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INTRODUCTION

The UF/IFAS Research Mission

The research mission of UF/IFAS – conducted under the auspices of the Florida Agricultural Experiment Station – is to discover new scientific knowledge, encourage innovative study, and create applications based on sound science that address challenges facing agriculture, natural resources, and interrelated human systems in Florida, our country, and the world.

Across academic departments and the Research and Education Centers (RECs), UF/IFAS faculty assess the needs and challenges of Florida’s agricultural and natural resource stakeholders. This assessment process and the research and discovery that follow provide solutions to problems in agricultural production, natural resources, and human systems.

The Purpose of this Research Roadmap

In partnership with stakeholders, colleagues across the university, and collaborators around the globe, UF/IFAS faculty will continue to play a critical role in creating new knowledge and advancing understanding of the most important questions facing Florida and the world. To achieve this, each academic department and Research and Education Center within UF/IFAS has developed a clear vision of research opportunities, core programs of the future, and critical hires needed to achieve its goals. Their research visions are compiled in this document.
AGRICULTURAL AND BIOLOGICAL ENGINEERING

Research Opportunities
The Department of Agricultural and Biological Engineering will strive to compete more aggressively and effectively in hydrologic, environmental, and biosystems modeling; climate change and variability effects on biological systems and natural resources; nano-scale science; nanobiotechnology; biofuels; sustainable bioproducts; packaging and postharvest engineering; biosystems logistics; biosystems safety; and decision-support systems in agricultural and managed ecosystems.

Core Programs of the Future
- Biocomplexity engineering focusing on complex coupled natural and human systems
- Bioproduct engineering and biofuel production focusing on innovative, sustainable solutions
- Postharvest engineering focusing on system optimization
- Packaging engineering systems
- Sustainable water use engineering, agricultural production, and agro-process engineering
- Smart technologies and biosystems engineering including technologies for a “Smart Farm of the Future”
- Nanobiotechnology and nano-scale science

Critical Hires
- Biosystems logistics engineer
- Biosystems safety engineer
- Food systems engineer
- Packaging engineer
- Postharvest engineer
- Smart technologies engineer
AGRICULTURAL EDUCATION AND COMMUNICATION

Research Opportunities
Faculty members in the Department of Agricultural Education and Communication are using national research agendas vetted through associated professional societies, combined with the significant challenges faced by their stakeholders in Florida, to frame their research programs and enhance research collaboration. These collaborations will impact the food, agriculture, natural resources, and human sciences (FANH) sectors. Areas of focus include public and policy maker understanding of FANH; adoption of innovations; teaching and learning in formal and non-formal contexts; exemplary educational programs; leadership for complex change and empowerment in domestic and international FANH contexts; and enhancing the effectiveness of educators, communicators, and leaders in agriculture.

Core Programs of the Future
- Supporting informed and science-based opinions and decisions on public issues affecting FANH
- Adoption of innovations in global contexts
- Leading and managing complex change
- Exemplary teaching and educational programs in FANH
- Enhancing human capacity in domestic and international contexts related to FANH

Critical Hires
- Extension and non-formal education in domestic and international settings
- Teaching and learning in online environments
- Leading and managing complex change
- Workforce education
- Design and systems thinking
AGRONOMY

Research Opportunities
The Agronomy Department will continue its focus on sustainable production and use of food, feed, fiber, energy, and recreational crops, as well as the design and evaluation of agroecosystems that have improved resilience. The research disciplines emphasized in the department will be plant breeding and molecular biology; physiology and ecology; carbon sequestration and ecosystem services; and weed ecology and management. New programs in applied phycology and agroecology of sub-tropical crops have increased the diversity of departmental programs, reflective of the agroecological diversity in the state of Florida. The formation of a new Center for Stress Resilient Agriculture (CSRA) presents opportunities for multi- and trans-disciplinary research on biotic and abiotic stresses and their effects on agroecosystems. The CSRA will allow scientific integration across all agricultural scales and system components, from crop production to impacts on human health. Through these approaches, enhanced interdepartmental and interinstitutional connections and collaborations will expand within the department.

Core Programs of the Future
• Agroecology of sustainable food and feed production systems
• Genetics/genomics
• Bioenergy
• Invasive plant ecology and management
• International programs

Critical Hires
• Aquatic/invasive plants
• Global agroecology of sustainable food production systems
• Climate change agroecology
• International agronomy
• Precision agriculture cropping systems
ANIMAL SCIENCES

**Research Opportunities**
The focus of the Department of Animal Sciences will continue to be on the primary forage-consuming species (beef cattle, dairy cattle, and horses) and their products (meat, milk, recreation, and sport). Our research direction will be enhanced by our capacity to use tools of functional genomics and proteomics, combined with unique models of animal performance as they relate to tropical and subtropical environments. Additionally, the department is becoming a center for development of livestock models for the investigation of human and animal health and performance.

**Core Programs of the Future**
- Genomics and proteomics
- Models of animal performance, particularly in tropical and subtropical environments
- Livestock systems analysis
- Livestock models such as emphasizing risks and benefits to health

**Critical Hires**
- Livestock systems management
- Meat science
- Reproductive physiology
- Forage genetics
ENTOMOLOGY AND NEMATOLOGY

Research Opportunities
Research in the Entomology and Nematology Department focuses on fundamental insect and nematode biology providing a foundation for sustainable approaches to mitigating losses in agricultural and urban settings that minimize negative impacts to the environment and human health. The ever-increasing movement of goods and people to our state makes Florida an important point of entry for invasive insect and nematode pests that cause significant losses to crops and livestock and are vectors for pathogens of plants, livestock, and humans. Urban pests affect our quality of life and cause significant loss to property. Arthropods and nematodes also provide important ecosystem services through pollination of fruits and vegetables, decomposition, and as natural enemies of other pest species. Studies of their biodiversity offer important insight into the impact of human activities on fragile ecosystems unique to our state. Our plan is to better understand, optimize, and manage the positive and negative impacts of these critical organisms in managed and natural ecosystems.

Core Programs of the Future
- Understanding pathways of entry, mechanisms of survival and dispersal of invading pests, and the community and ecosystem-level effects of invasive species
- Integrated pest management (IPM) including biological, chemical and cultural control of agricultural, veterinary, and urban pests and vectors of plant and animal diseases
- Development of alternative insecticides and nematicides specific to pest species and that minimize impact on non-target organisms
- Molecular interactions of insects and nematodes with host species, symbionts, and pathogens
- Conservation and biodiversity of pollinators and other non-pest species by integrating research efforts in conservation ecology, community, and ecosystem ecology, systematics, and molecular biology
- Fundamental studies of insect and nematode behavior and ecology

Critical Hires
- Biosecurity/Invasion Ecology
- Augmentative biocontrol (e.g., entomopathogenic nematodes)
- Molecular interactions of plant diseases and arthropod vectors
- Ecotoxicology and risk communication
ENVIRONMENTAL HORTICULTURE

Research Opportunities
Core programs of the Environmental Horticulture Department continue to focus on (1) how abiotic factors impact physiology, adaptation, survivability, human/sensory connections, and (2) environmental and economic sustainability of ornamental, edible, medicinal, and bioenergy crops produced across Florida, within the southeast region, and around the world. Faculty within the department are specializing in controlled environment and landscape production practices; biology and management of weeds and invasive species in crop production and landscapes; landscape best management practices; ecosystem conservation and restoration; invasive plant management; landscape sustainability in design and installation of sustainable Florida landscapes; biotechnology; and conventional breeding leading to the production of new landscape varieties. Research opportunities continue to emerge in these areas for faculty within the department. Exciting future focus areas for the department include plant improvement and management of new ornamental, turf, biofuel, native, and especially non-traditional edible species (i.e. hops, herbs, etc.).

Core Programs of the Future
- Sustainable landscape/turfgrass systems with improved ecosystem services and reduced water, pesticide, and nutrient input requirements, nursery/greenhouse production, and best design and management practices
- Applications of horticultural practices to ecosystem conservation/restoration
- Breeding/biotechnology of improved landscape varieties that use fewer natural resources
- Breeding/biotechnology of non-traditional edible crops with improved flavor, aroma, and/or nutritional values
- Invasive plant management/weed control practices
- Cultural management in controlled environments assessing impacts of light, temperature, water, and nutrient management on plant productivity
- Production practices impacting non-traditional edible crops
- Assessment of plants, landscapes, and gardening activities in horticultural therapy techniques

Critical Hires
- Ecophysiology (water/nutrient cycling in the landscape, climate impacts on plant stress tolerance and productivity)
- Global supply chain analysis (international movement of plants, postharvest, and marketing for Florida as a global gateway)
- Arboriculture and urban tree management
- Plant physiology/biochemistry/biophysics
- Tropical landscape management
- Horticultural therapy
FAMILY, YOUTH, AND COMMUNITY SCIENCES

Research Opportunities
The research mission of the Family, Youth and Community Sciences Department is to “create positive change in a changing world.” This is accomplished through rigorous, interdisciplinary research that seeks to enhance and sustain the quality of human life. Informed by ecological systems theories, faculty study individuals, social relationships, organizational systems, and community/societal influences. The specific focus is on identifying modifiable risk, protective, and promotive factors that inform the development, implementation, dissemination, and sustainability of interventions targeting youth, families, and their communities. Identifying vulnerable subgroups of the population and reducing disparities in outcomes is a particular emphasis. Overall, research in the department seeks to promote resilience; reduce negative behavioral, emotional, and health outcomes; and enhance individual, family, and community health and well-being.

Core Programs of the Future
- Prevention science and methodology
- Human development and family science
- Non-profit organizational leadership and community resilience

Critical Hires
- Prevention science - health, wellness, and risk prevention
- Prevention science - adolescence and emerging adulthood
- Rural mental health - health-risk behaviors among youth and adults
- Human development - early and middle childhood; adult development and aging
- Community resilience
FOOD AND RESOURCE ECONOMICS

Research Opportunities
The Food and Resource Economics Department addresses current and emerging agricultural, food and natural resource economics issues and policies affecting the livelihoods and well-being of Florida’s citizens and beyond. Faculty use the science of decision-making that entails balancing market and non-market costs and benefits across a wide range of stakeholders. Key research opportunities include:

• Examining how current food production and marketing systems can be transformed to address the challenges of resource scarcity, food security, climate change, and the health outcomes resulting from food choices.
• Investigating the policy implications associated with sustainable interactions and valuation within human and ecological systems, land use changes, and water systems. These involve interdisciplinary collaborations with other disciplines within IFAS.
• Examining the opportunities to promote sustainable growth in the agricultural-food-environment system and the communities which support them.

Core Programs of the Future
• Economics of the agricultural and food system to include marketing, trade, labor, consumer behavior, production decision making
• Economics of food security to include investigating the reliable access to a sufficiently affordable and nutritious food supply
• Economic modeling to ensure sustained provision of ecological services and economic benefits to natural resource stakeholders
• Economics of land use and water management
• Economics of resource, labor and trade issues in developing economies

Critical Hires
• Economics of climate change
• Economics of land use and water
• Economic resilience of rural areas
• Economics of international trade
Food Science and Human Nutrition Department is well positioned to conduct interdisciplinary, multi-investigator research that focuses on strengths in food and nutritional sciences. Our research capabilities encompass fundamental biomedical questions at the molecular level, as well as the applications of that knowledge for the benefit of populations and communities.

Core Programs of the Future
- Food safety and microbiology
- Functional foods and bioactive ingredients
- Micronutrient research
- Healthy digestion and immunity

Critical Hires
- Macronutrient expertise
- Food microbiology/virology
- Medical nutrition
- Support in modeling, statistics and bioinformatics
- Sensory Science
- Obesity: mechanisms and solutions
- Seafood quality and safety
- Processing and fermentation
HORTICULTURAL SCIENCES

Research Opportunities
High value horticultural crops (fruits and vegetables) are a cornerstone of Florida’s economy as well as a healthy diet. Challenges from a changing climate, labor shortage, emergence of new pests and pathogens, urbanization, and many other factors threaten sustainable crop production. Research in the Horticultural Sciences Department drives development of practical solutions for Florida’s specialty crop producers through integration of basic and applied research. Genetic improvement methods introduce new varieties that resist disease, offer high yields for farmers, and provide better quality for consumers. Basic research in the laboratory defines new boundaries of understanding in biochemistry, molecular biology, genomics, and physiology. Study of organic and conventional crop production examines ways to balance crop potential against environmental sustainability. Focus in post-harvest biology ensures the products reach a plate with the highest quality and safety. Research efforts underlie classroom content, and students are prepared for careers in high-demand specialty crop industries. Scientific findings dovetail with extension efforts, delivering relevant, up-to-date research to directly affect field practices.

Core Programs of the Future
• Increase the understanding of fundamental plant biology and develop innovative methods for plant genetic improvement and novel approaches towards horticultural crop sustainability and production
• Accelerate traditional breeding of high-value horticultural crops by integrating quantitative genetics and genomics-based approaches
• Improve production and harvest efficiencies with emphasis on environmental and economic sustainability, and development of strong markets for specialty crops at local and state levels
• Augment value-added qualities in specialty crops, especially nutritional value, flavor and postharvest quality

Critical Hires
• Translational synthetic biology
• Florida native crop domestication
• Computational biology
• New fruit/vegetable breeding for Florida
MICROBIOLOGY AND CELL SCIENCE

Research Opportunities
The future of biological research is likely to be driven by tightly-integrated, collaborative endeavors capable of addressing critical problems across multiple scales and from multiple points of view. Understanding how biological systems function under various environmental conditions is essential to harnessing the potential of living organisms to benefit humanity in agriculture and medicine. ‘Big Data’ biology is poised to ultimately build this understanding but will require integrating existing genomics and metagenomics data with emerging data from transcriptomes, proteomes, metabolomes, subcellular, cellular and multicellular structures, phenotypic measurements and data incorporating community, ecosystem and environmental information.

The anticipated future of Big Data biology provides two immediate opportunities for the Department of Microbiology and Cell Science to position itself firmly at the cutting edge. The first opportunity is integrating complex data across biological, spatial and temporal scales that will be required to learn about how living systems function. The second opportunity is translating ‘systems-level’ information into knowledge that can produce technologies and approaches that benefit humanity. This will require rigorous, hypothesis-driven research.

Faculty have established and emerging expertise in molecular and cellular biology, community and ecosystem organization and interactions, and omics-level data analysis. Facilitating and supporting the formation of integrative, project-driven collaborations - including other researchers at UF and new hires to fill critical gaps in expertise - will help position this department at the forefront of Big Data microbiology and cell science while maintaining the flexibility to adapt to new research challenges as they arise.

Core Programs of the Future
We have identified two core program areas that will form the foundation for the integrated, Big Data driven studies of the future.

- **Molecules-to-Cells**: Understanding how genome function impacts cellular function and interactions with neighbors remains a critical barrier to advancements in biotechnology and biomedicine. Research in this area is expected to bridge the gap between two primary layers of biological complexity.
- **Ecosystems on a Changing Planet**: Changes at the planetary scale are poised to radically alter biological systems in the near future, affecting the communities responsible for global chemical cycling and pathogen outbreaks. Research in this area is expected to help better predict and mitigate harmful environmental impacts.

Technology/analysis development will play a key role in supporting research in these core program areas, as will creative development of statistical analysis paradigms, tools, and approaches from synthetic biology. This department is heavily invested in training the next generation of microbiologists and cell scientists and continues to expand research on education and curriculum development, including investigating how technology and course modality impact student learning and retention in STEM. Our education research will incorporate large-scale learning analytics, mirroring the Big Data direction of the department’s research roadmap and thus providing powerful opportunities for research and education synergy.

Critical Hires
- Non-model or emerging model systems
- High-throughput metabolic analysis
- Single-molecule and/or single-cell analyses
- Microbial communities and ecosystems
PLANT PATHOLOGY

Research Opportunities
Plant diseases, new and old, are threatening economically important and signature crops of Florida. New faculty expertise and research advances will place the Department of Plant Pathology in a position to enhance the sustainability and diversity of Florida agriculture, and provide leadership in national and international plant disease management arenas. Developments in our understanding of plant pathogens, including genome content, evolving virulence mechanisms, and global pathogen movement, will allow us to predict and avert disease epidemics. In the face of a decline in citrus production, Florida agriculture would be well served by increasing crop diversity. Disease and environmental factors currently limit sustainable production of many crops in Florida. Fortunately, research advances can support the introduction of new crops, previously considered unsuitable for the Florida environment. Plant genome-based technologies, and knowledge about plant regulatory and metabolic responses to microbes and stress, will facilitate the development of disease and stress resistant crops. We are just beginning to learn that plant health and productivity is affected by complex multi-species microbial interactions with plants. Research on the entire biological system, the phytobiome, promises breakthroughs in sustainable crop production. Given the domestic and international importance of post-harvest losses and food safety issues, post-harvest disease and enteric pathogen management is a ripe area for investment. Only a few universities have made investments in research to reduce the risk of large economic losses due to post-harvest diseases and pathogen contamination. UF could and should be a leader in this research area.

Core Programs of the Future
• Emerging pathogens: Detection, epidemiology, ecology and management.
• Endemic pathogens: Adaptation of disease management strategies to changes in climate and to new crop production systems.
• Plant-associated microbial interactions: Effects on plant fitness, pathogen antagonism, interspecies/kingdom signaling, and microbial systematics.
• Interactions of pathogens with their hosts and/or vectors: Evolution of di- and tripartite interactions, signaling between/among partners, interaction disruption.
• Plant disease and environmental stress resistance: Commonalities in signaling pathways, multi-pathogen resistance, functional genomics and phenotype assessment.
• Pathogen population biology: Evolution, phylo-geography, population fitness, and population dynamics.
• Postharvest pathology: Molecular mechanisms of disease resistance, effects of plant development and physiology on disease resistance, disease management, and food safety.

Critical Hires
• Postharvest pathology and food safety
• Evolution of viral pathogens
• Plant, pathogen and microbiome associations
• Plant disease and stress resistance
• Ecology and epidemiology of emerging pathogens
Research Opportunities
Research programs in the School of Forest Resources and Conservation focus on forest, fisheries, aquatic, and geospatial sciences, with the goal of attaining efficient production, sustainable management, and informed conservation of natural resources. Our plan is to further enhance interdisciplinary research – spanning the terrestrial and freshwater to coastal ocean continuum and comprising the biological as well as social systems – to better understand, optimize, predict and communicate the whole-system effects of natural and human activities.

Core Programs of the Future
- Sustainability, including resource production, management and conservation in a changing world
- Human dimensions, including conflict management, community engagement, and social systems
- Integrative systems research scaling from the molecular to the landscape level to understand processes, synthesize across disciplines and make better predictions of future conditions

Critical Hires
- Limnology and freshwater fisheries
- Geodesy and GPS
- Urban ecosystem management
- Forest business and economic outreach
- Wetland and coastal forest ecosystems
SOIL AND WATER SCIENCES

Research Opportunities
The Soil and Water Sciences Department’s direction will address critical soil, water and environmental issues related to water quality; water conservation; soil quality; carbon sequestration; greenhouse gas emissions; emerging contaminants; waste management as related to environmental health; global change; and sustainable production of food, fiber, and fuel. The core programs will address issues in a range of ecosystems, including agricultural, forested, rangelands, urban, wetlands, and aquatic systems.

Core Programs of the Future
- Management of water, nutrients, pesticides, and wastes, with relevance to water quality and conservation, sustainable crop production, and climate adaptation
- Soil, water, and aquifer remediation, with relevance to public health
- Carbon dynamics and ecosystem services, with relevance to global change biology and climate change
- Wetlands and aquatic systems, with relevance to water quality, macro-elemental cycles, and sea level rise
- Modeling and landscape analysis, integration of environmental information across scales

Critical Hires
- Integrative soil and water scientist/environmental informatics
- Soil quality management/Soil health
- Aquatic microbiology
- Watershed management
- Organic soil and water chemistry
- Water conservation and soil physics
- Integrative systems modeling
- Limnology
WILDLIFE ECOLOGY AND CONSERVATION

Research Opportunities
The Department of Wildlife Ecology and Conservation addresses questions and seeks solutions to conserve biodiversity, maintain ecosystem health, and promote the sustainable use of natural resources. The department’s mission is pursued by conducting basic and applied science at all levels, from genotypes to ecosystems and from microhabitats to landscape scales, and by engaging in the development of management and conservation recommendations. Opportunities are presented by emerging issues such as climate change and sea level rise, water use and energy demands, land-use change, emerging zoonoses, pollutants, invasive species, overexploitation, and resource extraction policies.

Core Programs of the Future
- Implications of global environmental change to wildlife conservation
- Ecology and conservation of wildlife in wetland, upland, and coastal ecosystems at state, national, and international scales
- Invasive species ecology and management
- Human dimensions of wildlife conservation
- Urban ecology and conservation

Critical Hires
- Conservation implications of environmental change
- Invasive species ecology and management
- Conservation implications of resource use and extraction
- Conservation planning and policy
- Ecology of human-dominated and working landscapes
- International conservation and management of wildlife and protected areas
- Wildlife disease modeling
- Quantitative ecology
CITRUS RESEARCH AND EDUCATION CENTER

Research Opportunities
A major objective of the Citrus Research and Education Center’s research is to provide the basic foundation for sustainable, economically viable solutions to huanglongbing disease (a.k.a. greening or HLB). The realistic threat of exotic disease introduction provides an opportunity to develop proactive programs addressing management and control. Critical research opportunities include development of new citrus production systems; biorational pest control strategies; site-specific and regional water management programs; innovative technologies and approaches for sustainable citrus production, processing, and food safety; and novel citrus improvement strategies.

Core Programs of the Future
- Exotic disease control and management
- Endemic disease management
- Bioinformatics, functional genomics and computational biology
- Integrated pest management and chemical ecology
- Produce and juice food safety and quality
- Citrus water and agrosystems management
- Citrus breeding and improvement
- Citrus products, by products, biochemistry, and process engineering
- Citrus nursery and grove production systems
- Whole plant approaches to stress and disease

Critical Hires
- Extension entomologist
- Plant breeder
- Root pathologist
- Process engineer
- Precision agriculture engineer - sensors and big data management
- Plant molecular physiologist - disease resistance/stress physiology
- Acarologist
- Spray technologist
Research Opportunities
Agricultural production in southern Florida is facing critical issues with soil sustainability, water quality, invasive species, and damaging wildlife/agriculture interactions. The Everglades Research and Education Center is positioned to continue leadership in soil health and sustainability, and improving plant disease management through genomic research. Other major trends to address include improving rice production through multidisciplinary research; improving varieties to better match southern Florida conditions; addressing increasing problems with invasive species and crop damage by vertebrate wildlife species; developing farming systems for marginal soils (shallow mucks and sands); improving food quality and safety; and increasing productivity, sustainability, and management through use of automated smart technologies.

Core Programs of the Future
- Soil health and sustainability
- Plant breeding, agronomy, and pest management for rice
- Maintaining soil quality for agricultural production
- Everglades restoration and management practices at the farm level to improve water quality
- Wetlands restoration, invasive species mitigation, and wildlife/agriculture interactions

Critical Hires
- Agronomist/plant breeder for rice
- Plant Pathologist/molecular biologist/epidemiologist for insect-vectored plant viruses
- 'Smart Agriculture' precision agricultural scientist
- Soil and water scientist for soil health and sustainability
- Vertebrate wildlife - invasive species biologist
FLORIDA MEDICAL ENTOMOLOGY LABORATORY

Research Opportunities
The Florida Medical Entomology Laboratory’s research will continue to address the biology, ecology and control of arthropod-borne disease vectors, including the potential for local transmission of endemic and emerging vector-borne diseases in Florida and elsewhere. Florida, the United States, and Latin America rely on this laboratory’s research discoveries for novel surveillance methods, more effective vector control, and much needed advances in disease and vector ecology, genetics, molecular biology, landscape ecology and related fields.

Core Programs of the Future
- Molecular and biochemical aspects of arthropod biology
- Biology and ecology and behavior of arthropods in their natural environment
- Physiology of mosquitoes and other insects
- Genetics, including transgenesis and transformation of insects
- Ecology and epidemiology of vector-borne pathogens
- New and emerging disease surveillance
- Vector-virus interactions
- Improved control strategies

Critical Hires
- Vector ecology
- Geospatial vector and vector-borne disease ecologist
- Arbovirus epidemiology
- Molecular biology of arboviruses
**FT. LAUDERDALE RESEARCH AND EDUCATION CENTER**

**Research Opportunities**

Ft. Lauderdale Research and Education Center develops sustainable management for tropical and subtropical landscape systems for reducing the impact of invasive animals and plants on natural and highly urbanized habitats. This Center’s research focuses on water, nutrition, and pesticide management on turf and ornamentals; structural pest management; biodiversity and conservation issues; invasive plant and animal mitigation; microbial ecology; geomatics; and landscape analysis and modeling. This research helps better understand potential ramifications of increasing sea level, decreasing natural resources, and declining water quality in South Florida and elsewhere.

**Core Programs of the Future**

- Climate change/sea level rise: Impacts and resilience
- Aquatic and wetland habitats: Algae, plants and animals
- Invasive species: Detection, ecology and management
- Urban landscapes: Environmentally responsible management
- Structural pests: Environmentally responsible management
- Genomics: Microbes, algae, insects, plant pathogens, nematodes
- Geospatial research: Mapping ourselves into the interdependent web of life
- Commercial turf and ornamental production systems

**Critical Hires**

- Plant Pathologist (palm fungal diseases)
- Landscape Horticulturalist (Palm and woody ornamentals)
- Landscape Entomologist/Nematologist (Palm and woody ornamentals)
GULF COAST RESEARCH AND EDUCATION CENTER

Research Opportunities
The Gulf Coast Research and Education Center will develop and disseminate new scientific knowledge and technology for commercial agriculture that will assist Florida’s producers in becoming competitive nationally and in the world economy. Key elements of the center’s research mission are to develop low-input horticultural crop production and pest management systems; to develop conservation strategies to improve the sustainability of agriculture and urban landscape; to improve the genetics of commercially important horticultural crops; and to address major economic challenges to increase the profitability and sustainability of Florida agriculture.

Core Programs of the Future
- Genetic improvement and cultivar development of tomato, strawberry, emerging horticultural crops (blackberry and pomegranate), and landscape and ornamental crops
- Sustainable and integrated biological, chemical and cultural pest management systems (diseases, nematodes, insects, and weeds), including the development and use of disease forecasting or decision support systems
- Best management practices for sustainable crop and ornamental production systems, and urban tree and landscape management that conserve and protect soil and water resources
- Environmental impact of known and emerging contaminants on surface and groundwater resources
- Economics for profitable vegetable, fruit and ornamental production, including labor and trade impacts on industry sustainability
- Remote sensing and geographic information applications for agriculture, environmental monitoring, and high-throughput phenotyping

Critical Hires
- Agricultural engineering (mechanization, robotics and precision agriculture)
- Bioinformatics (genomics of horticultural crops, pathogens and insects)
- Horticulture/pathology- Food Safety (postharvest physiology and/or pathology)
- Soil and water science (nutrient management and environmental impact)
- Food science and nutrition (nutritional and sensory attributes, health benefits of phytochemicals/antioxidants)
Research Opportunities
Research at the Indian River Research and Education Center addresses sustainable agriculture, natural resources, and urban development and their interactions with the environment. Research directions include multidisciplinary, collaborative programs in best management practices for fresh citrus fruit production and management; soil and water quality; soil fertility and nutrient management; postharvest quality and handling of fresh produce; entomology; biological control of invasive plants and insects; plant pathology; bioinformatics; and aquaculture.

Core Programs of the Future
- Citrus horticulture (plant nutrition, root health, precision irrigation, pest management)
- Postharvest physiology and commodity management
- Genome-informed diagnostics of plant pathogens
- Biological control of invasive plants and insects
- Soil and water management for sustainable agriculture
- Environmental quality and restoration of wetlands and estuaries
- Bait fish and food fish production systems
- Interaction of sustainable agriculture and environmental quality

Critical Hires
- Agricultural engineering – hydrology
- Biological control of invasive insects
- Vegetable horticulture
- Agricultural and natural resource economics
- Environmental horticulture
- Environmental microbiology
- Chemical ecology
MID-FLORIDA RESEARCH AND EDUCATION CENTER

Research Opportunities
The research focus of the Mid-Florida Research and Education Center is “lifestyle horticulture.” This is profitable, yet environmentally responsible production and use of high-value horticulture plants and plant products to satisfy demand driven by consumer tastes, preferences, and wellness. The Center blends expertise in consumer economics, whole-plant physiology, breeding, pest management (i.e. insects, diseases, and weeds), and water management to focus on protected production of high-value foliage, beverage, and citrus rootstock crops; nursery production of landscape plants; and plants used in urban plant systems such as amenity landscapes and community agriculture.

Core Programs of the Future
- Protected production of foliage plants - breeding, integrated pest management, optimal production systems
- Protected production of beverage crops - optimal management for crop quality, pest control, economics, breeding
- Protected production of HLB-resistant citrus rootstock in phytosanitary greenhouses
- Nursery production of landscape plants - consumer preferences, water conservation, weed control
- Urban landscapes - consumer preferences for minimal resource use, integrated pest control, weed management
- Urban food systems - policy constraints, consumer engagement, production-aggregation systems

Critical Hires
- Urban food specialist in behavioral science/policies
- Landscape plant materials horticulturalist
- Urban vegetable production
- Climate pest/modeler for insects and diseases
- Entomologist
- Risk and crises communication science
- Biophysical scientist: measure, model, and develop useful products regarding evapotranspiration
Research Opportunities
In North and Northwest Florida, the major natural resource economic impacts and job impacts occur due to 1) vegetable and melon production, 2) integrated cattle/row crop enterprises, and 3) forest resource management and harvest. The North Florida Research and Education Center focuses on these areas via a team-based systems approach to succeed in its mission of enhancing agriculture, natural resources, and quality of life through science.

Core Programs of the Future
- Beef/forage systems, including breeding of valuable new forages
- Specialty crop systems, including new crop enterprises for North and Northwest Florida
- “Smart farming” technology use for lower risk farming
- Oilseed crops for biofuels production
- Integrated row crop/livestock systems for sustainable production of food and energy, including breeding of high-oleic peanuts for a growing farming and candy industry
- Natural resource systems for wildlife habitat, alternative forest products (including energy) and agriculture/forest/urban interface as urbanization increases and land uses change

Critical Hires
- Nematologist for row crops
- Entomologist for row crops (also support for oil crop bioenergy)
- Weed scientist
- Experienced farm manager for operation of new technology involved in farming enterprises
The mission of the Range Cattle REC is to provide science-based information to address the challenges affecting owners and managers of grazinglands. Today, the Range Cattle Research and Education Center hosts the most complete set of faculty programs in its 75-year history. The programs all serve a single clientele, the owners and managers of grazinglands. Our faculty disciplines represent the following UF/IFAS Academic Departments: Animal Sciences (beef cattle), Agronomy (forages and weeds), Soil and Water Sciences (soil nutrient management), Wildlife Ecology and Conservation (range and wildlife science), and Food and Resource Economics (livestock and forage economics). The research productivity of these faculty programs is further enhanced by growing improvements to our Center’s infrastructure, recruitment of outstanding graduate students, and research endowment support.

The Range Cattle REC will continue directing research to respond to emerging challenges and opportunities facing grazinglands, among them increasing costs of fertilizers and fuel; loss of grazing land to urbanization and public acquisition; and the environmental impacts and ecological benefits of pasture- and rangeland-based animal production. In addition to maximizing production, research efforts will focus on sustainable production practices that improve the economic efficiency and environmental quality of grazinglands in Florida and throughout the World.

Core Programs of the Future
- Soil and water management
- Grazingland management
- Weed control and management
- Beef production
- Wildlife habitat and ecology
- Climate change and mitigation
- Biomass production

Critical Hires
- Forage agronomy (forage breeding)
- Watershed biogeochemistry
Research Opportunities
The Southwest Florida Research and Education Center will address agricultural and natural resource issues that arise from the complex interplay among agricultural, urban, and natural systems. The overarching goal of the center’s research programs is to sustain a profitable agriculture industry, vital environmental services and quality of life in southwest Florida. Major research opportunities are in areas such as land and water use; pests and diseases of citrus and vegetables; alternative crops; improved crop production systems; and new technologies that more efficiently allocate resources for optimized agricultural productivity while protecting and conserving the natural environment and resources of the region.

Core Programs of the Future
- Maximizing sustainability and profitability in production agriculture
- Alternative crops and enhanced uses of land-biofuels and ecosystem services
- Sustainable pest management systems and biological control
- Improved agricultural technologies and cropping systems/precision agriculture
- Water quality, quantity and conservation
- Enhanced soil microbial communities/improved soil health
- Agricultural and natural resource economics

Critical Hires
- Entomologist: There is an expanding number of horticultural production problems related to direct plant damage due to insect and mite feeding and to insect/mite vectoring of diseases. This additional entomologist is needed to lead research projects to develop improved technologies to control these harmful insects and mites.
- Nematologist: Agricultural production in Southwest Florida, especially vegetables, is facing a wide array of nematode species that negatively impact profitability. A nematologist is needed to conduct priority research that provides solutions to nematode problems working in an interdisciplinary fashion with the soil microbiologist, weed scientist, soil scientist, entomologist, vegetable pathologist, and vegetable horticulturist.
TROPICAL RESEARCH AND EDUCATION CENTER

Research Opportunities
The Tropical Research and Education Center is uniquely located among diverse agricultural industries, federally protected natural areas (Everglades, Biscayne Bay, etc.), and major metropolitan areas in a tropical/subtropical climactic setting. The Center’s research efforts focus on three key areas including: (1) agricultural innovation, (2) natural resource conservation, and (3) climate and environmental stewardship.

Core Programs of the Future

Agricultural Innovation
- Improving tropical/subtropical fruits, vegetables, ornamental and energy plants through genetics, biotechnology, and breeding
- Developing invasive and endemic pest and disease monitoring and management systems
- Applied remote sensing and precision agriculture technologies
- Developing economically viable and sustainable horticultural practices
- Conducting economic assessment and monitoring of existing and future industries

Natural Resource Conservation
- Improving water management, soil quality, and ecosystem services
- Developing sustainable systems for agricultural, natural, and municipal areas
- Exploring the use and management of coastal and aquatic ecosystems
- Developing and promoting Florida-friendly landscape systems

Climate and Environmental Stewardship
- Assessing the impacts of climate variability and sea-level rise on regional industries and communities
- Investigating novel cropping systems and landscape management to mitigate and adapt climate variability effects including salt-water intrusion

Critical Hires
- Ornamental crops genetics and breeding
- Vegetable/oramental horticulture
- Remote sensing and precision farming
- Food science and technology
- Postharvest physiology
WEST FLORIDA RESEARCH AND EDUCATION CENTER

Research Opportunities
The West Florida Research and Education Center’s focus is on traditional agricultural systems, specialty and biofuel crops, natural resource conservation and management, and managed landscape sustainability.

Core Programs of the Future
- Turfgrass science
- Landscape and nursery horticulture
- Coastal ecology and restoration
- Applied forest ecology
- Weed ecology and management
- Invasive species management
- Integrated cropping systems
- Watershed management
- Insect ecology and pest management
- Agricultural and biological engineering

Critical Hires
- Coastal wildlife ecology
- Agricultural and biological engineering
- Forest biometrics and management
- Plant pathology
- Fisheries