricultural Engineering Scholarship.
- Undergraduate Student **Logan Sprague** received the Allen G. Smajstrala Scholarship.
- Undergraduate Student **John Fiorezi** received the Florida Section ASABE Scholarship.
- Undergraduate Student **Sirapoom Peanusaha** received the Florida Section ASABE Scholarship.
- Undergraduate Student **Joshua Jantz** received the Bob and Virgina Peart Scholarship.
- Undergraduate Student **Douglas Santos** received Giles and Martha Van Duyne Scholarship.
- Undergraduate Student **Jenna Phillips** received the Rush E. Choate Scholarship.

## NEW HIRES

### Vivek Sharma, Ph.D.

*Assistant Professor in Precision Water Management*

vsharma1@ufl.edu

Dr. Vivek Sharma previously served as an assistant professor in the Department of Plant Sciences at University of Wyoming. His research at UW focused on the precision agricultural water management with emphasis on irrigation science and engineering.

### Ying Zhang, Ph.D.

*Assistant Professor in Controlled Environments*

yingzhang409@ufl.edu

Dr. Ying Zhang earned her Ph.D. in Biosystems Engineering from the University of Arizona. Her research interests include system design, airflow analysis, and energy modeling in controlled environment agriculture.

## FALL 2019 DOCTORAL GRADUATES

### Shirin Ghatrehsamani

**DOCTOR OF PHILOSOPHY**

Ag Machinery/Machine Vision
Advisor: Dr. Yiannis Ampatzidis

### Hanxi Bao

**DOCTOR OF PHILOSOPHY**

Biological Engineering
Advisor: Dr. Zhaohui Tong

## FALL 2019 BACHELOR OF SCIENCE GRADUATES

### Erik Cooper
**BACHELOR OF SCIENCE**
Biological Engineering

### John-Paul Fox
**BACHELOR OF SCIENCE**
Agricultural Operations Management

### Serdar Ghujahmat
**BACHELOR OF SCIENCE**
Biological Engineering

### Zhonglin Lai
**BACHELOR OF SCIENCE**
Biological Engineering

### Kelli McCourt
**BACHELOR OF SCIENCE**
Biological Engineering

### James McVay
**BACHELOR OF SCIENCE**
Agricultural Operations Management

### Austyn Sanchez
**BACHELOR OF SCIENCE**
Agricultural Operations Management

### Garrett Spencer
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### Logan Sprague
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## GIVING

Your generous donation to the UF/IFAS Agricultural and Biological Engineering program will provide support for our students, faculty and staff.

To support ABE, our scholarships and more, visit **abe.ufl.edu/give**.