

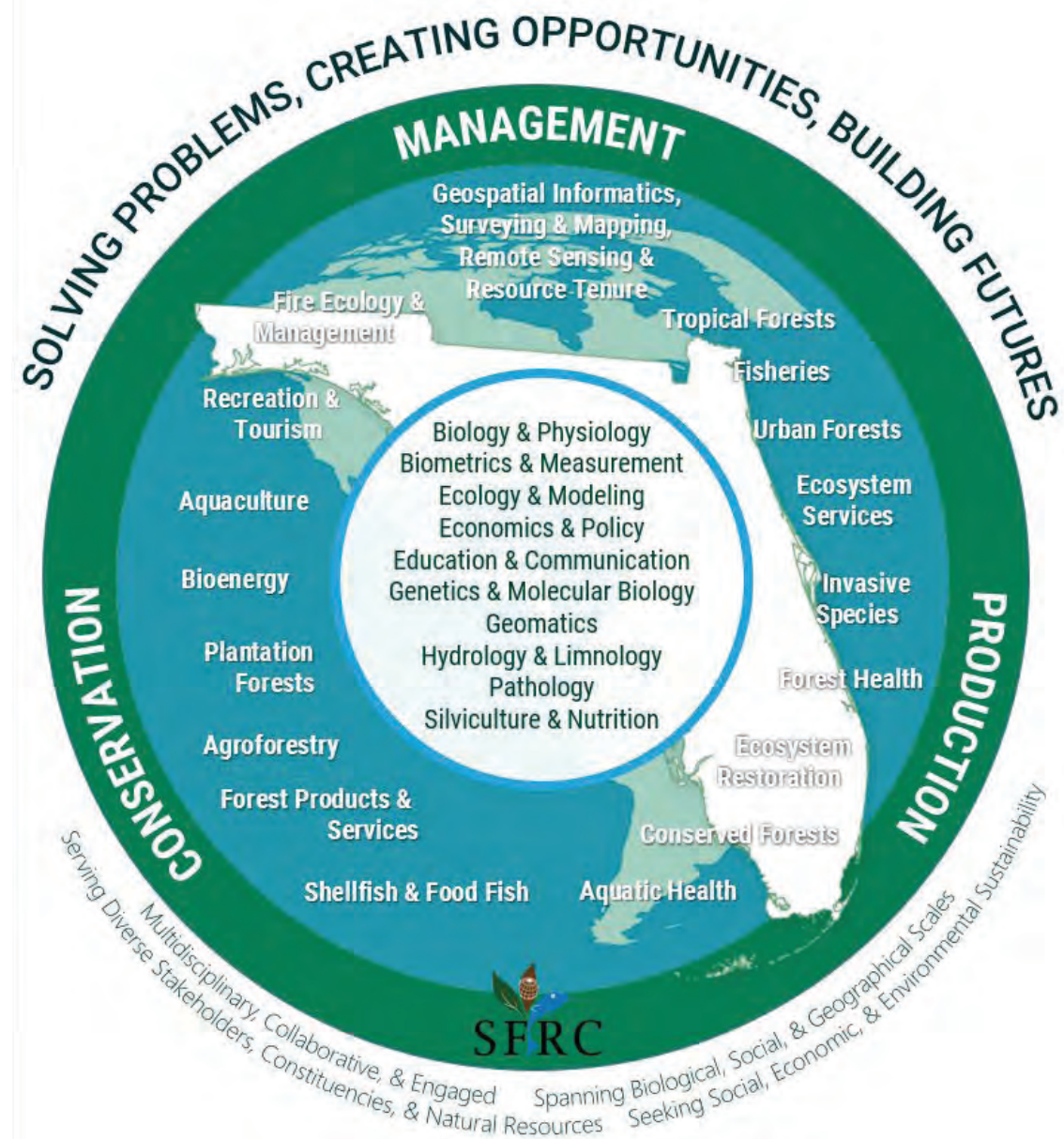
# SCHOOL OF FOREST RESOURCES & CONSERVATION

## 2020 PROSPECTUS

FOREST, FISHERIES, AND GEOMATICS SCIENCES







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**ORIGINS  
&  
VISION**



## MISSION & GOALS

### SERVING OUR STATE, THE NATION, AND THE WORLD

Forests cover one-third of the world's land area and half of Florida. They occur in protected areas, on private lands, and in cities. They impact the lives of all people through the products and services they provide. With annual revenues exceeding \$12 billion and cumulative economic impacts of \$25 billion, Florida's forests support an industry larger than any single agricultural crop. In addition, these forests provide non-timber products, clean water, spiritual renewal and mental health, wildlife habitat, carbon sequestration, climate stabilization, recreation, hunting, fishing, tourism, biodiversity, medicinals, and aesthetic beauty. The demand for these goods and services is increasing every year; yet, the forested land to meet these needs is decreasing.

Similarly, our marine and freshwater resources are critical for their economic values, recreational opportunities, biodiversity, and ecological services. Fisheries and aquaculture provide more than one billion people globally with most of their daily animal protein intake. Improving the productivity of fisheries and aquaculture while conserving and restoring the aquatic ecosystems upon which they depend is critical to food security and human well-being. Florida is the fishing capital of the world, with the longest coastline of any state in the lower 48. Our recreational fisheries rank first in the nation for participation and economic impact at \$14 billion per year, and our commercial fisheries rank fifth by value of landings at \$1 billion per year. Ornamental and shellfish aquaculture are important components of Florida's economy. In addition to being the leading producer of ornamental fish in the US, our growing shellfish aquaculture industry contributes \$31 million to the state's economy. Florida's aquatic resources and the industries they support are of utmost importance to the state, and they are globally connected through trade, tourism, and the common waters that are shared among the world's nations.

Surveyors, mappers, and geospatial scientists work in all 67 counties in Florida and throughout the U.S. for public and private agencies. Their work is advancing the science of natural resource management, conservation, sustainable urban planning, and many other fields with high-tech satellite imaging and geospatial data to inform decisions for the future. Now more than ever, the world needs scientists and professionals to measure, manage, and conserve our natural resources. Technological advances driven by geospatial scientists are providing the tools needed to adapt to a changing world.

### THE SCHOOL OF FOREST RESOURCES & CONSERVATION

The School of Forest Resources & Conservation (SFRC) is part of the University of Florida's Institute of Food and Agricultural Sciences (IFAS) with four missions: undergraduate education, graduate education, research, and Extension. We emphasize integrative, interdisciplinary approaches spanning three programs:

- 1) Fisheries and Aquatic Sciences, including sustainable fisheries, freshwater and marine ecology, ornamental and shellfish aquaculture, and aquatic animal health;
- (2) Forest Resources and Conservation including the biology, ecology, economics, policy, and human dimensions associated with sustainable management, conservation, and restoration of natural resources; and
- (3) Geomatics specializing in modern geospatial sciences such as surveying, mapping, remote sensing, satellite imagery, GIS, and GPS.

Since 1937, the School has been developing new knowledge and educating students and citizens about the sustainable management and conservation of natural resources. Our Extension, outreach, and continuing education programs provide information about forest resources, environmental education, geospatial sciences and fisheries and aquatic sciences to educators, youth, policy makers, land managers, landowners, and citizens to enable them to make informed decisions.

#### OUR PROGRAMS DELIVER:

a rich, personal educational experience for students;

new discoveries and applications that enrich lives, communities, and natural resources; and

lifelong learning opportunities for professionals, policy makers, landowners, youth, and the general public.

We are a highly interdisciplinary unit comprised of program areas in **Forest Resources and Conservation, Fisheries and Aquatic Sciences, and Geomatics.**





Students explore pine growth at the Austin Cary Forest during a silviculture course field trip.



Catching a fish from Fisheries and Aquatic Sciences' many stocked ponds during Family Fishing Day, a monthly public outreach event.

**Opposite page.** Pine trees marked for removal for timber or management purposes at the 2,600 acre Austin Cary Forest in Gainesville, Florida.

\* Universities.com  
 \*\*US News and World Report  
 ^College Factual

## CONTRIBUTING TO UF PREEMINENCE

Programs offered by the School have consistently contributed to UF's high national rankings. In 2020, UF rose in overall and program rankings for the third year in a row:

**UF RANKED #1**  
 in wildlife, fish, and wildlands science and management\*

**UF RANKED #2**  
 in surveying technology/surveying\*  
 in forestry\*

**UF RANKED #3**  
 in fishing and fisheries sciences and management\*

**UF RANKED #4**  
 in natural resources and conservation^

**UF RANKED #7**  
 in US public universities\*\*

## LOOKING TO THE FUTURE

In 2018, the School engaged our faculty, staff, students, and a wide variety of stakeholders in a strategic visioning process to explore where we have been, where we are going, and how we might continue to be successful serving our students, industry and agency partners, and the greater good given the changing landscape of natural resources. We learned about our strengths and obtained a clearer picture of the areas in which we have room to grow.

Clear strengths of the School include the deep disciplinary and interdisciplinary expertise we bring to teaching, research, and Extension in all three of our programs areas, as well as the strong and collaborative connection we have to our stakeholders. Sharpening our focus on diversity issues, growing our student enrollment and faculty numbers in Geomatics, and leveraging our communications to reach a wider public are the key areas we have identified for growth.

One of the goals of the visioning process was the identification of a new name for our School to better reflect the breadth of our program areas. We expect the renamed School of Forest, Fisheries, and Geomatics Sciences to become official in late 2020.

**Our indomitable spirit is a pivotal factor in our strength as a model unit and is key to our success and continued growth.**





## OUR STORY



**1935** ● The Florida Legislature funded the creation of a Department of Forestry in the College of Agriculture. Dr. Harold Newins, a professional forestry educator, was hired as the Head of the Forestry Department.

**1937** ● After a couple of years of growth, the unit became its own school, the School of Forestry, with the authority to grant its own Bachelor of Science Degree in Forestry.



● The Institute of Food and Agricultural Sciences (IFAS) was established, overseeing the four major agricultural units: College of Agriculture, School of Forestry, Agricultural Experiment Station, and Cooperative Extension Service.

● The School name was changed to School of Forest Resources and Conservation (SFRC) to reflect broadened responsibilities and activities, including recreation, wildlife, and fisheries.



**1973** ● The Geomatics Program (formerly known as Surveying and Mapping) was established in the College of Engineering's Department of Civil Engineering.

**1964**

**1971**

● The School began the process to change its name to be more representative of its three program areas.

● The Fisheries and Aquatic Sciences Department joined and merged into the School.

● The Geomatics program, including four faculty members, joined and merged into the School.

**1984**

● The School was divided into three departments: Forestry, Fisheries and Aquaculture (later renamed the Fisheries and Aquatic Sciences Department), and Wildlife and Range Sciences (later renamed the Wildlife Ecology and Conservation Department).

**2018**

**2008**

**2004**







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**WHO  
WE  
ARE**



## PROGRAM AREAS

### FOREST RESOURCES & CONSERVATION

The Forest Resources and Conservation program began in 1937 to help Florida manage its legacy of southern pine forests and train future foresters. Today we continue this tradition by conducting research to increase efficiency and sustainability of productive private forests, to restore native forest ecosystems, and to better understand how to manage 17 million acres of forested public and private lands that provide essential ecosystem services across our state.

Forestry programs are by nature interdisciplinary, but at UF we have broadened our scope to address tropical forests, carbon sequestration, urban forests, recreation, forest hydrology, climate change, and biomass energy. These critical topics are addressed through research activities at every scale; from genes and molecules to landscape ecology and international policy. In addition to this terrestrial forest ecosystem activity, the Forest Resources and Conservation program includes a significant social science program using economics, policy, education, environmental justice, conflict management, and communication to inform wise decisions and engage residents in social change across Florida's thriving communities. We are proud of the many partnerships we cultivate with state and local agencies, private individuals, industry, and environmental organizations to help achieve our common goals.

Our global economy creates multiple avenues for pathogens and other organisms to travel. As we have seen with the decline in avocado production due to a fungus carried by an ambrosia beetle from southeast Asia, some organisms can thrive in a new environment and cause significant damage to native trees and crops. Our faculty are working to get ahead of the next outbreak by assessing the risk of other beetles, which are related to our recent invaders, but have not yet been able to colonize Florida. Sampling systems and lures create an early warning system to help protect vulnerable forests in ports with the intent to stop infestations before damage is done.

We have recently expanded our capacity to address residential and urban landscapes, which are the most widespread and growing ecosystem in Florida. It is essential to better understand these systems and better manage the ecosystem services they provide. Stormwater ponds, lawns, rooftop gardens, and urban forests represent localized environments that can provide carbon sequestration, wildlife habitat, aesthetics and rejuvenation, pollination, water filtration, and other benefits to people. Our faculty and students are cataloguing, assessing, and modeling the benefits of urban ecosystems and seeking strategies to improve their design to enhance these important environmental benefits.

### FISHERIES & AQUATIC SCIENCES

The Fisheries and Aquatic Sciences program conducts education, research, and Extension related to the full breadth of issues facing fisheries, aquaculture, and aquatic ecosystems in Florida, the nation, and the world. The program is uniquely comprehensive in its coverage of the fisheries and aquatic sciences, including the study of physical habitats, biological resources, ecosystems, aquaculture techniques, economics, and human dimensions.

The program is broadly divided into four themes, sustainable fisheries; marine and freshwater ecosystems; aquaculture; and aquatic animal health. Faculty focusing on sustainable fisheries research study the fundamentals of fish population dynamics; undertake biological studies in support of fisheries assessment for many economically important species in the Gulf of Mexico, the South Atlantic, and the inland waters of Florida; study the behaviors and attitudes of recreational and commercial fishers; and develop quantitative models of fish populations and fisheries systems to support management decision making. We also conduct research on fisheries governance systems globally, through the analysis of fishery performance indicators; and in the state, through initiatives that explore new ways of engaging stakeholders in decision making. Important marine and freshwater ecosystem research foci include understanding and predicting the invasion potential and effects of non-native fish species, including freshwater species important to the aquarium trade and marine invaders such as the lionfish; the effects of diseases on crustacean populations, including the Florida spiny lobster; the ecology of management of freshwater lakes in the face of multiple anthropogenic pressures; and the monitoring and management of climate change impacts on freshwater and coastal ecosystems. Aquaculture research foci include the development of breeding and husbandry techniques for new ornamental species, ploidy manipulations for shellfish broodstock development, and the development of conservation aquaculture approaches to conserving and restoring threatened species such as corals and reef-associated keystone grazers. Aquaculture research plays a key role not only in supporting the aquaculture industry, but in reducing conservation threats and restoring natural populations and ecosystems. Our aquatic animal health research faculty develop health indicators for a wide range of species of aquaculture, fisheries, and conservation concern, interacting closely with the marine and freshwater ecosystems and the aquaculture research areas.

Our research is global in scope yet focused on many issues critical to the state of Florida. Not only does this focus serve the needs of our state, it recognizes that Florida is 'microcosm' of many issues faced in tropical and subtropical fisheries and aquatic systems globally, thus positioning our program at the center of knowledge creation for such systems.

**Opposite.** Student supervises a prescribed fire at the Austin Cary Forest (ACF) in Gainesville, Florida. The ACF is an important part of our teaching and research activities.

Faculty and students conduct underwater research in marine geomatics and fisheries and aquatic sciences.



Dr. Amr Abd-Elrahman demonstrates the use of surveying equipment to students in a real-world setting.





## GEOMATICS

Geomatics refers to the integrated approach of measurement, analysis, and management of geospatial data to produce physical models of the Earth and its resources. Geomatics professionals are indispensable for land development, boundary determination, transportation, and natural resource mapping. The strong demand for these professionals in Florida and elsewhere makes our degrees emphasizing Geomatics a critical source of graduates.

Geomatics students learn legal systems of boundaries and property rights, measurement systems such as drones and LiDAR, resource mapping by remote sensing, and land development principles, leading to rewarding careers in the public and private sectors, often with very competitive salaries.

Our faculty in Geomatics lead research projects in precision elevation determination to monitor sea level rise, remote sensing methods for assessing agricultural crop health and the extent of invasive species, enhanced LiDAR measurements using drones, and GIS models of tourist behavior. They also address issues of land tenure in a global context such as: 1) What factors contribute to adaptive capacity of poor rural households and can they be enhanced to make these households more resilient? 2) Can we design more efficient, less costly, and more transparent methods for mapping property boundaries using unmanned aerial systems (UAS) or drones? 3) What is the relationship between tenure security and human wellbeing and how can we measure this in developing countries? 4) How can tenure security in community-based customary tenure systems be enhanced?

## OUR PEOPLE, OUR STRENGTH

Our people are the reason the School is successful. The dedication and commitment to innovation and service that our faculty, staff, students, and even stakeholders bring to their work makes us a powerful force in the generation and dissemination of knowledge in natural resources.

### FACULTY

Our faculty represent a wide variety of academic disciplines as well as career stages who collaborate with other scientists from around the world. They develop innovative programs, fund their research through significant grant awards, consistently earn research and teaching recognition, and maintain an impressive track record of publication, all while teaching and mentoring our numerous graduate and undergraduate

Faculty and staff collaborate and commingle professionally and even socially, owing to our collegial environment.



students.

Most of our faculty are located at UF's Gainesville campus, but several reside throughout the state at IFAS Research and Education Centers and in the communities we serve. The School consists of over 50 tenure-track and more than dozen non-tenure-track faculty; we partner with additional adjunct, courtesy, and affiliate faculty members across campus, industry, and agencies who more than double our core faculty.

### STAFF

We are supported by a dedicated team of over 70 administrative, academic, and programmatic staff who are critical to our success. Our core administrative and academic units operate within smaller, highly effective teams covering functional operations such as fiscal, human resources, graduate support, undergraduate support, online program support, grants, IT, facilities/operations, and more.

The low turnover among our staff is a testament to the collegiality of the School and provides us with the ability to develop and retain specialists who are uniquely capable of supporting the needs of our students, faculty, and administrative responsibilities.

### STUDENTS

Our undergraduate and graduate students hone their skills through hands-on, experiential learning to become better scientists, resource managers, community leaders, and policymakers. Whether designing a job-training program for veterans, teaching high school students photogrammetry skills, joining the Peace Corps, or cleaning up after Hurricane Michael, our students are using their own talents and energy to serve and make their mark on the world.

Students get involved within the School through student organizations, including graduate and undergraduate student associations and campus chapters for professional organizations, such as the Society of American Foresters. Our students may be geographically located on the Gainesville campus, at one of the IFAS Research and Education Centers throughout Florida, or even place-bound and enrolling in one of our several fully online degree or certificate programs.

We support our students in many ways, providing them with significant resources and high-touch assistance for academic advising, scholarships and awards, graduate assistantships and first-hand research experience, in addition to professional networking and career opportunities.





## STRUCTURE & PROCESS

Our faculty and staff take pride in our collegial working environment, with service and shared governance as core tenants of our culture. The School is lead by our Director who is supported by one faculty Associate Director from each of our three programs and three staff Assistant Directors who focus on School-wide administrative and academic functions.

Our School maintains a number of standing and ad hoc committees who recommend and vet decisions on all aspects of operations, from curriculum to promotion, the management of School-owned properties, and more. Our commitment to shared governance is codified in a charter maintained by our Faculty Advisory Committee.

## DIVERSITY AND INCLUSION

We are committed to supporting diversity among our students, faculty, and staff. Just as we value biological diversity in ecosystems, we value diversity of backgrounds, experiences, and perspectives in our community. The Diversity Committee, comprised of faculty, staff, and graduate students, meets monthly to promote and support a more diverse and welcoming faculty, student body, and overall workforce within the School.

## STAKEHOLDER ADVISORY COMMITTEES

Stakeholders employ our graduates and apply our research to manage natural resources, operate their businesses, develop public policy, and improve a host of other practices. We maintain connections with stakeholders through Extension programming, ongoing collaborations, and formal advisory groups, such as one School-wide Advisory Board and three Program Advisory Committees, one for each program area (fisheries and aquatic sciences; forest resources; and geomatics). Our Advisory Boards meet twice per year to provide invaluable advice and feedback to the Director and faculty about program development and improvement. The Advisory Board and Program Advisory Committees also effectively advocate for the School as needed.

Our faculty connect directly with stakeholders in many ways including: collaborative research projects and corporate research cooperatives; specialized research, Extension, and educational project advisory committees; and long-standing professional relationships.



I knew I wanted to go to law school, but I wanted a background in conservation and environmental policy. The unique Natural Resource Conservation major at UF gave me the opportunity to build my studies around what I was interested in so I could truly focus on my goals as an individual.

- Daisy Andrews, Senior

**Opposite.** The aquaculture program works on both desirable and undesirable species. Dr. Jeff Hill holds an Asian swamp eel, which has become a pest in ornamental aquaculture ponds in Florida.







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**WHAT**

**WE**

**DO**



## TEACHING: UNDERGRADUATE

Today we face the significant challenge of protecting the environment while enhancing our quality of life. There is a need for professionals who care about the environment, have a broad understanding of natural resources and how to manage them, are creative, and enjoy a challenge. In addition to the quality of our faculty instructors, one of the greatest strengths of our undergraduate education is the effort and commitment we make to ensure that our students receive real-world field experience from their first course in any of our majors through the last. Our goal is for students to apply the principles learned in the classroom to practical and relevant situations now and in the future.

At the undergraduate level, we offer four majors: Forest Resources & Conservation, Geomatics, Interdisciplinary Marine Sciences, and Natural Resource Conservation.

Students shape their learning experience with the assistance of a faculty advisor and two staff advisors. In recent years, our advising team has been honored twice with CALS Undergraduate Advisor of the Year awards and once with UF Faculty Advisor of the Year.

### FOREST RESOURCES & CONSERVATION MAJOR

The Forest Resources and Conservation major introduces students to a wide range of natural resource fields, including ecosystem management, modern technology applications for natural resource managers, wildlife management, and forest health. The curriculum for this major is broad, with required coursework in tree biology, forest ecology, communications, soil science, resource inventory, and resource economics and policy. Students spend significant time in the field gaining hands-on experience with ecological and management principles.

This major offers seven optional specializations: Business Management, Environmental Pre-Law, Forest Resource Management, Protected Areas Management, Recreation

Resources Management, Urban Forestry, and Watershed Science and Management. These specializations reflect the broad career opportunities available to our graduates, ranging from conservation and restoration work on government-owned lands to the practice of environmental law, and from working with the forest resources in and around cities and towns to privately-owned lands managed by consulting firms. Six of the seven specializations in the major are accredited by the Society of American Foresters. Our School offers the only accredited forestry programs in Florida.

Our graduates go on to become successful professionals who help create solutions in a number of environmental areas including; ecological restoration, sustainable wood supply, alternative energy, global climate change, environmental policy and law, and clean air and water. According to a 2014 survey of alumni, 89% find full-time employment in the field within six months. Over their entire career, 63% of alumni work for a government agency, 57% work for a private company, 25% work for an academic institution, and 6% work for a non-profit/non-governmental organization.

When asked, “How well did your degree prepare you for your career?” 83% of alumni responded “well prepared” or “excellently prepared.”

### GEOMATICS MAJOR

Geomatics students learn how the Earth is measured, how Earth-based data are analyzed and how these data are integrated into forms and systems that people can use. Geomatics has applications in all disciplines that depend on spatial data, including forestry, environmental studies, planning, engineering, navigation, geology, and geophysics. Data come from many sources, including Earth-orbiting satellites, air and sea-borne sensors and ground-based instruments, and is processed and manipulated

**Previous page.** Early morning photo of mist in the trees taken by a camera mounted atop a carbon flux monitoring tower at the Austin Cary Forest in Gainesville.

**Below.** Students enjoying our annual Spring Celebration proudly demonstrate their “gator chomp” for the camera on the deck of the Stern Learning Center overlooking Lake Mize at the Austin Cary Forest.





**Opposite.** A surveyor puts Geomatics to practical use, precisely centering a reflecting prism over a ground control point.



The Stern family took a lot of time to meet and talk with me about Mr. Roland and their family business. I know I have a lot to live up to and am grateful to have the opportunity.

- Chad Ward,  
Roland T. Stern  
Scholarship Recipient



with state-of-the-art information technology. Collection, analysis, interpretation, and application of spatial data and land information requires a broad and technical, as well as practical, education. Surveyors and mappers, who represent the practice of geomatics, provide these professional services to society.

To become these professionals, our students gain hands-on experience working with equipment in the field and in high-tech classrooms. They focus on surveying, remote sensing and photogrammetry, cartography, geographic information systems, property or cadastral studies, and global positioning.

The Geomatics Program within the School is the oldest program of its kind in the southeastern United States. The Bachelor of Science in Geomatics is accredited by the Applied and Natural Science Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), and students graduating with this major are eligible to sit for the Professional Surveyor and Mapper licensure exam. Students are also exposed to advanced topics and research leading to potential further study as master's and Ph.D. degree-seeking students with their faculty advisors.

Our Geomatics major is available at four locations throughout the state of Florida: on the main campus in Gainesville, at the Mid-Florida Research and Education Center in Apopka (MFREC), at the Fort Lauderdale Research and Education Center (FLREC), and at the Gulf Coast Research and Education Center (GCREC) in Plant City.

## MARINE SCIENCES MAJOR

Marine Sciences is an interdisciplinary program and a truly holistic discipline, requiring the integration of marine biology, ecology, conservation, and sustainable resource management. Our program takes a fittingly interdisciplinary approach to prepare students for a variety of rewarding academic and professional careers.

From oceans to coastal wetlands, students learn about marine organisms and their behaviors and interactions with the environment. Marine Sciences students study oceanography, statistics, fisheries and aquatic sciences, and aquatic invertebrate biodiversity.

Our students develop a customized program focused on their specific interests and career goals. Marine Sciences students are advised by a faculty member with expertise in their specific area of interest. A flexible curriculum and one-on-one advising distinguish this major from others like it. Graduates are prepared for continuing into graduate study or pursuing careers related to marine ecology and resources management.

## NATURAL RESOURCE CONSERVATION MAJOR

The Natural Resource Conservation major allows students to create a curriculum that suits their interests and career goals. Working with a faculty adviser, students can elect to focus their curriculum on any number of natural resource fields, varying from focused and specific to broad and multidisciplinary, depending on students' interests and career goals. Students have successfully pursued careers in environmental law, fisheries, education, policy, recreation, ecosystem restoration, international development, and scientific illustration, for example.

The core curriculum is built upon the following nine categories, within which all students in the major are required to complete courses: Professional Seminar, Ecology, Quantitative Analysis and Assessment, Natural History, Human Dimensions, Policy and Economics, Field Applications, and Spatial Analysis, and a capstone experience. These categories are designed to give students flexibility as they develop a broad understanding of natural resources, their management, and the policies that influence management activities.

This major is also offered at the West Florida Research and Education Center in Milton, Florida. Ideal for place-bound students, the course offerings at this location provide a broad ecology/environmental management curriculum.

## SCHOLARSHIPS

The School maintains over 20 active and ongoing undergraduate scholarship endowments through which we award over \$70,000 annually to dozens of students in our majors. Awardees are chosen based on a combination of academic performance, service, need, and the guidelines of individual endowments.







## TEACHING: GRADUATE

Graduate education is focused on cultivating highly-experienced Doctoral and well-qualified Master's graduates. Graduate students design their programs under the guidance of a dedicated faculty advisor and committee, focusing on areas of study ranging broadly from the molecular to landscape levels and spanning disciplines such as ecology, resource management, social sciences, quantitative biology, and geospatial sciences including cadastral principles, unmanned aerial vehicle applications, LIDAR, and more. Our graduate degree programs also include a variety of optional interdisciplinary concentrations.

### FISHERIES & AQUATIC SCIENCES

Our program in Fisheries and Aquatic Sciences leads to the Master of Science, Master of Fisheries and Aquatic Sciences (non-thesis), and Doctor of Philosophy degrees.

Graduate students work closely with the faculty to develop comprehensive programs of study and projects spanning the range of Florida's diverse aquatic systems. We emphasize field experiences, development of critical thinking skills, strong faculty-student interactions and other educational experiences to ensure that our students develop a set of core competencies that are consistent with their professional success and sustainable competitive advantage.

### FOREST RESOURCES & CONSERVATION

Our Forest Resources and Conservation program offers Master of Forest Resources and Conservation (professional, non-thesis), Master of Science (thesis and non-thesis), and Doctor of Philosophy degrees.

Students in this graduate program focus on areas of study such as: agroforestry, biometrics, biotechnology, ecology, economic sustainability, ecotourism, environmental education, fire science, forest economics, forest genetics, forest nutrition, geographic information systems, geomatics, hydrology, human dimensions, international forestry, management operations, pathology, physiology, policy, recreation and tourism, reforestation, remote sensing, resource management, silviculture, soils, tropical forestry, and urban forestry.

#### Geomatics Concentration

Master of Science and Doctor of Philosophy concentrations in Geomatics are offered to enhance a student's capabilities in this developing technical and professional arena. The MS student is expected to provide technical leadership to surveying and mapping organizations. PhD students conduct research to advance the Geomatics knowledge base.

**Opposite.** Students take a break during coursework at the Austin Cary Forest. The Forest is used by more than 30 different courses each year, from throughout the University.



## TEACHING: BEYOND



The Tropical Aquaculture Lab, located in Ruskin, Florida, has been instrumental in the captive-breeding of a variety of species previously only available through wild-capture.

### CERTIFICATE PROGRAMS

In addition to our undergraduate and graduate degree programs, we also offer nine Graduate Certificates and one undergraduate-level Certificate. These are official UF credentials and are available to both degree- and non-degree-seeking students, which include the general public, state and federal agency stakeholders/employees, students from other universities, and natural resource professionals nationwide. Our faculty expertise and course quality serve to increase both the reach of the School and the knowledge base of the public on natural resource issues.

### INNOVATION IN ONLINE LEARNING

Since 2011, we have offered an increasing variety of courses, most of our certificate programs, and several graduate programs in a fully-online delivery format. Working professionals are often unable to join traditional programs but require the knowledge and skills of an advanced degree. Our online programs provide this opportunity to a stable audience of hundreds of Master's and certificate students geographically ranging from Saskatchewan to Okinawa. These are students who otherwise may never have attended graduate school at the University of Florida.

Our online programs are often held up as an exemplar within the College of Agricultural and Life Sciences and across campus due to the quality and robustness of our course development and innovative technology implementation, the growth of our programs over time, and the positive feedback we receive from students. In contrast to traditional teaching programs, our online programs generate considerable revenue which is direct to the School and helps support the quality of both our online and traditional education programs.



...this program's students were given the same level of instruction and explanation as those in the classroom...

- Online Student



I just wanted to say thank-you so much for a wonderful experience with UF. I couldn't be happier that I completed the Fish Health & Aquaculture Graduate Certificate this past year.

- Online Certificate Student

**“This program did for me what I needed it to do and much more. The fact that the program is online adds huge benefits from those students who are older (like me), who do not live in Florida, but really want to attend what I believe to be the absolute premier Geomatics program in the country.”**

- Online Certificate Student

## DEGREES, CERTIFICATES, AND CONCENTRATIONS

### UNDERGRADUATE

- Bachelor of Science, Forest Resources and Conservation
- Bachelor of Science, Geomatics
- Bachelor of Science, Marine Sciences
- Bachelor of Science, Natural Resource Conservation
- Minor, Fisheries and Aquatic Sciences

### GRADUATE

- Master of Fisheries and Aquatic Sciences\*
- Master of Forest Resources and Conservation\*
- Master of Science, Fisheries and Aquatic Sciences (non-thesis option)\*
- Master of Science, Forest Resources and Conservation (non-thesis option)\*
- Doctor of Philosophy, Fisheries and Aquatic Sciences
- Doctor of Philosophy, Forest Resources and Conservation

### OPTIONAL CONCENTRATIONS

- Agroforestry
- Ecological Restoration
- Geomatics
- Hydrologic Sciences
- Natural Resource Policy & Administration
- Toxicology
- Tropical Conservation and Development
- Wetland Sciences

### CERTIFICATES

- Aquaculture and Fish Health
- Ecological Restoration
- Environmental Education and Communication
- Forest Health and Resilience
- Geomatics
- Geospatial Analysis
- Natural Resource Policy and Administration
- Quantitative Fisheries Science
- Unmanned Aerial Systems

\*fully online option available



## RESEARCH

Our research programs span the disciplines that inform aquaculture, fisheries, forestry, geomatics, and natural resource conservation.

Research in the School is problem-oriented and aimed at advancing knowledge and providing solutions. Thus, the size, sponsors, and focus of individual grants vary widely depending on the nature of the problem(s) addressed and the stakeholder(s) involved. Grants range in size from multi-million dollar, multi-university projects to local contracts providing partial support of specific research efforts.

Our faculty support their research and graduate students primarily through competitive research grants that provide competitive salaries, benefits, and tuition while students are seeking their degrees. Our faculty are highly productive when it comes to research and discovery and often author the highest impact publications within UF/IFAS. They consistently win awards, fellowships, and named professorships.

### SELECTED RECENT FUNDING AWARDS

| Funded Project   | Sponsor   | Award         |
|--|---|---------------|
| Integrating Research, Education and Extension for Enhancing Southern Pine Climate Change Mitigation and Adaptation | National Institute of Food & Agriculture        | \$ 20,000,000 |
| Phylogenomic Discovery and Engineering of Nitrogen Fixation into Poplar for a Bioenergy Crop                       | US Department of Energy                         | \$ 7,309,576  |
| Estimating the Absolute Abundance of Red Snapper in the U.S. Gulf of Mexico  | National Oceanic and Atmospheric Administration | \$ 2,346,717  |
| Regional Geospatial Monitoring   | National Oceanic and Atmospheric Administration | \$ 1,992,077  |
| Genome and Transcriptome Based Prediction and Regulator Inference of Molecular and Whole-Plant Phenotypes          | National Science Foundation                     | \$ 1,956,424  |

**Opposite.** Dr. Jiri Hulcr's Forest Entomology laboratory is known as the world's largest cryo-collection of bark and ambrosia beetles. In 2013, he established a citizen scientist Extension and research program to allow the public--from anywhere in the world--to trap and mail vials of tiny bark beetles to his lab for identification. This has led to the discovery of at least one new species thanks to the lab's advanced genome sequencing capabilities.

Hulcr's research and Extension work involves scientists and collaborators throughout the world who share a common goal of preventing, protecting, and managing forests and crops against pest invasions that pose economically and ecologically important threats to our quality of life.





## SELECTED RESEARCH FINDINGS & FOCI

Examples of significant discoveries and projects that have emerged from our faculty research efforts are listed below by program area.

### FISHERIES & AQUATIC SCIENCES

A global synthesis of fishery performance indicators shows that ecological, economic social performance of fisheries are not in conflict but rather, act synergistically.

New generalizations about size-and density-dependent processes in fish populations improve fisheries stock assessment models.

New concepts and approaches to understanding relationships between spawning and recruitment in fish stocks, e.g., “reproductive resilience.”

New methods to improve estimates of age, growth and mortality components for economically important Gulf of Mexico fish stocks.

Understanding spread, impacts and management options for the invasive lionfish.

New tools for designing fish hatchery programs to address socio-economic and conservation objectives.

Unraveling the impacts of disease on spiny lobster biology and fisheries.

First at succesful breeding and rearing of blue tang (“Dory” fish) in captivity.

Interplay of ecology and evolution in freshwater crayfish invasions.

Development of tetraploid oyster brood stock for Florida’s shellfish hatcheries.

A new screening tool to assess potential invasiveness of freshwater fish species.

Culture methods and health screening protocols to help restore the sea urchin *Diadema antillarum*, a key grazer on Florida’s coral reefs, through restoration aquaculture.

### FOREST RESOURCES & CONSERVATION

Testing the role of forest fertilization in drought conditions that mimic future climatic changes.

Demonstrating the value of high quality ecotourism programs that increase wildlife populations.

Assessing the complex role of groundwater in enhancing ecosystem services in urban regions.

Exploring strategies to increase Brazil nut production to enhance productivity in the Amazon.

Selecting reliable and valid tools to assess connection to nature.

Modeling changes in tick populations.

Documenting the change in rainfall patterns in the South and projecting the increased risk of wildfire.

Assessing the benefit of various policies to protect southern forests from new forest pests.

Identifying effective climate change education strategies.

### GEOMATICS

A new ground targeting method substantially improves accuracy assessment strategies for drone lidar.

Object-based image analysis can be used to automatically delineate and identify intertidal habitats such as oyster reefs, salt marshes, and mudflats in UAS imagery.

A new model using sky oriented photography can effectively predict GPS signal attenuation in forests.

Airborne and drone lidar uncertainty can be effectively predicted using sensor modeling.

Social media data can be used to analyze the effect of hurricanes on local mobility patterns.

Crowd-sourced data from GPS Sport tracker apps can determine factors associated with the level of physical activities in Florida State Parks.

Temporal analysis of iNaturalist termite records shows that the role of Citizen Science data as a source for species distribution models is expected to grow significantly in the near future.

AI-deep learning networks can improve the accuracy of wetland classification, including identifying areas of cogan grass.

Newly discovered above-ground architecture of Raleigh Island.



## EXTENSION



Each summer the Austin Cary Forest hosts “Camp Kids-In-The-Woods” – a partnership between the School and the USDA Forest Service which gets middle-school-aged students out in the field.

Our Extension programs contribute to the mission of UF/IFAS Extension by ensuring that the generation of knowledge is extended and accessible to the public to enhance and improve human life. Our programs reflect the diversity of our faculty expertise and the broad needs of industry, state and federal agencies, NGOs, private citizens, and the general public.

Our Extension programs are diverse and creatively meet needs around the state. We regularly host workshops for family forest landowners and aquaculture managers to better understand management strategies that can enhance productivity and revenue. Annually we provide opportunities for local youth to fish at the Millhopper facility and for teams from across the state to test their knowledge of Florida forests at the Austin Cary Forest. We manage statewide networks for assessing water quality (LakeWatch) and training teachers (Project Learning Tree). We also build capacity of professional natural resource staff to work toward managing resource conflicts (Natural Resource Leadership Institute) and of community leaders to address local issues (Community Voices, Informed Choices). We regularly work with county and regional agents to deliver programs, and also key contacts in our industries and state agencies to provide information and influence behavior. Our programs are organized into six broad categories:

### AQUACULTURE & AQUATIC ANIMAL HEALTH

Assisting the industries associated with shellfish, finfish, and other aquatic organisms

### COMMUNITY CAPACITY

Fostering public engagement to improve governance through programs such as NRLI and CIVIC

### COUPLED HUMAN & NATURAL SYSTEMS

Providing information and strategies to enhance resource management and improve built environments

### FISHERIES & AQUATIC STEWARDSHIP

Assisting private landowners and public agencies with coastal planning, non-native and invasive species, marine and freshwater fisheries, habitat improvement, water quality, and restoration

### FOREST HEALTH & STEWARDSHIP

Assisting private landowners and public agencies with tree diseases and insects, harvesting, marketing, alternative products, restoration, and invasive species in a variety of forest types

### YOUTH EDUCATION

Providing instructional materials and youth programs to enhance knowledge and problem-solving skills through Project Learning Tree, Project WET, Aquaculture, Climate Change, 4-H programs and contests, Fishing for Success, Kids in the Woods, Backyard Beetles, etc.

Key partnerships that are instrumental in program development and delivery include: Florida Cooperative Extension Service county agents and Research and Education Center specialists; Florida Department of Agriculture and Consumer Services, Divisions of Aquaculture and Animal Industry, Florida Forest Service; Florida Fish & Wildlife Conservation Commission; NOAA; Florida Sea Grant and the National Sea Grant College Program; Florida Tropical Fish Farms Association; Florida Aquaculture Association; Florida Forestry Association; Florida Surveying and Mapping Society; National Aquaculture Association; U.S. Department of Agriculture Animal and Plant Health Inspection Service; the U.S. Forest Service Southern Research Station’s Interface-South office; county governments; and public aquaria, marine parks, zoos, industry groups, and non-profit organizations.

Although a majority of extension faculty and staff are based in Gainesville, specialists and staff are also located at the Tropical Aquaculture Laboratory in Ruskin, in Cedar Key, and at a number of Research and Education Centers throughout Florida. Graduate students also play a major role in developing and delivering Extension materials and Extension programs, using their own research to complement these activities.

Through its large network of collaborators, partners and audiences, our overall Extension program is well positioned for continuing the legacy of strong science delivery and application.



Courses utilize Lake Alice, located in the center of main campus, for several courses. Here, students pose with a largemouth bass collected (and then released) during sampling exercises.



The 4H Forest Ecology contest brings together chapters from across Florida to compete in the identification of plants, wildlife, pests and disease issues, and related. Workshops to help students and their advisors with the finer points of the contest material involve a variety of collaborators, including the Florida Forest Service.

Below. Fishing boats lined up on a Caribbean shore, where Fisheries and Aquatic Sciences faculty and graduate students work with local communities.







4

**REACHING  
FURTHER**



## AUSTIN CARY FOREST

The Austin Cary Forest is a natural laboratory serving the University's missions in education, Extension, and research. Beginning in 1936, the originally-named School of Forestry needed a forest to put into practice the theories and principles of its academic subjects such as protection, silviculture, mensuration, management, economics, and others, thus the Austin Cary Forest was created. The 2,600-acre property is used by a wide variety of individuals and groups, and accommodates research, teaching, and outreach projects from throughout the University and beyond.

The Forest is managed to meet three objectives: 1) support the teaching, research, and outreach needs of the School; 2) maintain and improve the overall health of the Forest, and; 3) generate revenue to support operations. The Forest is unique among public lands in Florida in that it is managed to include the greatest diversity of conditions possible. Portions of the Forest are intensively managed to maximize economic benefits through fertilization and high-density planting, mimicking the private timber industry. Other portions of the Forest are managed to create and maintain pre-Columbian conditions of frequent fire, low densities of overstory, and native species composition, as with many other public lands. Within these two extremes, specific areas are managed to demonstrate a variety of variable conditions.

Operations at the Forest are self-funded through revenue sources such as competitive timber sales and rental fees for conference facilities. In addition to permanent staff, the Forest provides valuable work and field experience for several part-time student employees.

Ongoing fundraising efforts seek to expand our education exhibits, which currently include a re-construction of an original turpentine still, nature walks, and interpretive signs. In the near term, we plan to create an exhibit with an existing 1940s-era sawmill within the Forest to tell the story of the sustainability of Florida's forests and how advances in technology have impacted both forests and the lives of all our citizens.

## ROLAND T. STERN LEARNING CENTER

Within the Austin Cary Forest we operate a suite of conference/classroom facilities collectively designated as the Forest Campus. The centerpiece of these is the Roland T. Stern Learning Center, our beautiful 7,800 sqft conference, teaching, and rental facility, built on standards of sustainability. We strive to create a modern atmosphere conducive to learning, growth, and collaboration and at the same time to provide visitors with a serene experience in the forest, emphasizing the importance of natural resources to our lives. The Learning Center was funded almost entirely through donations from our alumni and supporters, with great support from IFAS administration and our own Development Committee. In 2017, the Roland T. Stern family generously contributed and the Learning Center was named for him.

**Opposite.** The Roland T. Stern Learning Center sits on the north shore of Lake Mize. The Lake is actually a plugged sinkhole, and is the deepest lake in Florida.





## MILLHOPPER FISHERIES CAMPUS

The main offices and laboratories for the Fisheries and Aquatic Sciences program are located about nine miles from the main campus in northwest Gainesville, a few miles east of the San Felasco Hammock Preserve State Park. Many courses in the Fisheries and Aquatic Sciences program are taught here and on the main campus.

More than 30 ponds and a fish hatchery are also in operation at this facility. These are used for research, teaching, and conducting demonstrations and workshops for the public, particularly youth education activities.

Extensive microscope facilities are available within our laboratories, as well as access to a broad range of technical software and platforms including GIS capabilities. We maintain active laboratories in: aquatic plants, aquatic invertebrates, algal and microbiological culture, cell biology, fish health, fisheries ecology, genetics, paleolimnology, reproductive physiology, and water chemistry analysis.

## TROPICAL AQUACULTURE LABORATORY

Our Tropical Aquaculture Laboratory (TAL) in Ruskin, Florida strives to enhance the understanding of tropical, ornamental aquaculture through research and education. The Laboratory performs applied research, fish disease diagnostic services, and Extension education programs and promotes professionalism in Florida's tropical aquaculture industry.

The TAL consists of a 5,000 square foot office and disease lab where over 20 faculty, staff, and students work, as well as a six and a half acre fish farm with 48 ponds, five greenhouses, a fish quarantine space, and a building that houses tanks and lab space for a wide range of projects. Aerated well water, seawater, and reverse osmosis water is plumbed throughout the facility to allow for research in fresh, brackish, or seawater with an unlimited variation available to serve each project's needs.

As part of the Land Grant mission, the programs at TAL have always focused on research and Extension to solve problems or create opportunities and have provided millions of dollars each year in savings or new profits to farms. Working closely with industry and other partners, the faculty, staff, and facilities development have all been strategically planned and implemented. USDA continues to maintain their Wildlife Services regional programs office at TAL. Additionally, USDA has added veterinarians from USDA APHIS Veterinary Services, including the Aquaculture Program Leader and the Aquaculture Import/Export Coordinator.

Industry-driven applied research, Extension outreach programs, and teaching of future

aquaculture leaders are key avenues to achieve our mission of supporting the tropical ornamental aquaculture industry in Florida.

## RESEARCH & EDUCATION CENTERS

We are proud to maintain a presence at several of the UF Research and Education Centers throughout Florida. Our faculty, staff, and students work with local communities in Extension and research as well as providing on-location and remote teaching programs for several of our degrees and certificates.

- Fort Lauderdale REC** (Fort Lauderdale)
- Indian River REC** (Fort Pierce)
- Mid-Florida REC** (Apopka)
- North Florida REC** (Quincy)
- West Florida REC** (Milton)
- Gulf Coast REC** (Plant City)

## CENTER FOR CONSERVATION

The Center for Conservation at Apollo Beach is a partnership between the Florida Aquarium (FLAQ) and the Florida Fish and Wildlife Conservation Commission who operate research and rehabilitation aquaria and a fish hatchery at the site. We collaborate closely on these initiatives, with the Center of Conservation housing faculty and graduate students specializing in restoration aquaculture at the facility. This partnership greatly enhances our ability to conduct experimental restoration aquaculture and enhances the access of our collaborators to cutting-edge science.

## FISH & WILDLIFE RESEARCH INSTITUTE

We collaborate closely with the Fish and Wildlife Research Institute (FWRI), the Florida Fish and Wildlife Conservation Commission's research arm. The FWRI Freshwater Fisheries Research Section is co-located with the program at our Millhopper campus, and faculty and graduate students are also embedded in the FWRI Marine Fisheries Research Section in St. Petersburg. Co-location and close collaboration with FWRI brings multiple advantages- it enhances access to research expertise, training, and advanced degrees for FWRI staff and allows our faculty and students access to extensive, statewide monitoring data sets and research facilities.



During Family Fishing Days, adults and children get the opportunity to catch fish, and learn about fishing and fish ecology at the Millhopper Fisheries campus. These events, which are free and include the use of all necessary gear and bait, routinely attract over 200 participants.



The Millhopper Fisheries campus includes ponds, hatcheries, and even managed forest acreage.



The Tropical Aquaculture Lab is located south of Tampa, in the heart of the ornamental aquaculture region of the state. In addition to the fish ponds visible here, the facilities include enclosed tanks used to study the production of a variety of freshwater and marine species.

**Opposite.** A black bear meanders through the Austin Cary Forest.



## 2020 PROSPECTUS

We are proud to have assembled a world-class group of faculty and staff who work hard every day to help solve real problems for real people. Increasingly, we are recognized as leaders in understanding and unravelling the complex relationships that develop when progress meets tradition, where rural meets urban, and when science must provide solutions to some of our most pressing natural resource challenges. None of this would be possible without the many partners, supporters, and friends that comprise our larger family.

We look forward to continuing to work with and for all of Florida, the region, and our many domestic and international neighbors who look to our School to lead by example.

### SCHOOL OF FOREST RESOURCES & CONSERVATION

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