

State University System Climate Change Workshop

March 18, 2011
Florida Atlantic University
Boca Raton, FL



***Cover photos courtesy of the South Florida Water Management District**

STATE UNIVERSITY SYSTEM CLIMATE CHANGE WORKSHOP

Florida Atlantic University, Boca Raton, Florida

March 18, 2011

It is a pleasure to welcome you to the first State University System climate change workshop. This event is an activity of a recently awarded State University Research Commercialization Assistance Grant. Florida Atlantic University, Florida State University and University of Florida are joint recipients of this grant and initiated this effort based on our earlier cooperation on climate change. We hope and expect the effort to become statewide. The impacts of climate change; sea level rise; temperature changes and changes in the amount, distribution and intensity of rainfall are collectively greater in Florida than almost anywhere else in the world. We, the State University System (SUS), have the responsibility to bring the best of science, social science and other disciplines, working together, to bear on the problem of understanding, mitigating and adapting to a changing environment. We also have the responsibility of communicating inside and outside the classroom the insights we have on what, arguably, is the greatest challenge of our time.

As part of a small, select group of invitees, your participation will be critical to the success of this workshop and project. The workshop will serve as an organizing process which will:

- Identify and confirm priority topics;
- For high priority topics, initiate working groups involving faculty from different universities and individuals from public and private institutions;
- Provide information for a State-wide data system;
- Inform attendees of existing climate change courses and curricula across the state and identify unmet needs;
- Identify universities who wish to join the Florida Climate Institute or develop a SUS consortium to facilitate greater cooperation on climate change research, education, and outreach.

White papers will be developed as a product of this workshop and will be the first steps at synthesizing what we know about some important climate-related topics, but will leave much to be done. As we go through the year, we collectively need to find ways to fill the gaps, and to design a collaborative way of deepening our understanding of the issues and communicating their importance. If Florida is a most vulnerable place, we should be the most dedicated research group ever!

Sincerely,

Len Berry
Florida Atlantic University

Eric Chassignet
Florida State University

Jim Jones
University of Florida

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AGENDA: SUS CLIMATE CHANGE TASK FORCE WORKSHOP

Student Union Conference Center, Florida Atlantic University, Boca Raton, FL
March 18, 2011

8:00-8:30am	Registration/Check-In – <i>Foyer</i>
8:30-8:45am	Welcoming Remarks and Workshop Overview - <i>Majestic Palm</i>
8:45-9:30am	<p>Presentation by the 3 PIs: Project description and goals, including Q and A - <i>Majestic Palm</i></p> <ul style="list-style-type: none"> • Len Berry, FAU • Eric Chassignet, FSU • Jim Jones, UF
9:30-10:15am	Participant Introductions (one minute) - <i>Majestic Palm</i>
10:15-10:30am	Breakout Group Overview & Charge - <i>Majestic Palm</i>
10:30-11:00am	Break - <i>Foyer</i>
11:00-12:30pm	<p>Breakout Groups: Discussion of white papers – content, organization and participation</p> <ul style="list-style-type: none"> • Assessment of climate change scenarios – <i>Sago Palm</i> <i>Moderated by: Eric Chassignet, FSU</i> • Biodiversity and land use change – <i>Majestic Palm A</i> <i>Moderated by: Susan Cameron Devitt, UF</i> • Coastal county adaptation – <i>Senate Chambers</i> <i>Moderated by: Thomas Ruppert, UF and Jaap Vos, FAU</i> • Education and training – <i>Majestic Palm B</i> <i>Moderated by: Jim Jones, UF</i> • Water management – <i>Silver Palm</i> <i>Moderated by: Len Berry, FAU</i>
12:30-1:30pm	Lunch - <i>Foyer</i>
1:30-3:00pm	<p>Breakout Groups continued: Discussion of white papers – content, organization and participation</p> <ul style="list-style-type: none"> • Assessment of climate change scenarios – <i>Sago Palm</i> <i>Moderated by: Eric Chassignet, FSU</i> • Biodiversity and land use change – <i>Majestic Palm A</i> <i>Moderated by: Susan Cameron Devitt, UF</i> • Coastal county adaptation – <i>Senate Chambers</i> <i>Moderated by: Thomas Ruppert, UF and Jaap Vos, FAU</i> • Education and training – <i>Majestic Palm B</i> <i>Moderated by: Jim Jones, UF</i> • Water management – <i>Silver Palm</i> <i>Moderated by: Len Berry, FAU</i>
3:00-3:30pm	Break - <i>Foyer</i>
3:30-4:45pm	15 Minute Summary of Each Breakout Session (highlighting goals and outcomes) - <i>Majestic Palm</i>
4:45-5:00pm	Discussion of the Workshop Outputs, Conclusions and Next Steps - <i>Majestic Palm</i>
5:00pm	Adjourn

PROJECT LEADS

Florida Atlantic University - Dr. Berry

Len Berry, PhD

Distinguished Research Professor and Director, Florida Center for Environmental Studies

Dr. Berry , born in England, studied tropical environments in East and South Asia, and later in Eastern Africa, with 12 years residence in that area in various university positions. While in Africa, he developed an interest in natural resource management and rural development applied problems, including work on regional planning problems for the government of Tanzania.

He has a Ph.D. in physical aspects of tropical geomorphology from Bristol University, England. He has worked on hydrological issues in Africa, South America and the United States. He is a core member of the Inter American Water Resources Network and chairs the board of the WaterWeb Consortium, an international water information group. He has extensive administrative experience as Provost of Clark University and as Vice President for Academic Affairs at Florida Atlantic University from 1987-1993.

He has been the Director of the Florida Center for Environmental Studies since 1994. He has studied issues of climate change in Africa and the U.S. for the past twenty years, organized a workshop on climate change in Florida in January 2006 and a state-wide conference on climate change in Florida, May 2007, in Tampa, Florida. He was a member of the planning committee of the National Council for Science and the Environment (NCSE) conference on climate change, January 2008 and also of the Florida's Wildlife: On the Frontline of Climate Change, October 2008, and is coordinator of Florida Atlantic University's Integrated Collaborative on Climate and Energy Initiative.

Florida State University – Dr. Chassignet

Eric Chassignet, PhD

Professor and Director, Center for Ocean-Atmospheric Prediction Studies (COAPS)

Professor Eric Chassignet came to Florida State University in March of 2006 to assume the directorship of the Center for Ocean-Atmospheric Prediction Studies (COAPS) after 15 years serving as a professor of Oceanography at the University of Miami Rosenstiel School of Marine and Atmospheric Sciences (RSMAS). He is a professor of Oceanography at the Florida State University, and the Co-Director of the Florida Climate Institute.

His background is in geophysical fluid dynamics and ocean modeling. His current area of research interest is on the role of the ocean in climate variability from the complementary perspectives of coupled ocean-atmosphere modeling and observations, with an emphasis on the study of the thermohaline circulation, western boundary currents, associated eddies and their impact on the world ocean circulation, and on the validation of the HYbrid Coordinate Ocean Model (HYCOM) with data assimilation capabilities.

University of Florida – Dr. Jones

Jim Jones, PhD

Distinguished Professor, UF Department of Agricultural and Biological Engineering

Dr. James W. Jones, PhD, is a Distinguished Professor and Director of the Florida Climate Institute. As a faculty member at the University of Florida in the Agricultural and Biological Engineering Department, he has conducted research and taught graduate classes for the last 35 years. He is an expert in cropping systems modeling and decision support systems. His research has focused on modeling the effects of climate on crops and on applying those models to study effects of climate variability and climate change on crop yield and to evaluate management options that minimize climate risks. He is PI and co-leads the Southeast Climate Consortium (SECC), a 3-state (Florida, Georgia, Alabama) Regional Integrated Science Assessment (RISA) center. The SECC conducts research on climate variability, agriculture, and water resources management and provides climate risk management information to farmers, foresters, and water managers through the Cooperative Extension Services in these states. He has led and participated in many interdisciplinary research programs nationally and internationally. He is author of more than 250 refereed scientific journal articles and teaches graduate courses on mathematical modeling and simulation of biophysical systems. He is a Fellow of the American Society of Agricultural & Biological Engineers, Fellow of the American Society of Agronomy, Fellow of the Soil Science Society of America, and serves on several international science advisory committees related to climate and agriculture.

BREAKOUT SESSIONS

ASSESSMENT OF CLIMATE SCENARIOS

Sago Palm

Moderator: Eric Chassignet

Rapporteur: Vasubandhu Misra

Breakout Session Charge

The working group products will be incorporated into a white paper that will

1. Outline Florida's climate change related challenges and identify the key decision makers impacted by those challenges at state, regional and local community levels.
2. Identify ongoing and needed research and monitoring initiatives.
3. Explore ways to assist decision making at state, regional and local levels.

Questions to guide breakout group discussions

1. What historical data are available for users from climate and sea level changes in Florida, and are these data readily available? *approximately 20 minutes*
2. What is known about climate variability and climate forecasts for Florida, and how can these data be accessed? *approximately 20 minutes*
3. Are there readily available climate change scenario data sets based on IPCC climate model outputs? Have any of these been evaluated relative to their ability to hindcast Florida's climate? Where are the data? *approximately 30 minutes*
4. What climate change, climate variability, and sea level change research and outreach programs do our SUS universities have in place now? *approximately 30 minutes*
5. What are the major gaps in research that need to be filled? *approximately 15 minutes*
6. What interdisciplinary and collaborative programs or working groups (internal and external) exist? *approximately 20 minutes*
7. Discuss communication needs, methods and opportunities, including those that already exist and those that are needed. *approximately 30 minutes*

Wrap Up - approximately 15 minutes

BIODIVERSITY AND LAND USE

Majestic Palm A

Moderator: Susan Cameron Devitt

Rapporteur: Corrie Rainyn

Breakout Session Charge

The working group products will be incorporated into a white paper that will

1. Outline Florida's climate change related challenges and identify the key decision makers impacted by those challenges at state, regional and local community levels.
2. Identify ongoing and needed research and monitoring initiatives.
3. Explore ways to assist decision making at state, regional and local levels.

Questions to guide breakout group discussions

1. What are the key vulnerabilities and impacts from climate change associated with each target area (water management, coastal counties, and Florida's biodiversity and land resources)? *approximately 30 minutes*
2. What research is being done in Florida now and by whom (universities, agencies, etc.)? *approximately 30 minutes*
3. What research and outreach programs do our SUS universities have in place now? *approximately 30 minutes*
4. What are the major gaps in research that need to be filled? *approximately 15 minutes*
5. Who are the key decision makers involved in climate change issues in each target area? *approximately 15 minutes*
6. What interdisciplinary and collaborative programs or working groups (internal and external) exist? *approximately 15 minutes*
7. Discuss communication needs, methods and opportunities, including those that already exist and those that are needed. *approximately 30 minutes*

Wrap Up - approximately 15 minutes

COASTAL COUNTY ADAPTATION
Senate Chambers

Moderator: Jaap Vos and Thomas Ruppert

Rapporteur: Marianne Quinn

Staff Assistant: Kelly Paluck

Breakout Session Charge

The working group products will be incorporated into a white paper that will

1. Outline Florida's climate change related challenges and identify the key decision makers impacted by those challenges at state, regional and local community levels.
2. Identify ongoing and needed research and monitoring initiatives.
3. Explore ways to assist decision making at state, regional and local levels.

Questions to guide breakout group discussions

1. What are the key vulnerabilities and impacts from climate change associated with each target area (water management, coastal counties, and Florida's biodiversity and land resources)? *approximately 30 minutes*
2. What research is being done in Florida now and by whom (universities, agencies, etc.)? *approximately 30 minutes*
3. What research and outreach programs do our SUS universities have in place now? *approximately 30 minutes*
4. What are the major gaps in research that need to be filled? *approximately 15 minutes*
5. Who are the key decision makers involved in climate change issues in each target area? *approximately 15 minutes*
6. What interdisciplinary and collaborative programs or working groups (internal and external) exist? *approximately 15 minutes*
7. Discuss communication needs, methods and opportunities, including those that already exist and those that are needed. *approximately 30 minutes*

Wrap Up - approximately 15 minutes

EDUCATION AND TRAINING

Majestic Palm B

Moderator: Jim Jones

Rapporteur: Alana Edwards

Staff Assistant: Carolyn Cox

Breakout Session Charge

The working group products will be incorporated into a white paper that will

1. Outline Florida's climate change related challenges and identify the key decision makers impacted by those challenges at state, regional and local community levels.
2. Identify ongoing and needed research and monitoring initiatives.
3. Explore ways to assist decision making at state, regional and local levels.

Questions to guide breakout group discussions

1. What are the existing educational opportunities in the SUS regarding climate (climatology, meteorology, oceanography, etc.) and climate change in particular?
approximately 20 minutes
2. What are existing educational opportunities in the SUS regarding interdisciplinary studies on climate change and societal responses? *approximately 20 minutes*
3. Are there gaps in undergraduate and graduate climate change related education programs that need to be filled? *approximately 30 minutes*
4. What mechanisms exist to allow any student in an SUS university to take courses that may exist in other universities, and how can this situation be improved? *approximately 20 minutes*
5. What SUS-organized continuing education and outreach programs currently exist? What sectors are being targeted (public, professional and business)? *approximately 15 minutes*
6. Are there opportunities to develop collaborative outreach and continuing education programs via a consortium of SUS universities? What programs or working groups currently exist? *approximately 30 minutes*
7. How might we improve communication between educational institutions to advance climate change learning? *approximately 30 minutes*

Wrap Up - approximately 15 minutes

WATER MANAGEMENT

Silver Palm

Moderator: Len Berry

Rapporteur: Chris Lockhart

Staff Assistant: Nicole Hammer

Breakout Session Charge for All Groups

The working group products will be incorporated into a white paper that will

1. Outline Florida's climate change related challenges and identify the key decision makers impacted by those challenges at state, regional and local community levels.
2. Identify ongoing and needed research and monitoring initiatives.
3. Explore ways to assist decision making at state, regional and local levels.

Questions to guide breakout group discussions

1. What are the key vulnerabilities and impacts from climate change associated with each target area (water management, coastal counties, and Florida's biodiversity and land resources)? *approximately 30 minutes*
2. What research is being done in Florida now and by whom (universities, agencies, etc.)? *approximately 30 minutes*
3. What research and outreach programs do our SUS universities have in place now? *approximately 30 minutes*
4. What are the major gaps in research that need to be filled? *approximately 15 minutes*
5. Who are the key decision makers involved in climate change issues in each target area? *approximately 15 minutes*
6. What interdisciplinary and collaborative programs or working groups (internal and external) exist? *approximately 15 minutes*
7. Discuss communication needs, methods and opportunities, including those that already exist and those that are needed. *approximately 30 minutes*

Wrap Up - approximately 15 minutes

QUESTIONNAIRE RESULTS

FLORIDA AGRICULTURAL AND MECHANICAL UNIVERSITY

Tallahassee, Florida 32307

A. Respondent(s)

Dr. Odemari Mbuya, Professor, Center for Water and Air Quality, Email: Odemari.mbyua@famu.edu

Research Interests: Watershed processes/management, irrigation, nutrient management, impact of land use/land cover change on climate.

B. Current University-Wide Climate Change Research

1. Enhancing NASA's COAST Online Application for Agricultural Best Management –Practices / Decision Support
2. Integrating Agricultural Best Management Practices into the HSPF Model for Improved Watershed Decision Making in the Caloosahatchee Watershed, SW Florida

C. Current Climate Change Courses Offered and/or University Contact Name

Dr. O.S. Mbuya; Dr. Cassel Gardner; Dr. Katherine Milla; Dr. Margaret Gitau

FLORIDA ATLANTIC UNIVERSITY

Boca Raton, Florida 33431

A. Respondent(s)

Dr. Leonard Berry, Director, Florida Center for Environmental Studies Coordinator, FAU Climate Change Initiative, Jupiter, FL 33458; Email: berry@fau.edu **Research Interests:** In the whole issue of adaptation to climate change in South Florida and globally with special emphasis on the tropics. I'm particularly interested in the impacts of sea level rise in the limestone environment of South Florida leading to salt water intrusion and with changes in precipitation patterns, various kinds of flooding impacts. Adaptation research involves interdisciplinary approaches and I am interested in ways in which different perspectives can be merged. Outreach and education is also an interest, particularly to non-professional audiences.

Dr. Frederick Bloetscher, Civil Engineering, Boca Raton Campus; Email: h2o_man@bellsouth.net **Research Interests:** In how sea level rise affects vital infrastructure (water, sewer, drainage and transportation) and the consequences for local communities, from a planning, funding, and an economic perspective. The long-term economic impact on communities is an under-developed but particularly significant issue. My area of expertise is the development, expansion and management of infrastructure systems. The strategies for adaptation to rising sea level in the long and short term are areas of current research. I was part of a project at FAU to evaluate the impacts of sea level rise on water utilities. We are currently working on a project with FDOT to evaluate their infrastructure needs. I have previously looked at the impact of sea level rise of groundwater in the US, and the impact that the needs to adapt to changing water quality and availability will have on power (ongoing).

Dr. Marguerite Koch, Professor, Biological Sciences; Boca Raton; Email: mkoch@fau.edu **Research Interests:** Research interests are in nutrient cycling and primary production in tropical marine ecosystems and stressors that influence tropical plant communities. We are currently focused on climate

change impacts including upper temperature and salinity limits of marine plant communities and changes in partial pressure of CO₂. We examine stress responses from the physiological and molecular scale, consider life history strategies of individual species and life-stage, as well as focus on ecosystem-level indicators of stress, such as hypoxia. In addition to direct plant responses to stress, we are also interested in biogeochemical changes at the ecosystem-scale that can destabilize plant communities and influence the sustainability of foundation plant communities that support marine ecosystems. The majority of our work is in shallow tropical carbonate environments of South Florida, The Bahamas and wider Caribbean. We typically take an experimental approach to examine several alternative hypotheses in mesocosms and under field settings.

Dr. Julie Lambert, Associate Professor of Science Education, Teaching and Learning, College of Education, Boca Campus; Email: jlambert@fau.edu **Research Interests:** In general, global climate change education (GCCE). Instructional strategies and students' understanding of basic science concepts. Students' attitudes and views on global climate change. Assessment and Survey Development on GCCE. Manuscript on Students' Understanding of GCC has been accepted with revisions to the International Journal of Science Education. PI on NASA GCCE grant to develop curriculum materials for high school and undergraduates on how to address misconceptions using scientific data or evidence.

Dr. Mantha Mehallis, Director and Professor, Management Programs, College of Business, Davie Campus; Email: mehallis@fau.edu **Research Interests:** My primary interest in climate change research is action research concerning the impacts of climate change on business. Much work has been done on the scientific aspects of climate change but it is only relatively recently that work has begun on economic and social aspects impacting the business world and the entire area of business continuity, adaptability, and sustainability.

This past month I presented a training session to cruise line executive environmental and safety officers with regard to the impact of climate change on the cruise industry. This pertains both to the shipping business and to tourism. Ship captains, officers, and engineers need to understand the concepts behind climate change, why it is occurring, what their role has been contributing to it, and, most importantly, what they can do to adapt and to create a sustainable business and a sustainable world.

Dr. Diana Mitsova, Assistant Professor, School of Urban & Regional Planning, Fort Lauderdale Campus; Email: dmitsova@fau.edu **Research Interests:** (1) Integrate concepts and techniques from geosciences, hazards research and statistics to improve the spatial accuracy of coastal vulnerability assessments and contribute to the understanding of vulnerability as an integrated spatial phenomenon. (2) Provide geospatial visualization of the impact of sea level rise on shoreline protection that can be used by agencies or communities to enhance resilience to hazards, facilitate adaptation to sea level rise and improve the health of marine ecosystems in highly urbanized areas.

Jim Murley, J.D., Director, Center for Urban and Environmental Solutions, Fort Lauderdale Campus; Email: jmurley@fau.edu **Research Interests:** My recent work has been in the field of applied research as Principal Investigator. Two reports were produced: "Southeast Florida's Resilient Water Resources: Adaptation to Sea Level Rise and Other Impacts of Climate Change" and "Florida's Resilient Coasts: A State Policy Framework for Adaptation to Climate Change." These reports were funded by the National Commission on Energy Policy.

I continue to work with external agencies and working groups that are involved in parallel research on climate change and coordinate climate change research initiatives with the FAU Center for Environmental Studies. External collaboration includes membership on the National Academy of Public Administration's Review Panel for NOAA's Proposed Climate Service; serving on the Miami-Dade

County Climate Change Action Team and the Broward County Climate Change Task Force; advising the Southeast Florida Regional Climate Change Compact; and Chair of the Florida Energy and Climate Commission.

Other roles include: the FAU team to study the impacts of sea level rise on transportation for FDOT.

Dr. Jorge Restrepo, Professor, Dept. of Geosciences, Boca Raton, Email: restrepo@fau.edu **Research**

Interests: My interest is in hydrologic studies as it relates to water resources. Past accomplishments include several groundwater models for SFWMD and directing the hydrologic study of a hydroelectric power plant project and inferred statistical information using a hydrologic regionalization technique to infer extreme flows, average flows, and correlation structure. As a member of the National Academy of Sciences National Research Council, we focus on the sustainable underground storage of recoverable water. Current research interests and studies:

- Evapotranspiration in southern Florida, modeling recharge, evapotranspiration and runoff.
- The development of a Wetland Simulation Model.
- Model conceptualization and a data compilation in GIS for a regional three-dimensional groundwater flow model.
- Modeling the groundwater and solute transport flow for landfill areas
- The development of an optimization model to support the planning of a regional ASR facility along a canal system.

Dr. Tara Root, Assistant Professor, Dept. of Geosciences, Boca Raton/Davie; Email: troot@fau.edu

Research Interests: One of my primary research interests is water-rock interaction and the use of groundwater chemistry as a tool for delineating groundwater flow paths and characterizing surface water-groundwater interactions. A detailed understanding of surface water-groundwater interaction is necessary for developing models to predict how hydrologic systems will respond to climate change and planned municipal and regional water supply projects.

Another avenue of my research is sustainability of water resources. I am particularly interested in 1) water use science and developing robust tools for quantifying water use, 2) investigating human perceptions of water availability and developing educational materials to promote conservation, and 3) evaluating how regulations, such as watering restrictions, influence water consumption. This type of research will be useful to municipalities and regulatory agencies as they plan for meeting both human and ecosystem demands for water at a time when the hydrologic system is adjusting to climate change.

My current climate-change related activities include: (1) I am supervising a Ph.D. student who is in the early stages of developing a dissertation proposal related to water use and sustainability of water resources. (2) I am supervising another Ph.D. student who is developing a dissertation proposal to develop modeling tools that can be used to help evaluate how S. Florida's hydrologic system will respond to predicted changes in precipitation patterns and storm intensity. (3) I am in the early stages of setting up a water quality laboratory that will support a variety of water quality-related research – include projects focused on ecology, drinking water supplies, and climate change.

Dr. Ramesh S. V. Teegavarapu, Assistant Professor, Civil, Environmental and Geomatics Engineering,

FAU, Boca Raton, Florida. Hydrosystems Research Laboratory (HRL); Email: teegava@fau.edu ,

ramesh@civil.fau.edu **Research Interests:**

Interests in Climate Change Research

1. Development of methodologies for climate-change sensitive and sustainable management and operations policies for water and environmental systems
2. Water Resources modeling and Management under climate-change uncertainty, scenario generation, and climate change impact and adaptation
3. Extreme events under climate change scenarios, stationary issues, climate teleconnections, use of teleconnections for improvement of seasonal or intra annual forecasts for management of water resource/environmental systems
4. Development of downscaling methods for climatic variables (precipitation, temperature, etc.)
5. Hydrologic design for future

Current Research (funded by USGS, SFWMD, SWFWMD, FEMA, UNESCO, FDOT and others)

1. Climate Change-sensitive Water Resources Management: Use of optimization and Soft Computing Methods for addressing climate change model uncertainty
2. Sustainable hydrologic design under climate change uncertainty
3. Extreme Events (especially precipitation events), trends over the last century (historical climatology) and assessments for future
4. Teleconnections: Atlantic Multi-Decadal Oscillations, ENSO, Elnino and Lanina, PDO and others. Impacts of teleconnections on regional and local climate and extreme events
5. Spatial and Temporal assessments of Extreme events. Evaluation of Global precipitation and Temperature re-analysis data sets
6. Evaluation of statistical and dynamically downscaled future projections of climatic variables and development of methodologies for climate-change models for regional and local use.
7. Uncertainty assessments from downscaled projects and dynamic simulation models for impact and risk assessments for water and environmental systems
8. Impact of Sea-level rise on infrastructure in coastal areas

Dr. Jaap Vos, Associate Professor and Director of the School of Urban & Regional Planning, Fort Lauderdale Campus; Email: jvos@fau.edu. **Research Interests:** My main interests are environmental planning, environmental justice, sustainable development and climate adaptation. Research interests include: the interaction between built, natural and social environment, equity and representation, sustainable cities and regions, and climate adaptation. Current research is focused on the relationship between Everglades restoration and urban development in southeast Florida, water scarcity and policy responses to water scarcity. Other research interests include seasonal variability in urban runoff in subtropical areas and coastal adaptation and planning responses to sea level rise.

Recent publications include:

“The Everglades: Where Will All the Water Go?”

“The Comprehensive Everglades Restoration Plan: The Missing Link With Land-Use”

“Seasonal Variability in PAH Concentrations in Urban Runoff Discharged to Biscayne National Park and Aquatic Preserve” (with Diana Mitsova)

“USA Florida Everglades: Policy Arrangement for Water Shortage” (with Yexsie Schomberg)

B. Current University-Wide Climate Change Research

1) HUMAN SYSTEM PROBLEM ASSESSMENT AND SUSTAINABILITY- RE-ENGINEERING AND ADAPTATION

Topic 1: Integrated Hydrological Model Development for Risk Assessment of Climate Change

Topic 2: Water Resources, Utilities and Flood Protection/Supply under a Changing Climate

Topic 3: Adaptation for Transportation Infrastructure

Topic 4: Coastal Urban Societal Response and Adaptation to Climate Change

Topic 5: Adaptation through Coastal and Marine Spatial Planning

2) NATURAL SYSTEM ASSESSMENT AND TECHNOLOGY DEVELOPMENT

- Topic 1: Carbon Cycling and Sea Level Rise in Peatlands and Coastal Stability
- Topic 2: Coastal and Ocean Ecosystem Responses to Increased $p\text{CO}_2$ (Ocean Acidification: OA)
- Topic 3: Coastal Monitoring and Ocean Technology Development
- Topic 4: Climate Change and Critical Mega-fauna Profiling and Tracking
- Topic 5: Coastal Ecosystem Research, Management and Conservation under Climate Change

3) CLIMATE CHANGE COORDINATION, EDUCATION (K-GRADUATE) AND OUTREACH

- Topic 1: Climate Change Education through Gaming and Visualization
- Topic 2: Climate Change Education K- University
- Topic 3: Focus on Decision Makers and Outreach

C. Current Climate Change Courses Offered and/or University Contact Name

1. ARC 6598 Sustainability and Tropical Architecture
2. BSC 6936 Climate Change: Ecosystems To Human Health
3. CGN 4930 Dynamic Hydrology
4. EDG 5931 Climate Change Education
5. EGN 4070 Sustainability Leadership for Engineers
6. ESC 2070 The Blue Planet
7. ESC 3704 Environmental Issues in Earth and Atmospheric Sciences
8. EVR 2017 Environment and Society
9. GEA 4275 Human Environmental Interactions
10. GEOC 4280 Water Resources
11. GLY 4241 Environmental Geochemistry
12. GLY 6746 Global Environmental Change
13. MET 2010 Weather and Climate
14. URP 4430 Sustainable Cities
15. URP 4930/ URP 6930 Seminar in Cities and Climate Change Adaptation
16. WST 4349 Green Consciousness

FLORIDA INTERNATIONAL UNIVERSITY

Modesto A. Maidique Campus: Miami, Florida 33174

Biscayne Bay Campus: North Miami, FL 33181

A. Respondent(s)

Dr. Hugh Gladwin, Program Director, Institute for Public Opinion Research; Assoc Prof, Dept of Global & Sociocultural Studies, 394A AC1, Biscayne Bay Campus, Email: gladwin@fiu.edu

Research Interests: Urban growth patterns in South Florida and resultant environmental/social justice implications given requirement for sea level rise planning. Public opinion about climate change. Public understanding of probabilistic climate and weather forecasts. Economic, social, and health impacts of climate change and SLR in Miami-Dade County (work as member of County Climate Change Advisory Task Force). Climate change alteration of hurricane risk mitigation requirements (steering committee work on county local mitigation strategy).

Dr. Palab Mozumber, Assistant Professor, Department of Environmental Studies, University of New Mexico, Email: mozumber@fiu.edu

Research Interests: Socio-economic Impacts of Climate Change. Adaptation Behavior and Decision-making. Economic Analysis of Climate Change Mitigation Options.

B. Current University-Wide Climate Change Research

1. NSF Urban Long-Term Research--Exploratory (ULTRA--Ex) project focused on interaction of globalization and climate change affecting human system and ecosystem functioning/services in South Florida.
2. Florida coastal Everglades long term ecological research (FCE LTER - NSF), climate and disturbance working group (and many other climate change research activities in other parts of the FCE LTER).
3. FIU - Florida Keys Working Group on Climate Change and Sea-Level Rise
4. Socio-economic Aspects of Adaptation behavior.
5. Inundation Mapping using LIDAR.
6. Ecological Impacts of Climate Change and Sea-Level Rise.

C. Current Climate Change Courses Offered and/or University Contact Name

1. Our Coastal Environment from the Bay to the World
2. Global Climate Change: Science, Society and Solutions
3. New Courses in the works

FLORIDA STATE UNIVERSITY

Tallahassee, Florida 32306

A. Respondent(s)

Dr. Eric Chassignet, COAPS Director, FCI Co-Director, Professor, Department of Earth Ocean Atmospheric Science; Email: echassignet@coaps.fsu.edu **Research Interests:** Climate change research involves the role of the ocean in climate variability from the complementary perspectives of coupled ocean-atmosphere modeling and observations. Research emphasis is on the study of the thermohaline circulation, western boundary currents, associated eddies and their impact on the world ocean circulation and on the validation of the HYbrid Coordinate Ocean Model (HYCOM) with data assimilation capabilities.

Dr. James Elsner, Professor, Geography; Email: jelsner@fsu.edu **Research Interests:** How tropical cyclone activity is regulated by climate variability and climate change.

Dr. Vasu Misra, Asst. Prof., Dept. of Earth, Ocean and Atmospheric Science, COAPS, FCI; Email: vmisra@fsu.edu **Research Interests:** We are looking at impact of increased greenhouse gas concentration, urbanization and irrigation on southeast US mean climate and its variability. We are also examining low frequency variations on Florida sea breeze from possibly AMO, and PDO. I am also interested in Asian monsoon climate variability, and changes in the trade wind regime in a changing climate.

B. Current University-Wide Climate Change Research

1. Hurricanes in a changing climate: Tim LaRow, L. Stefanova, Jim Elsner
2. Extra-tropical transition of tropical cyclones in a warming climate: Bob Hart
3. Sea Level Rise: Joe Donoghue
4. Permafrost changes: Jeff Chanton

C. Current Climate Change Courses Offered and/or University Contact Name

1. MET 5533 Tropical Meteorology I
2. MET2101: Introduction to physical climatology
3. Others in the Geography Dept

UNIVERSITY OF CENTRAL FLORIDA

Orlando, Florida 32809

A. Respondent(s)

Dr. Scott Hagen, Associate Professor; Civil, Environmental & Construction Engineering; Email: scott.hagen@ucf.edu **Research Interests:** Coastal dynamics (ecosystem and the human infrastructure) of climate change. Late last year, I received a five-year, \$3M grant from the NOAA / NOS / CSCOR Ecological Effects of Sea Level Rise Research Program (NOAA Award Number NA10NOS4780146) that is focused on the northern Gulf of Mexico. My team includes biologists (landscape ecologist, marine scientist, marsh ecologist, as well as a staff biologist at NFWMD), civil engineers (hydrologist with downscaling expertise, deterministic overland flow and transport modeling, & coastal hydroscience), coastal engineers (tide & storm surge modeling, 3D circulation & transport modeling, and coastal morphology), and last, but not least, a social scientist.

Dr. Reed Noss, Professor, Dept. of Biology, Email: Reed.Noss@ucf.edu **Research Interests:** I am most interested in the biological impacts of sea level rise in Florida and in devising strategies to mitigate those impacts (i.e., adaptation strategies). I have conducted preliminary research on these topics, with a focus on species and natural communities of high conservation concern. I organized and led a symposium on sea level rise in Florida, held at Archbold Biological Station in January, 2010. I am guest-editing a special issue of *Climatic Change* on this issue, which contains some papers from this symposium and a couple new papers. I have no current research, as I am awaiting news on the status of several grants for which I have applied.

B. Current University-Wide Climate Change Research

1. EESLR: Integrated Modeling for the Assessment of Ecological Impacts of Sea Level Rise, Scientific PI: Scott C. Hagen

C. Current Climate Change Courses Offered and/or University Contact Name

1. Water Resources in a Changing Environment, taught by Dr. Dingbao Wang, who is one of two faculty we have hired with expertise in climate change research. The objectives include: To increase the students' knowledge and awareness of the potential impact of climate change and human activities (such as land use change, groundwater and surface water withdrawal etc.) on hydrology and water resources systems at various spatial and temporal scales; For students to understand how to identify research questions of the anthropogenic and climate induced hydrologic change correctly and how to separate and quantify the attribution of human and climate induced change.
2. Conservation biology course, Dr. Noss
3. Others in Process

UNIVERSITY OF FLORIDA

Gainesville, Florida 32611

A. Respondent(s)

Dr. Susan E. Cameron Devitt, Assistant Professor, Dept. Wildlife Ecology and Conservation, UF, Gainesville, FL, Florida Climate Institute, School of Natural Resources and the Environment; Email: scameron@ufl.edu **Research Interests:** I study how climate change affects biodiversity (mostly animals). My main focus is developing predictions of how changing climate affects where species can live. I am interested in how species have responded to climate change in the past (on the scale of decades

to thousands of years) and developing estimates of future change. I am also interested in conservation and management implications of climate change, particularly as it relates to sea level rise in Florida.

Dr. Wendy Graham, Director, University of Florida Water Institute, Gainesville Florida; Email: wgraham@ufl.edu **Research Interests:** Climate variability and change have the potential to dramatically affect the amount and quality of fresh water available at any given time. In addition to extreme events such as floods, droughts and tropical storms, cyclical climate patterns known to affect water resources in the Southeastern United States include the El Niño-Southern Oscillation (ENSO) and the Multi-decadal Oscillation (MDO). Predicted impacts of global climate change including changing weather patterns; higher surface air temperatures; longer, more frequent droughts; shorter, higher intensity rainy seasons; and sea-level rise which will cause salt water intrusion into freshwater aquifers and habitat destruction. Uncertainty about climate variability and climate change may increase competition among water users requiring that critical decisions be made to allocate sufficient water for agricultural use and consumption by cities, for maintaining water reservoirs and ensuring in-stream flows for aquatic ecosystems, and for industrial and energy production and recreational uses. The goal of this research area is to develop and improve predictive tools that allow us to simultaneously manage water resources for multiple uses under the certainties of climate variability, and the uncertainties of climate change. These tools include models that predict the hydrologic impacts of short-term (hourly to seasonal) climate variability and water management decisions, as well as long-term (years to decades) hydrologic impacts of the effects land and water planning decisions and climate change.

Dr. John Hayes, Professor and Department Chair, Wildlife Ecology and Conservation, and Director, Ordway-Swisher Biological Station; Email: hayesj@ufl.edu, **Research Interests:** Although my personal research program is limited, I serve as the UF lead for the National Ecological Observatory Network (NEON) and am interested in linking researchers from the region to NEON and our efforts at the Ordway-Swisher Biological Station.

Dr. Keith Ingram, Coordinator, Southeast Climate Consortium, Associate Research Scientist, Department of Agricultural and Biological Engineering; Email: ktingram@ufl.edu, **Research Interests:** Providing locally relevant information and scenarios to planners and decision makers. Assessing vulnerabilities, potential impacts, and adaptation strategies.

Current research: Assessing regional capacity for climate change research, information dissemination, and adaptive responses to anticipated climate changes, including:

1. Literature and web searches for assessment frameworks that have been successfully implemented in other regions and nations.
2. Social network analysis to identify key institutions, individuals, and communities based on results from literature and web searches.
3. Decision maker surveys to assess their perceived needs for climate change information and potential adaptive responses to perceived climate change threats.
4. Key stakeholder interviews: i) to identify priority issues and information needs for current and potential future climate sensitive decisions; ii) to ascertain how decision makers value climate information and their sources of climate information; iii) to investigate stakeholder perceptions of their vulnerability to climate change at different time scales; iv) to assess stakeholders' perceptions of the relative importance of climate information in their decision environment; v) to identify policy issues of concern to stakeholders; and vi) to identify the best methods for engaging stakeholders in research and assessment processes.

Dr. James Jones, Distinguished Professor, ABE, Director, Florida Climate Institute, Co-Leader of the Southeast Climate Consortium.; Email: jimj@ufl.edu **Research Interests:** Modeling dynamic crop, soil, climate, and management interactions; climate variability and climate change impacts on agricultural systems; research on climate change adaptation and mitigation management of soils and crops; decision support systems for climate risk management in agriculture and water resources; integration of crop and other models from molecular to field and broader scales; providing leadership in communities of agricultural systems modeling. Lead Developer of the Florida Climate Institute, a joint institute of the University of Florida and Florida State University for interdisciplinary research and education on societal responses to climate change. Co-developer /co-leader of the Southeast Climate Consortium, a NOAA Regional Integrated Science Assessment (RISA) Center of six universities in three SE states. This Center conducts research on climate change/variability for use in adaptive management of agriculture and natural resources and develops web-based decision support systems and outreach programs for engaging stakeholders. Developed dynamic models for important food crops that are now used worldwide for research on impacts of and adaptation to climate change and climate variability. Founding developer of an international consortium (www.ICASA.net) that developed data and interface protocols for integrating models of soil, climate, crops, and management for use in research on management of cropping systems and assessment of climate effects on production of crops. Organizer and teacher in many courses worldwide on concepts and applications of agricultural systems models for assessment of climate and management responses during the last twenty years.

Thomas Ruppert, JD Florida Sea Grant College Program, Coastal Planning Specialist; Email: truppert@ufl.edu, **Research Interests:** My research interests on climate change primarily relate directly to sea-level rise (SLR) and local government planning. This includes coordination with other Sea Grant programs, NOAA, non-profits, and state agencies in Florida and regionally, particularly in the Gulf of Mexico.

As an attorney, my focus is on legal issues with implementation strategies, particularly federal (constitutional) and state (statutory) takings law. Another focus, due to extensive statutory requirements, is the role of comprehensive planning in implementation of adaptation policy. Work with communications experts and stakeholders has indicated that with many communities, the best method to approach such work with communities not already explicitly addressing SLR is to begin with engagement in the area of hazard mitigation and coastal resilience. This has the benefit of being less politically charged and threatening than initial insistence on directly addressing SLR and takes advantage of federal requirements (such as the requirement that local governments develop a Local Mitigation Strategy) and state requirements (such as development of a Post-Disaster Recovery Plan and specified elements of the Coastal Management Element in local comprehensive plans).

Specific current projects include a cooperative project with other attorneys around the Gulf of Mexico examining the takings law impacts on adaptation options.

In addition, Florida Sea Grant is also facilitating the local government use of the Coastal Resilience Index to promote local government work on coastal resilience issues.

B. Current University-Wide Climate Change Research

Topics per Dr. Susan Cameron Devitt:

Wildlife management and climate change, invasive species and climate change, physiological and genetic adaptation to changing environments.

Funded Grants:

1. Agricultural Model Intercomparison and Improvement Project (AgMIP), Jones, James W

2. Assessing the Vulnerability of Florida Coastal Highways & Bridges to Hurricane Induced Storm Surge and Coastal Flooding Damage, Sheng, Yeayi P
3. Caribbean Food Systems Vulnerability to Global Environmental Change, Jones, James W
4. Climate Information System for Agriculture and Water Resource Management in the SE USA 2009, Jones, James W
5. Decision Support System for Reducing Agricultural Risks Caused by Climate Variability, Jones, James W
6. Decision Support Systems to Evaluate Global Environmental Change and Food Systems, Jones, James W
7. Development of a Prototype SURA-SCOOP Modeling Grid, Sheng, Yeayi P
8. Development of a Gene-Based Ecophysiology Model, Jones, James W Co-PI
9. Downscaling and Applying Climate Forecast in Agriculture, Jones, James W
10. Estuarine Response to Extreme Events-The GTMNERR Case Study, Sheng, Yeayi P
11. The Florida Climate Institute and NSF Science and Technology Center to understand and respond to climate, Jones, James W
12. Hurricane Suiter Simulation to Support FDEM's Hurricane Exercise, Sheng, Yeayi P
13. Iconic Agricultural Crops: Climate Change Impacts on Peanut, Cotton, and Corn in Georgia and Florida, Jones, James W
14. Integrated Crop Management Information System under Current and Future Climate Conditions, Jones, James W
15. Integration of NASA Models and Missions into Agricultural Decision Support, Jones, James W
16. Regional Applications of Enso-Based Climate Forecasts, Jones, James W
17. Risk Reduction for Specialty Crops in the Southeastern U.S.A., Jones, James W
18. State of Florida Hatch fund appropriation, Climate Center seed funding, Jones, James W
19. Understanding and Predicting the Impact of Climate Variability and Climate Change on Land Use and Land Cover Change via Socio-Economic Institutions in Southern Africa, Southworth, Jane
20. Use of Intra-seasonal and Seasonal Forecasts to Reduce Risk in Regional Public Water Supply Management, Martinez, Christopher J
21. Use of Seasonal to Multi-Decadal Climate Forecasts and Predictions for Public Water Supply Planning, Graham, Wendy Dimbero
22. Using Climate Forecasts to Improve Tomato Production , Jones, James W
23. Civil & Coastal Engineering: research on probable changes to storm surge extent under various SLR scenarios (Dr. Peter Sheng)
24. Florida Sea Grant: Assessments of coastal issues in Citrus and Wakulla counties, including issues related to climate change
25. Florida Sea Grant and Dept. of Urban & Reg'l Planning: Research linking property appraisers' database records with elevation data to establish statewide, regional, and county estimates of loss of property tax base revenues under various SLR scenarios; research currently very coarse; will be ongoing to make more precise and explore other ways of dissecting information already in the database. (Thomas Ruppert, Dr. Paul Zwick)
26. Florida Sea Grant and Dept. of Urban & Reg'l Planning - Proposal to Fla. Dept. of Community Affairs to conduct a feasibility analysis and benefit-cost analysis of different adaptation responses for climate change at the parcel level in Okaloosa and Martin counties; research would include analysis of Okaloosa and Martin county comprehensive plans and review of other comprehensive plans for models; web-based summary of project would be included. (Dr. Gene Boles, Dr. Dawn Jourdan, James Nicholas, Thomas Ruppert, Dr. Stanley Latimer)
27. UF Dept.of Urban & Reg'l Planning: Assessment of vulnerability and resilience of transportation infrastructure under SLR scenarios (Dr. Zhong-Ren Peng)
28. UF Law: Research on law and policy related to SLR consideration in siting and construction of Turkey Point Nuclear Reactor; past research on adaptive planning options

C. Current Climate Change Courses Offered and/or University Contact Name

Contact Name: Jim Jones, Director, Florida Climate Institute

1. GEO 5809: Geography of World Agriculture (3) World distribution of crops and livestock related to natural and cultural conditions. Agricultural problems related to products, economic organization, agricultural regions, and the significance of world affairs.
2. GEO 5945C: Field Course in Geography (3) Methods of geographical fieldwork. Observation, classification, interpretation, note-taking, traversing, and mapping of data. Aerial analysis; landforms, climate, vegetation, soils, resources, settlement patterns, and land use.
3. GEO 6118: Contemporary Geographic Thought and Research (3) *Prereq: admission to graduate program in geography.* Summary of major currents of intellectual thought and research orientations in contemporary geography.
4. GEO6255: Climatology - *Course taught by Dr. Corene J. Matyas*
5. GEO 6375: Land Change Science Seminar (3) Interdisciplinary study of land use and land cover change dynamics and their relationship with global environmental change.
6. GEO 6495: Environment and Behavior (3) *Prereq: graduate standing.* Theoretical and empirical analysis of how people perceive and interpret ordinary environments and their influence on well being.
7. MET 5504: Weather and Forecasting (3) *Prereq: familiarity with basic meteorology.* Skill development in predicting and discussing daily weather patterns using meteorological instruments to collect data and analyze weather events. *Course taught by Dr. Corene J. Matyas*
8. MET 6530: Hurricanes (3) *Prereq: familiarity with basic meteorology.* Meteorological and climatological concepts related to hurricanes. Forecasting current activity; researching past storms; and analyzing storm structure, damage, and future trends. *Course taught by Dr. Corene J. Matyas*
9. MET 6752: Atmospheric Data Analysis (3) *Prereq: MET5504 or MET6530, or consent of instructor.* How atmospheric data is collected and analyzed both for meteorologic and climatologic-scale research. Learn where to obtain various types of data and how to analyze data to answer specific research questions. *Course taught by Dr. Corene J. Matyas*
10. GLY 5075: Global Climate Change: Past, Present, and Future (3) *Prereq: GLY 4552C.* Evolution of the Earth's climate through geologic time, including discussion of modern climatology and methods of paleoclimate interpretations. *Course taught by Dr. Ellen Martin*
11. GLY 6695: Topics in Paleoclimatology (4; max: 12) *Prereq: undergraduate degree in geology or consent of instructor.* Studies of paleoclimates and interpretation of climate change from rock record.
12. WIS6934: in Species Distribution Modeling. Approximately 1/3 of this graduate level course focuses on developing models to predict climate impacts on species distributions. It is anticipated that this course will be offered every other spring. *Course taught by Dr. Susan Cameron Devitt*
13. WISXXXX: An undergraduate course on Case studies in Climate Change Ecology, will be offered every spring, starting 2012

Comment from Dr. Keith Ingram: If we are to be relevant, we need to also consider climate variability at seasonal and decadal time scales. If we focus exclusively on climate change at 50 to 100 years or longer time scales, we will not meet the needs of most decision makers. Similarly, courses on basic climate sciences that might include a section on climate change are probably more important for student education than courses that address only climate change.

UNIVERSITY OF MIAMI

Coral Gables, FL 33124

Rosenstiel School of Marine and Atmospheric Science, Miami, FL 33149

A. Respondent(s)

Dr. David Letson, Professor, RSMAS, Email: dletson@rsmas.miami.edu, **Research Interests:** Climate adaptation in agriculture and water resources.

Dr. Craig Mattocks, Atmospheric Research Scientist, RSMAS/ Division of Meteorology and Physical Oceanography, Email: cmattock@rsmas.miami.edu **Research Interests:** (1) Running high-resolution climate simulations with a icosahedral global climate model (OLAM) to investigate the impact of anthropomorphic changes to the landscape on the rainfall in Florida and the Caribbean. (2) Developing a climate-driven coastal flood modeling system to guide policy makers, planners and managers in making decisions that will help communities adapt to the risk of sea-level rise under current and future climate warming scenarios and build sustainable, hazard-resilient coastal communities?

B. Current University-Wide Climate Change Research

Climate: Research covers a wide range of topics, both global and regional. We study climate variations on time scales from sub-seasonal to interannual to decadal, as well as ancient (paleo) climates and future climate changes. Efforts include analysis of satellite data, field observations and global data products, and a large focus numerical climate modeling.

<http://www.rsmas.miami.edu/academics/divisions/meteorology-physical-oceanography/research/>

<http://www.rsmas.miami.edu/groups/climate/>

<http://www.rsmas.miami.edu/people/tag/climate/>

C. Current Climate Change Courses Offered and/or University Contact Name

1. **MSC 102 - Introduction to Atmospheric Science (3 cr)** Structure, physics, dynamics and thermodynamics of the atmosphere; weather phenomena weather forecasting, climate and climate change. Contemporary topics covered in this class include global warming, the ozone hole, hurricanes and El Nino.
2. **MSC 220 - Climate and Global Change (3 cr)** The Earth's climate system and the role of natural and anthropogenic processes in shaping climate change.
3. **MSC 415 - Coral Reef Science and Management** The interdisciplinary nature of coral reef science and management: biological, environmental, ecological and socioeconomic aspects of coral reef science, coral reef management problems and approaches at local to global scales, and the implications of climate change for coral reef science and management.
4. **RSM 571 – Sustainability**
5. **MGG 676 – Paleoclimatology**

UNIVERSITY OF SOUTH FLORIDA

Tampa, FL 33620

A. Respondent(s)

Dr. Gary Mitchum, Professor, College of Marine Science, Email: mitchum@marine.usf.edu **Research Interests:** I work on estimates of total sea level change from tide gauges and satellite altimetry. An emphasis for me is whether the observed rates (not the sea level height, but rates of change of the height) are consistent or not with past observed changes at the decadal to centennial time scale.

I am also interested in the dynamics of decadal variations in regional to global scale sea level changes whether these changes are natural or anthropogenic. This interest includes decadal to centennial

modulations in wintertime storminess, which I suspect might be very important for determining human vulnerability to climate change.

Dr. Joseph M. (Donny) Smoak, Associate Professor, Environmental Science, St. Petersburg; Email: smoak@mail.usf.edu, **Research Interests:** My research focuses on wetland carbon sequestration and the role wetlands play as potential positive or negative feedbacks in climate change. I examine freshwater wetlands and mangrove systems (coastal wetlands) to assess the wetlands current contribution to the global carbon budget (i.e., over last 100 years), and how the contribution may change as the climate warms and sea level rises. I use sediment cores and Pb-210 dating to make these assessments. I currently have projects at several sites in Brazil and in the Florida Everglades.

Dr. Mark Stewart, Professor, Geology Department, Univ. of South Florida-Tampa; Email: mark@usf.edu, **Research Interests:** (1) Mathematical modeling of geologic carbon sequestration (2) Determining the effects of climate change on stream flow and water resources in Florida (3) Carbon sequestration pilot project, Polk County, Florida.

Dr. Kalanithy Vairavamoorthy, Director School of Global Sustainability, Director Patel Center for Global Solutions (also Full Professor in Department of Civil Engineering); Email: vairavk@usf.edu, **Research Interests:** My research concerns the effects of global change on urban water management. My current research is looking into how to make urban water systems more flexible so they can respond to uncertainties associated with global change.

I am also the Scientific Director of research project called SWITCH (www.switchurbanwater.eu). SWITCH is one of the largest water research projects funded by the European Union. The project involves 32 partners from across the globe, including 17 from the EU and 12 from developing countries. The aim of SWITCH is to develop scientific, technological and socio-economic solutions for the sustainable and effective management of water in the city of the future (2050) - a city facing major global change pressures.

A focus of my research is how to design and manage urban water systems in an uncertain world (as external pressures like climate change show a great degree of uncertainties). Hence we have looked at how to best describe uncertainties, and developed frameworks to generate flexible water systems that are robust and adaptable to new, different, or changing requirements. For example, we have investigated the potential of small-scale decentralized storm-water options that provide internal degrees of freedom, allowing many different combinations to be considered (hence flexibility can be optimized over time). Such strategies could be important climate change adaptation strategies.

Another focus area has been on transitioning systems so that they can cope with climate change. The tendency has been to see urban form as fixed. However, if we want to develop more adaptable and robust systems that can cope with climate change, we need to develop effective transitional pathways that allow the system to function over time while moving it from its existing trajectory to an optimal trajectory. Transitioning is not only about infrastructure – we also need to know how to transition our institutional frameworks so that they are better suited to manage our resources in more intelligent and sustainable way.

B. Current University-Wide Climate Change Research

Research studying changes in the Earth's gravity field (i.e., water mass redistribution between the land and ocean), we have strengths in remote sensing of a variety of variables, and also have strengths in paleo-oceanography and climate modeling.

Dr. Smoak's Research:

1. Carbon capture and sequestration
2. Effects of climate change on hydrologic systems
3. Effects of climate change on ecosystems
4. Clean energy research: solar, hydrogen fuel cells

Research at the School of Global Sustainability and the Patel Center for Global Solutions:

The Patel Center is coordinating the project 'Resilient Tampa Bay'. As Tampa Bay will become more vulnerable due to climate change (sea level rise, more extreme events etc.), this project is looking out how we can improve its resiliency. The project is demand driven, where an alliance of stakeholders are working with USF to establish a relevant and meaningful research programme. This includes looking at how urban planning can improve resiliency, how natural systems can improve defenses, and how greater integration between different agencies can lead to a more coherent approach to resiliency.

One of the main priorities of the Patel Center is to develop a training kit that will help coastal cities worldwide to improve their resiliency and reduce their vulnerability. This training program called 'Resilient Coastal Cities' will be tested in several coastal cities along the Gulf of Mexico in the next 12 months. The training kit will be launched on the Coastal City Summit in April 2012 in St. Petersburg.

USF is also part of the 'Coastal Area Climate Change Education' (CACCE) Partnership. The goal of this partnership is to develop a comprehensive climate education plan to educate K-12 and college students about the impacts of global climate change. It is expected, that these educational efforts will have broad impacts for adapting to and mitigating the socio-economic challenges that global climate change will impose upon coastal communities.

C. Current Climate Change Courses Offered and/or University Contact Name

Tampa Campus:

1. GLY 2073 Global Climate Change, Mark Stewart, Geology, USF mark@usf.edu
2. EVR 2217 Energy, Environment, and Sustainability, Yogi Goswami, Civil and Env Engineering
3. Global Warming: Science and Politics, Jeff Cunningham, Civil and Env Engineering
4. PSC 2515 Energy and Humanity, R. Criss, Physics

College of Marine Science:

A variety of courses in remote sensing,
A core curriculum in ocean, atmosphere dynamics,
A strong set of courses in statistics and data analysis methods,
A course covering the global hydrologic cycle,
Several courses in numerical modeling methods for the ocean and atmosphere, and
Courses in the physics of decadal to centennial ocean, atmosphere variations.

St. Petersburg Campus:

EVR 4934 / EVR 6934 Global Climate Change. Undergraduate and Graduate level every other year

Dr. Kalanithy Vairavamoorthy: It is not possible to provide a complete list of climate change related courses at USF. However, I list the following:

- Weather, Climate and Society (Prof. Jennifer Collins)

- Climatology (Prof. Jennifer Collins)
- Climate change and health (Prof. Connie Mizak)
- Paleoclimatology (Prof. Philip Edward van Beynen)
- Climate Change (Dept. of Geography, Environment and Planning)
- Global Climate Change: A Geoscience Perspective (Dept. of Geology)
- Global Climate Change: Past and Future (Prof Benjamin P. Flower)

Please note that there will be several other courses that I'm currently not aware of, and also many courses that include a strong element of climate change within them.

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State University System Climate Change Workshop

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