FIU Southeast Environmental Research Center

Working to Restore and Protect our Unique Environment

Florida International University

Miami's public research university

Who We Are:

Since its beginning, one of SERC's primary missions has been to serve as a resource center providing accurate, detailed, unbiased scientific information to those who must make decisions affecting the sustainability of our fragile resources. SERC facilitates linkages between scientists and local, state, and federal agencies, providing an organizational structure for regional environmental research initiatives and interdisciplinary environmental investigations.

The Southeast Environmental Research Center is staffed by faculty, students and technicians from a variety of disciplines who work together on environmental research efforts to promote understanding, protection and restoration of the water resources, recreational lands and natural ecosystems of the Southeastern United States and the Caribbean. Special emphasis is placed on work in Biscayne, Big Cypress, Everglades, and Dry Tortugas National Parks; the Greater Everglades ecosystem, the Florida Keys National Marine Sanctuary, and other freshwater and coastal areas.

In addition, SERC houses the offices of the intergovernmental South Florida Ecosystem Restoration Task Force, to coordinate the development of consistent policies, strategies, plans, programs, projects, activities, and priorities addressing the restoration, preservation, and protection of the South Florida ecosystem. These federal, state, local, and tribal representatives work cooperatively and communicate with all stakeholders in this unprecedented conservation endeavor.

What We Do:

SERC research is focused broadly on aquatic ecology, biogeochemistry of freshwater and marine environments, and ecosystem dynamics in tropical and subtropical forests. More specifically, areas of expertise offered within SERC include:

water quality studies	ecotoxicology
aquatic ecology	soil microbiology
hydrogeology/hydrology	environmental geochemistry
ecological modeling	biogeochemistry
pollution studies	photochemistry
plant community ecology	wetland ecology

SERC Research:

From its humble beginning in 1993 to the present, SERC has received funding of more than $76 million from agencies and organizations including the National Science Foundation (NSF), Environmental Protection Agency (EPA), National Park Service (DOI-NPS), National Oceanographic and Atmospheric Administration (NOAA), South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (FDEP), the Everglades Foundation, several NGOs and the private sector. Current examples of these projects and areas of research excellence include:

Florida Coastal Everglades LTER

Funded by the National Science Foundation, the Florida Coastal Everglades LTER program is investigating how long-term changes in climate, freshwater flow, and disturbance affect the coupling of terrestrial and marine ecosystems of South Florida.

Seagrass Ecology

There are over 15,000 km^2 of seagrass beds in south Florida. The Seagrass Ecosystems Research Laboratory is engaged in basic and applied research into the structure and function of seagrass beds and the food webs they support.

Marsh and Mangrove Ecology

As part of a joint effort between SERC and the South Florida Water Management District (SFWMD) to track nutrient inputs into NE Florida Bay, we have been monitoring surface water salinity and estimating fluxes of water, TN, and TP at 4 sites in the southern Everglades mangrove zone.

Water Quality Monitoring in South Florida

The function of the SERC Water Quality Monitoring Network is to address regional water quality concerns that exist outside the boundaries of individual political entities. This network covers among others the estuaries of the Florida coastal Everglades including Everglades National Park and Biscayne Bay, as well as Florida Bay and the Florida Keys National Marine Sanctuary. Funding for the Network has come from many different sources with individual programs being added as funding became available. The Network provides a "big picture" of what is happening in the South Florida coastal waters.

Biogeochemical Research

Many SERC faculty are actively involved in biogeochemical research focused on the dynamics, sources, transport and fate of nutrients and natural organic matter in the greater Everglades ecosystem. Biogeochemical research at SERC is strongly supported by state-of-the-art analytical equipment including the nutrient analysis laboratory, stable isotope facility, and the field operations center.

Terrestrial Ecosystems

Terrestrial Ecosystem Group carries on a field-oriented, multi-disciplinary approach to ecosystem function in pine forests of the lower Keys, Biscayne Bay coastal wetlands, Shark Slough tree islands, and the wet prairies where the sparrows still roam. SERC is investigating

questions critical to natural area management best addressed through an ecosystem approach.

Everglades Periphyton Research

Periphyton is the surface matrix of algae and other microbes that cover sediments and plants in this system. The periphyton group focuses on determining algal community responses to long-term environmental change in an effort to determine trajectories of environmental response to natural disturbance and to restoration efforts now underway.

Environmental Chemistry and Ecotoxicology

The Environmental Analysis Research Laboratory (EARL) focuses on studies regarding source, transport, and fate of organic pollutants in freshwater and marine ecosystems; analytical chemistry of organic contaminants; biological markers of chemical exposure in freshwater and coastal environments. The Ecotoxicology Laboratory is a state-of-the-art facility which conducts ecotoxicity studies with organic and inorganic chemicals and a multitude of exposure types with indigenous, exotic and standard test species.

Hurricane Disturbance and Recovery Research

SERC has conducted several projects related to the effects of Hurricane Andrew, and hurricanes in general, on ecosystem function and structure.

Climate Change/Sealevel Rise Research

Our scientists are involved in several projects related to the effects of sea level rise on endangered species/ecosystems in the Florida Keys.

Caribbean Initiative

Our established links with scientists, policy makers, and politicians in the wider Caribbean region have resulted in a great variety of potential joint research and support initiatives. Among them are the formation of partnerships between SERC and the Association of Marine Laboratories of the Caribbean (AMLC), Conservation International (CI), the Caribbean Community Center for Climate Change (CCCC), the Cisneros Foundation, the Bermuda Government, the Universidad Nacional Autonoma de Mexico (UNAM), and others. As such SERC faculty are performing research activities in Antigua and Barbuda, Belize, Bermuda, Mexico, US Virgin Islands, Panama and Venezuela. We expect to further expand geographically and increase our research in the region in the years to come.

SERC Research Facilities:

SERC's laboratories are a unique resource for environmental research, because they are specifically staffed and equipped to support the multifaceted environmental analyses required by the interdisciplinary research team. Each lab employs a cadre of technicians who do the physical portion of the research, which may include collecting samples in the field, as well as preparing the samples and carrying out the analyses in the laboratories.

SERC facilities include both general and specialized laboratories, all superbly equipped with state-of-the-art analytical equipment for environmental sample analysis. This equipment is available to the research teams along with a variety of equipment for direct field measurements.

The Nutrient Analysis Laboratory includes Bausch and Lomb and Shimadzu spectrophotometers, Gilford Fluoro-IV scanning fluorometer, Shimazdu scanning fluorometer, RC-5 refrigerated centrifuges, Antek 9000N total nitrogen analyzer, Shimadzu 5000 TOC analyzers, 3 Shimadzu TOC-V with TN option, Alpkem rapid flow nutrient analyzers, Amicon Model 200 ultrafiltration units, Beckman LS3801 scintillation counters, Carlo Erba elemental analyzer, high performance liquid chromatographs; capillary gas chromatographs with an assortment of specific detectors; headspace and purge and trap gas chromatographs, autoclaves, water baths, incubators, balances, drying ovens, and muffle furnaces. The facility also includes all the equipment necessary to support these analytical laboratories (glass washing facilities, ice machines, electron microscopes, ultra-low temperature freezers, radioisotope and autoradiography rooms, etc.).

The Microscopy and Digital Imagery Laboratory is equipped with several optical microscopes and digital image capture technology specifically fitted for algal and bacteriological studies. This includes a Zeiss Axioscope II compound light microscope (with Nomarski/DIC optics and high resolution Plan-Apo 10-100X objectives) equipped with a Sony DKC 500 1.2 mp color digital camera, a Zeiss compound epifluorscent microscope (with Plan-Neofluoar 10-100X objectives) equipped with a Hamamatsu color chilled 3CCD 2mp digital camera, two microcomputers with Image Pro® and other analytical software, and a Sony UP-D5500 digital color printer to produce publication-quality plates. In addition, a Coulter Multisizer II equipped with Coulter AccuComp Color Software is available for particle/cell counting. The lab also houses a curated algal herbarium that includes a permanent specimen library of more than 300 South Florida algal taxa, a comprehensive reference resource of books and taxonomic literature and a digital image-based catalogue of regional algae.

The Environmental Inorganic Laboratory has several state-of -art instruments used for the determination of trace metals, metalloids, and organometallics in a variety of environmental and biological samples. The laboratory is also equipped to carrying out speciation research for toxic chemical contaminants, which is one of the emerging areas in environmental chemistry. The laboratory currently has one hydride generation-atomic fluorescence spectrometry (HG-AFS) system for arsenic and selenium analysis and speciation; two gas chromatography- atomic fluorescence spectrometry (GC-AFS) system for mercury speciation, one gas chromatography-atomic emission spectrometry (GC-AES) for simultaneous determination and speciation of organometallics; one graphite furnace atomic absorption spectrometry (GFAAS); two high performance liquid chromatography (HPLC), which can be coupled to AFS for speciation of metals and metalloids; and one microwave digestion system for digestion of environmental and biological samples. Additionally, several ICP-MS and ICP-high resolution/MS systems are available through the Department of Chemistry.

The Stable Isotope Laboratory is equipped with three stable isotope ratio mass spectrometers (IRMS), which can be used to determine the stable isotopic ratios in many different types of organic and inorganic compounds. Primarily, the research conducted at the laboratory focuses on the carbon ($^{13}C/^{12}C$), nitrogen ($^{15}N/^{14}N$), and oxygen ($^{18}O/^{16}O$) isotopic signatures in organic material. The laboratory has two continuous flow IRMS machines coupled to elemental analyzers for the analysis of C, N, and O from a variety of solid and liquid samples. These machines include one Micromass Prism IRMS coupled to a Europa-PDZ ANACA and a Finnagin MAT Delta C IRMS coupled to a CE 1500 Series II elemental analyzer. Additionally,

for more specialized compound specific isotopic measurements of biomarkers (such as alkenones, n-alkanes, etc.), the Stable Isotope Laboratory has a Finnagin MAT Delta Plus coupled to an HP 6890 gas chromatograph (GC-IRMS). The goal of this approach is to better understand how changes in the hydrologic cycle and environmental conditions (nutrients, pCO2, etc.) affect different biogeochemical systems. These isotopic methods aid in improving our understanding of both past and present climatic and ecologic change.

The Environmental Analysis Research Laboratory *(EARL)* is equipped to conduct specialized trace organic analyses in a wide range of environmental samples (waters, sediments/soils, biological tissues, etc.), with methods aimed to achieve detection limits in consonance with the low-level concentrations of pollutants generally present in the biotic and abiotic compartments in the South Florida Ecosystems. For this purpose the laboratory has a massive array of instrumentation for the selective analysis of the most common agro-chemicals (insecticides and herbicides) and other organic contaminants like polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs) and petroleum-related hydrocarbons. The instrumentation available for routine organic analyses includes fully automated high resolution gas chromatography (HRGC) with selective detectors for halogenated (Dual-ECD), nitrogen and phosphorous (NPD), and sulfur (FPD) compounds; multi-elemental detection by atomic emission (AED) and mass selective detectors (MSD) operating in both electronic impact and chemical ionization modes (EI-CI). In addition, liquid chromatographs with UV-Visible and photo-diode array detectors (PDA) are also at hand as well as a HPLC/MS system. The EARL team of researchers and students are in constant pursuit of the development and validation new analytical protocols to improve and expand the range of services that the lab can offer.

The Environmental Geochemistry Laboratory is focused on research activities primarily related to studying the biogeochemistry of organic matter in aquatic environments. This includes, soil/sedimentary OM as well as dissolved organic matter (DOM). The research group has focused mainly on investigations on organic matter dynamics in wetlands, riverine ecosystems and estuarine environments, but has recently also started marine systems work. Our work also includes paleoenvironmental assessments and issues related to soil formation and sustainability. The lab is equipped with several GC/MS systems including pyrolysis-GC/MS, HPLC with dual UV-Vis/Fluorescence detection, UV-Visible spectroscopy and 3-D Fluorescence spectroscopy, among others.

The Ecotoxicology Laboratory is a state-of-the-art NELAC accredited facility located on Biscayne Bay in North Miami, Florida. The laboratory conducts ecotoxicity studies with organic and inorganic chemicals and a multitude of exposure types (e.g., single-slug, intermittent and continuous) with indigenous, exotic and standard test species. Species studied in the laboratory include amphibians/reptiles, fish, aquatic and soil invertebrates, phytoplankton, aquatic vascular plants, and terrestrial plants. Test species are housed separately and continuously cultured in the laboratory. Studies are designed to assess the biological effects of exposure to previously contaminated sediment, water and soil as well as in spiked samples of these matrices. Our location and computer-interface systems provide us with unique capabilities in aquatic and sediment toxicity to conduct exposures in natural full-strength seawater as well as in freshwater. The laboratory contains a salinity control system to automatically produce a range of salinities for estuarine studies based upon study needs. The toxicant exposure systems in the laboratory are

used to evaluate the effects of short-term (acute) and long-term (chronic) exposures to chemicals in soil, sediment and water to determine effects on survival, growth, development, and reproduction of organisms. We can also monitor swimming behavior and respiration to measure attraction-avoidance responses, swimming speeds, locomotor patterns and metabolism. The unique feature of our flow-through water systems is that chemical dosing, photoperiod and temperature in both acute and chronic exposure studies are automatically controlled and monitored via a Windows-based Diluter Control System. Sediment toxicity exposure systems are also automated to deliver and control overlying water volumes and different cycle times.

Single-species as well as multi-species outdoor microcosm studies are conducted. Exposure systems are used to study the bioavailability, bioconcentration and bioaccumulation of contaminants from water, sediment and soil. All ecotoxicity studies are supported by in-house analytical chemistry.

The Soils/Sediment Biogeochemistry Laboratory (SBL) is a College of Arts and Sciences recharge center that provides teaching, research, and service support. The SBL specializes in the extraction and analysis of chemical components from soil/sediments and soil/sediment porewater. In addition, the SBL is capable of limited analysis of surface water, and plant tissue. The facility includes state of the art equipment for research, service, and training in soil/sediment sample collection and nutrient and gas analyses. An abbreviated analytical equipment list includes: a Cytofluor 4000 multi-well plate reader, Fisher Scientific (FS) Accu 224 Analytical Balance, FS Accu 3102T triple range top-loading balance, FS Accumet AR50 dual channel pH/ion/Conductivity meter, Hewlett Packard 5890 Gas Chromatograph with a 7694 headspace sampler and equipped with flame ionization and electron capture detectors and a Shimadzu MTN-1 methanizer, a Technicon 3-channel Automated colorimeter, and a Perkin Elmer 2400 CHNS/O analyzer. Field sampling equipment includes various coring apparatii capable of collecting soil/sediments from uplands, wetlands, and lakes (< 35 m), a Licor LI-1400 light meter with air and underwater sensors, a YSI DO meter with 5905 BOD probe and a YSI 600QS probe for profiling physicochemical conditions of water columns.

The Field Operations Center (FOC) enables SERC fieldwork by providing access to a fleet of research vehicles and vessels. We presently have 15 boats for both marine and wetland (Airboats) applications and 9 vehicles to respond to the Center's field work needs. The FOC is managed by professional staff and also features a series of specialized field equipment such a Hydrolabs, field fluorometers, sediment collection devices, water flow detection devices, weather stations, and others.

SERC Core Faculty and Research Specialties:

Dr. Rudolf Jaffé (Chemistry), Director - organic biogeochemistry
Dr. Joseph N. Boyer (Environmental Studies), Associate Director - marine microbial ecology/biogeochemistry
Dr. Bill Anderson (Earth Sciences) - environmental geochemistry/stable isotopes
Dr. Yong Cai (Chemistry) - environmental chemistry/trace metals
Dr. Jim Fourqurean (Biological Sciences) - seagrass ecology and marine biogeochemistry
Dr. Evelyn Gaiser (Biological Sciences) - phycology

Dr. Piero Gardinali (Chemistry) - environmental chemistry/trace organics
Dr. Jim Heffernan (Biological Sciences) – ecology, biogeochemistry
Dr. Rene Price (Earth Sciences) - hydrogeology and geochemistry
Dr. Gary Rand (Environmental Studies) – ecotoxicology
Dr. Jennifer Rehage (Environmental Studies) – aquatic ecology
Dr. Mike Ross (Environmental Studies) – terrestrial plant ecology
Dr. Len Scinto (Environmental Studies) - wetlands soils biogeochemistry

In all, the SERC faculty supports a significant number of graduate students and post docs annually in addition to many undergraduate students and professional staff. The Center has in excess of 200 employees on its parole. As such, SERC has an exceptionally high productivity with extramural funding on the order of $7 Million/year and *ca.* 50 publications and over 100 presentations at national and international meetings annually.

Florida International University:

Florida International University (FIU) is an urban, multi-campus, doctoral-granting institution located in Miami, Florida's largest population center. The university's mission is to serve the people of southeast Florida, the state, the nation and the international community by imparting knowledge through excellent teaching, creating new knowledge through research, and fostering creativity and its expression.

The five strategic themes which guide the University's development are: **International, Environmental, Urban, Health** and **Information**. According to the December 1996 FIU Planning Document "Reaching for the Top", the Environment Strategic Theme is built upon the concept that understanding the relationships and interactions of our natural and man-made environments is necessary for their continued viability. Causes of environmental problems are diverse. Environmental knowledge relies on all disciplines, from the humanities, which clarify our values and attitudes toward our environment, to the basic and applied sciences, which teach us how the external world works and how we can influence it. SERC, due to its philosophy and structure, is uniquely equipped in the university to carry out the spirit of this strategic theme.

SERC Funding Needs and Opportunities:

In planning to meet the expected increased demand for critical research information on South Florida's ecosystem in the 21st century, SERC faculty and staff have identified three priority areas with ample funding opportunities. These areas are:

I. Continuity through Endowment

An operating endowment is SERC's greatest priority in an environment of federal, state and local government cutbacks, as well as decreased funding per student within the state university system. An operating endowment will provide funding for crucial research projects, special lectures and important publications, and will provide the financial support and flexibility needed to ensure the long-term viability of SERC and its research mission.

All gifts for endowment purposes totaling $100,000 or more are eligible for state matching funds (sliding scale). FIU *will provide recognition for endowments commensurate with the size and nature of the gift.*

II. Equipment Purchase and Maintenance

Analytical equipment capable of detecting substances in the parts-per-trillion range are absolutely necessary for meaningful environmental research. Unfortunately, these instruments are also extremely expensive to purchase and to maintain. The ability to buy and maintain this equipment is crucial to SERC's ability to conduct its research. State funds provide for only basic laboratory facilities.

III. Academic Excellence through Endowment

Endowments provide a major source of enhancement funds for SERC. The unique matching gift programs of the Florida State University System provide powerful incentives to donors to designate gifts for endowment purposes. There are several categories of endowments we are pursuing.

- **Eminent Scholars Chair**

The Eminent Scholars Chair will be used to attract internationally-prominent scientists who, in turn, will attract other distinguished faculty and students to SERC and the University.

An Eminent Scholars Chair can be established with a minimum gift of $750,000, which is enhanced by a 70% State match to create an endowment of $1.25 million.

- **Endowed Professorship**

Named Professorships will provide supplemental funding to support the teaching and research activities of existing distinguished faculty members in SERC.

A named Professorship can be established with a gift of $100,000 or more, which qualifies for a state match of 50 percent.

- **Student Fellowships**

The Student Fellowships will fund graduate and undergraduate research activities related to the SERC mission. Fellowships are designed so as not to interfere with existing financial aid.

For further information about SERC please contact:

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