

RISK AND RESPONSE: SEA LEVEL RISE SUMMIT

THE FUTURE OF FLORIDA AND THE COAST

June 20-22, 2012

Marriott Boca Town Center, Boca Raton FL

FINAL REPORT

**Prepared by Florida Atlantic University's
Center for Environmental Studies (CES)**

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EXECUTIVE SUMMARY:

Climate Change and Sea Level Rise are Critical Issues for Southern Florida

South Florida's agencies are very familiar with the challenges related to climate change and sea level rise. We recognize that we must plan and adapt our communities to be sustainable in a dynamic and complicated future. The ocean has risen 8" - 9" in the last 100 years. The problems that we are facing in Florida will impact all facets of life: the insurance and protection of our homes and communities; the transportation infrastructure; the water supply and flood control infrastructure; the maintenance of our beaches; and being able to sustain our environmental resources as a basis for Florida's tourism, fisheries and agricultural economy. It may sound like a formidable challenge, but the time for preparation and planning is now. It is time to turn this challenge into a unique opportunity, creating new sustainable methods for adapting and thriving.

In 2006, scientists at Florida Atlantic University (FAU) recognized that sea level rise impacts were clearly apparent and on their way to becoming a critical issue for the region. FAU responded by identifying climate change and sea level rise impacts as a central, university-wide research and outreach priority. The Center for Environmental Studies (CES) has taken the lead by managing the Integrative Collaborative on Climate and Energy (ICCE) that links faculty education and research efforts of more than 80 faculty members in the Colleges of Biology, Geosciences, Engineering, Education and Business. The Florida Climate Institute links and expands the research and education being conducted by a group of Florida's universities.

At a regional level, local communities and elected officials have created the Southeast Florida Climate Change Compact to plan for regional adaptation. The Compact was so successful that the Seven50 Initiative received federal support to develop a 50-year regional plan for the seven Southeastern Florida counties that includes a long-term plan to address the impacts of sea level rise. We recognize that there is a strong desire from citizens for smart, sensible policies that will address impacts that are already evident in our communities such as:

- During high tide events, sea waters frequently rise through the drainage systems, flooding low-lying urban areas in Broward and Miami-Dade counties with polluted water;
- Saltwater is intruding into coastal drinking water wells;
- Drainage canals, designed fifty years ago, no longer function properly; and
- Storm surge eroded and flooded a section of A1A in Ft. Lauderdale costing millions of dollars.

In order to counteract, or at least ameliorate these current impacts, it is critical for Florida's leaders to embrace energy use plans that emphasize emission reduction and incentives for the use of clean energy. These regulations need to be implemented with incentives for the development of alternative energy sources such as solar, wind, as well as creative long-term options, such as harnessing energy from the Gulfstream. FAU's College of Engineering and Computer Science is conducting a cutting edge, ocean energy research project under a contract with the US Department of Energy. FAU, the Southeast Florida Climate Change Compact, and our South Florida partners continue to lead the way and work towards building a resilient and sustainable future by conducting research and coordinating conferences that discuss important policy and planning issues addressing climate change and sea level rise.

For information on upcoming events online: www.ces.fau.edu/SLR2013 and

<http://southeastfloridaclimatecompact.org/2013-broward-county-in-fort-lauderdale/>



1.0 Introduction

On June 21 & 22, 2012, Florida Atlantic University's Center for Environmental Studies (CES) hosted the "Risk and Response" Sea Level Rise Summit in Boca Raton, Florida with over 300 attendees from the private and public sectors. The Summit had many sponsors including the US Geological Services (USGS), Florida Sea Grant, The Flora Foundation, University of South Florida's (USF) Patel School for Global Sustainability, Coastal Areas Climate Change Education (CACCE), National Oceanic and Atmospheric Administration (NOAA), Wells Fargo, National Resources Defense Council (NRDC), The Community Foundation of Palm Beach and Martin Counties, RenaissanceRe, The Northeast Regional Council and The Florida Climate Institute. The purpose of the Summit was three-fold:

1. To highlight the interrelationships between sea level rise, saltwater intrusion into fresh water aquifers and water management in Florida;
2. To share the ongoing sea level rise responses, adaptations and planning underway by agencies, institutions and civic organizations; and
3. To compare Florida's challenges and responses with other vulnerable localities in the US and worldwide.

The Summit was opened by keynote speaker Dr. Margaret Davidson, Director of the NOAA Coastal Services Center, who delivered a powerful message that:

- ***Science, coordination and communication are the successful elements needed for our future as a sustainable and resilient society.***

She reminded us that risk should drive decision-making; however, it rarely does. In the US, 59% of coastal cities have developed a climate change adaptation plan, which is close to the worldwide average of 58%, but far behind South America's 95%. Only 12% of US cities have done a vulnerability assessment. Her message was that we need to expand the audiences, get them engaged, use stories, communicate the cost, not the cause of climate change, and have a positive message. To get the public engaged, you must start with issues that concern people, and then make them laugh! Climate change is everyone's problem. We need to be creative, resilient and work together to find solutions.

The Summit featured seven panel sessions composed of experts in their specialized fields that discussed the complex sea level rise (SLR) issues in Florida. The panelists provided intriguing examples from Florida and other coastal regions within the U.S. and internationally.

The sessions were:

1. **Sea Level Rise and Florida: A Complex and Unique Relationship**
2. **Managing Risk: Organizing for an Uncertain Future**
3. **Economic Implications: From Insurance to Tourism**
4. **Impacts on Built Environments: Urban Planning**
5. **Impacts on Built Environments: Water Utilities, Energy and Transportation**
6. **Collaboration: Organizational Structures**
7. **Public Engagement: Communication, Outreach and Education**

2.0 Pre-Summit Events

The Summit kicked off with engaging activities that took place on Wednesday, June 20. There was a media and networking poster reception, followed by the screening of Filmmaker Briar March's moving documentary, "*There Once was an Island.*" The film highlights the impacts of sea level rise and climate change and the difficult decisions facing a native island community near Papua New Guinea.

Students, experts, the media and general public networked during the poster session and reception. More than 40 posters represented local, state and national government agencies, researchers, planners, students and universities.



Leah Booher explains her SLAP pole project to Ambassador Richard Benedick

The posters were categorized as:

- SLR Impacts on the Built Environment
- Economic Impacts: Partnerships – Organizing for Climate Change
- Preparing for the Future: Adaptation & Mitigation
- Education: Explaining the Problem, Sharing the Message

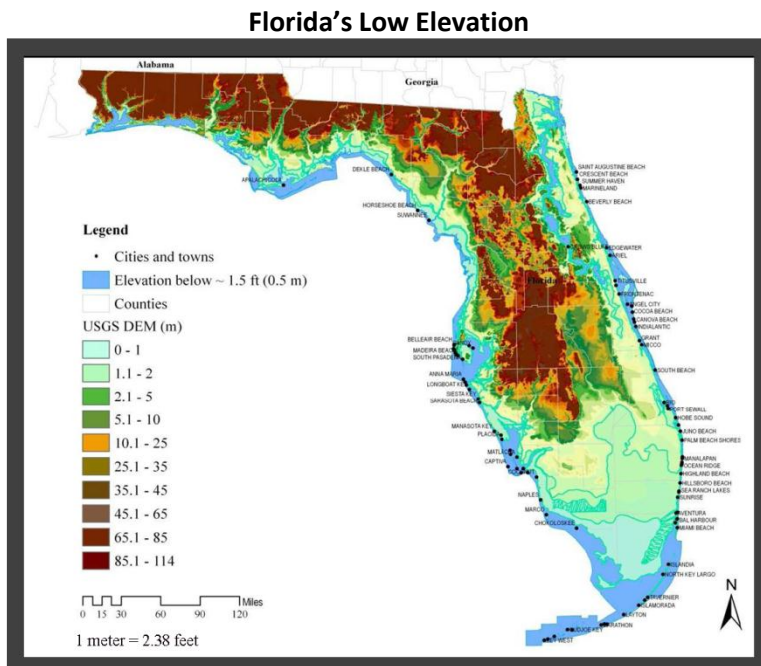
The posters remained on display throughout the Summit and served as a springboard for lively discussions. A very popular addition was the Sea Level Awareness Pole (SLAP) created by local high school students. The eight foot high display illustrated SLR impacts such as reduced acreage and flooding of roads, schools, airports, etc. It displayed two conservative estimates of one and two feet of sea level rise.

Continuing education credits (CEUs) were made available for attendees by the Florida Chapter of the American Planning Association, Certified Floodplain Managers and Florida Board of Professional Engineers.

3.0 Summit Presentation Sessions

3.1 Session One: Sea Level Rise and Florida: “A Complex and Unique Relationship”

The objective of the first session was to have the speakers focus on the current rates of sea level change, potential acceleration changes and the impacts that are already being experienced. The bathtub model was used to explain how warming of the oceans (thermal expansion) and melting of continental ice sheets contribute to rising seas. In 1920, the global sea level was rising at a rate of 1 mm per year, by 1990 the rate was 2 mm per year, and since 1990 it has been 3 mm per year. Tide gauges throughout the world and satellite altimetry are tools used to measure change over time. Satellite data and tide gauge data are in harmony, showing that sea levels are accelerating along the northeast US coast, north of Cape Hatteras, North Carolina. In Florida, sea levels are steadily rising at a fairly constant rate, but more data are needed during the next 20-30 years to answer the sea level rise questions about acceleration rates.



Florida's population centers are at risk with 1,197 miles of coastline vulnerable to SLR, storm surge and flooding. In the US, 4.9 million people live below an elevation of 4 feet; almost half of these (2.4 million people) are living in Florida. There are 107 towns and cities in Florida where over half of the residents live along the coast below 4 feet in elevation (Strauss, 2012). Organizations in South Florida have taken the lead in planning for the risk associated with sea level rise. A map showing

the next generation of risk is being developed by Climate Central and will be used to graphically depict and tell the story of sea level rise to help initiate and direct policy changes.

There are many impacts already observed in South Florida as a result of low elevation and rising seas. Coastal flooding is being experienced as flood control structures operate less efficiently and various flood gates cannot be opened at high tide. Salt water intrusion is a critical issue as Florida’s porous limestone geology allows the salt water to infiltrate fresh water well fields (South Florida’s primary source of drinking water) along the coast and inland. The presence of salt water in the surficial aquifer and fresh water wells appears to be accelerating. The Florida Everglades and fresh water wetlands face the challenges of peat collapse and sea level rise that affect natural and developed landscapes and wildlife habitat. Local, regional, state and federal agencies in Florida are working together to develop plans to address these challenges. The South Florida Water Management District (SFWMD) has plans to replace existing gravity fed flood control structures with pump stations; however, it is an expensive option. Measures such as the Comprehensive Everglades Restoration Plan (CERP) and implementing water conservation practices can aid in holding back salt water intrusion by maintaining a fresh water supply. The USGS and Massachusetts Institute of Technology (MIT) are developing a landscape plan that will map the vulnerable ecological areas that can be designated as protected in the future. While it can be difficult to predict the imminent nature of SLR or the impacts that it will have on Florida’s communities, there are regions in Florida that have started planning and taking action to protect their communities.

➤ ***Adaptation is the key to survival as communities will need to evolve to meet changes in our coastal environment.***

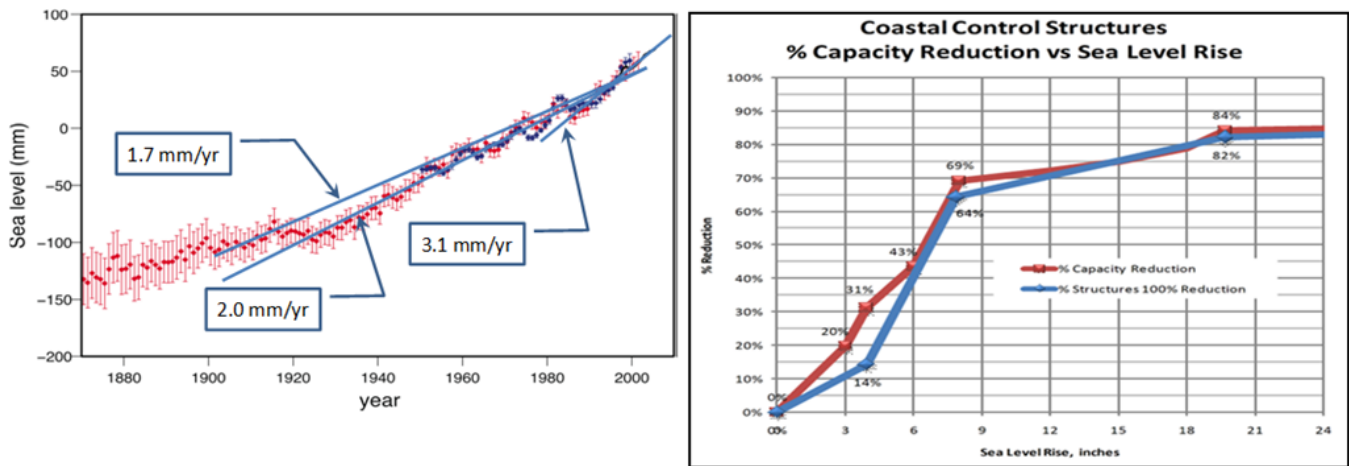


Figure 1. Changes in the rate of sea level rise over the past century (left), modified from IPCC, 2007. Increased sea level effects on the capacity of flood control structures (right), Obeysekera, SFWMD, 2009.

3.2 Session Two: Managing Risk: Organizing for an Uncertain Future

The focus of this session was to understand Florida's mitigation and adaptation planning practices. Goals, such as flood protection and hurricane resilience, have economic and environmental benefits regardless of timing and scope. During the redevelopment of areas affected by extreme events, SLR adaptations should be integrated into the long term recovery process. Recovery funds received after catastrophic events should be mandated to incorporate mitigation and adaptation strategies in redevelopment and recovery plans. Local communities are beginning to implement this strategy. This session identified several successful examples by federal agencies, the state of Florida, regional planning councils and municipalities.



NOAA's Dr. Margaret Davidson Delivers a Powerful Keynote Presentation

On the federal level, the National Flood Insurance Program analyzes past risk data to help determine future risk when considering the long term life of structures. The Federal Emergency Management Agency (FEMA) focuses on future risk and more effective protection. The National Disaster Recovery framework (resiliency and sustainability) addresses the risk in building codes including energy efficiency, SLR and hurricane resiliency. The emergency risks that will increase due to SLR need to be addressed from the local, state, regional and community level to ensure that vulnerable communities can be protected.

On the state level, the FL Department of Economic Opportunity's Division of Community Development offers technical assistance to local governments on coastal issues. The

Community Resilience System Initiative incorporates pre-disaster plans that assess vulnerabilities at the community level, and consider how to pre-plan for long term recovery. They are exploring new management options for beach restoration for coastal communities. This five year planning initiative involves building partnerships and identifying pilot adaptation action areas.

On a regional level, counties within the Southwest Florida Regional Planning Council (SWFRPC) are already working collectively, along with Southeast Florida's Monroe, Miami-Dade, Broward and Palm Beach Counties. Florida's regions will be affected by sea level rise in different ways. One effective method of communicating the impacts of SLR to the public is to illustrate the dramatic changes in the landscape that are already occurring.

At the county level, a pilot program in Broward County is developing a menu of options and processes for integrating SLR adaptations into policies and incentives. They are integrating SLR mitigation options into their comprehensive plan. Leading by example, proactive government agencies can share successful strategies and methods for adapting to SLR in their communities.

On a local level, a key recommendation is to include SLR adaptation plans in one's local comprehensive land use plans. For example, the City of Punta Gorda's plan is based on vulnerabilities and adaptations that the community identified and prioritized and integrates plans for relocation areas. They have mapped areas of the City that will not be armored and placed adaptation action areas in their comprehensive plans. They are working with The Nature Conservancy to maintain natural shorelines, with the goal of living with the environment, and considering wildlife migration. The City is already seeing shifts in plant communities, for example, salt marshes have migrated inland about the length of a football field due to higher tides and sea levels. They have found that hardening coastal areas with seawalls is not the only alternative and in some areas increasing wetland buffer zones can be a more effective option.

Emergency management is beginning to embrace an uncertain future due to climate change and SLR. Adopting a mitigation strategy program is a tool for looking at all hazards and identifying vulnerabilities. Agencies can prioritize strategies for adaptation and mitigation then approve cost-effective actions to implement. The impacts of SLR, such as storm surge and salt water intrusion, are considered emergency hazards.

- ***Public and private partnerships are essential; especially where the private sector drives resiliency initiatives and the government supports them by implementing policies that address SLR and methods to protect vulnerable communities. The risk of SLR must be borne and addressed by the whole community, not by the government alone.***

3.3 Session Three: Economic Implications: From Insurance to Economic Well-Being

The speakers on this panel session discussed how the impacts of SLR would affect insurance rates, real estate values and codes, land use and the densely populated built environment along Florida's coastlines. The new risks associated with climate change and SLR have complicated the already challenging insurance industry in Florida.

The panelists emphasized that the insurance industry is aware of SLR issues and are already beginning to respond. They addressed the importance of insurance companies working with municipalities to plan and mitigate for future impacts instead of avoiding the issue. Insurance companies struggle with an imbalance between keeping rates affordable while properly managing risk.

Florida's Alliance of Safe Homes was formed after hurricane Andrew in the 1980's to help recovery efforts deal with contractors and home owners to establish safer building codes. For the first time, flood provisions have been incorporated into the building code, so positive change has begun.

AIA in Ft. Lauderdale Post-Sandy
Photo: Broward County Natural Resources
Planning & Management Division



In the years following back to back hurricanes, insurers, like state-owned Citizens Property Insurance had to step in to subsidize the market so that Florida residents could be insured. There are three main insurance subsidies in Florida: the National Flood Insurance Program, Citizens Coastal Policies Group, and the Florida Catastrophe Fund reinsurance. Insurance is intended for sporadic events, hurricanes, storm surge, not an ongoing issue like SLR. The State of Florida is working on methods to attract private capital and agencies back to provide insurance coverage in the state.

The panelists also discussed the impacts of high insurance assessments on the economy. They voiced concerns that the increased awareness of SLR could scare people away from Florida and negatively affect the local economy. Florida faces a very difficult challenge. How do we manage Florida's built environmental for the risk of SLR? Do we continue the expensive subsidy programs that support rebuilding along the coast and in vulnerable communities?

- ***The experts all agreed that solutions lies in adaptive management and mitigation planning for the impending effects of climate change, SLR and related uncertainties.***

This is true particularly for utilities. The most cost-effective way to reduce risk is by reducing power plant emissions. Utilities need to start planning for and identifying cost-effective mitigation measures, as doing nothing will cost them much more in the long run.

3.4 Session Four: Impacts on Built Environments: Urban Planning

This session provided a definition of the built environment as the *collection of buildings where we live, play, work and procreate*. The coastal built environment has a substantial economic value at risk. Reports indicate that with every vertical foot of SLR there is a 10% increase in water flow velocity and 200 feet of horizontal inundation. Early warning systems protect people but not built environments.



Speakers Ray Butts, FP&L and Jeff Williams, Entergy

The panel discussed how urban planners address infrastructure and housing adaptations needed for projected increases in SLR. What is the future of Miami, the Florida Keys, Northeast Florida, San Francisco, and Cancun, Mexico? In Miami-Dade County alone, there are over 250,000 residential coastal structures, valued over \$50 billion, which are currently vulnerable to storm surge (Alvarez, 2012). A vision from presenter Daniel Williams theorized that the combination of SLR and higher

taxes to rebuild infrastructure will result in an isolated and expensive island community that he referred to as the “Miami Keys.” The area would be sustainable, but reliant on rainfall for fresh water and local solutions for power and sewage.

Other panelists shared the vision of urban centers in which the built environment was reinvented for resilience. These included short and long-term adaptations, along with modifications to individual structures. Short term options included modifying existing water management structures to reduce flooding and enhancing natural coastal defenses. Another option included installing mangrove and wetland buffers along urban coastal areas to help absorb storm surge and coastal flooding. These types of short term adaptations are necessary to gain time to work on long term modifications such as improving building standards and reengineering coastal infrastructure to resist storm surge and sea level rise.

Monroe County, which includes the Florida Keys, is very vulnerable to SLR but continues to be proactive. Committees representing different agencies, architects and community groups meet regularly to develop action plans that also include the residential community. They are planning to integrate climate change and SLR into their comprehensive master plans. Examples of their proactive actions include new infrastructure being built two feet above code (although the code has not been changed and it is not yet required) and buildings and infrastructure in Key West must be green-certified. In addition, outreach programs are educating residents how to prepare for impacts of SLR including flooding and storm surge; however, the message is delivered so as not to alarm residents.



2012 Western Palm Beach County Flooding Photo: Gary Coronado

Northeast Florida does not have the same urban coastlines as South Florida. In this region of the state, 50% of the land is still forested and they prefer incentives to regulations. The NE Florida Regional Council partnered with the Urban Land Institute and conducted analysis of the anticipated growth with input from counties. They were challenged to create an image

with no new development on the coast. Unfortunately, the term “climate change” was an issue, so the term was avoided at the risk of losing credibility. They plan for more research to be conducted by the regional council. They expect to partner with local governments to incorporate resiliency for their vulnerable communities into their comprehensive plans.

There are many examples of proactive planning in built environments worldwide. The San Francisco Bay has been addressing SLR since 1989 and has a development plan in place. New York is raising subway gutters by seven inches. They have developed an adaptation plan which balances climate change responses that has political and professional support. New Zealand is paying for relocation. Sweden uses floating facilities. The panel stressed there needs to be the same level of active response by officials to SLR in Florida as there has been in other regions of the world.

- ***Not all options will work in Florida, but we must broaden the communication between agencies that are already conducting the work to the decision makers that implement policy, and then to the public to increase awareness and thus, support of the necessary SLR adaptations.***

3.5 Session Five: Impacts on Built Environments: Water Utilities, Energy and Transportation

This session focused on how SLR would affect transportation, energy and water utilities. Risk management can be characterized as a 3-dimensional cube, consisting of high hazard, high impact probability and high consequences. Choosing the “best” alternative requires a comparison of decision criteria including benefits, costs and probability of impacts. A single adaptation will rarely reduce risk to an acceptable level. As a result, risk management options often consist of multiple strategies. Different regions perceive risk differently; therefore, local solutions are needed.

There can be conflicts between current goals and long term planning. For example, Florida Power & Light placed systems underground to avoid wind damage, but sea level rise is now a problem for these underground connections which decay with saltwater intrusion. Investment firms, such as Wells Fargo, are investing in sustainable technologies, increasing their energy efficiency and supporting grassroots efforts. Organizations that commit to support environmental issues make citizens feel better about their communities.

A recent study for the Florida Department of Transportation identified roads that are vulnerable to sea level rise and brought attention to issues that need to be addressed including the fact that roads in South Florida are often at a low elevation and most of their infrastructure lies below the roadway. The study showed that, in some areas, road base materials will fail from saturation long before sea level rise submerges the roads. In addition, navigable clearance under low bridges and highway drainage will be a concern. Increases in road elevation might adversely impact nearby homes and neighborhood infrastructure improvements may be needed. The cost of rebuilding infrastructure and providing power will dictate which solutions will be pursued and where.



AIA in Ft. Lauderdale Post-Sandy

Photo: Broward County Natural Resources Planning & Management Division

The panel discussed specific flooding issues, such as the malfunction of gravity sewers due to inundation. Florida’s flood control system was designed in the 1950’s based on a six inch head differential that has already been eliminated by SLR. Upgrading the drainage system will require

more pumps to be installed and therefore an increased energy demand. Flooded storm drains will have reduced velocity with sediment build up that will increase the cost of maintenance. Larger ditches will be needed to maintain the function of stormwater drainage systems.

Florida's residents will not easily accept the higher taxes and eminent domain needed for future highways and drainage systems.

- ***We must prepare our communities now with open discussion and education to increase the public's SLR awareness so they will support local decision making on these issues.***

3.6 Session Six: Collaboration: Organizational Structures

Climate change is not just an environmental issue, it is an economic imperative. If communities take no action, businesses will eventually move to places that have addressed the risks. A desirable goal would be to set up methods to prevent the avoidable impacts and mitigate impacts that are unavoidable. Panelists discussed effective adaptation and mitigation programs and the importance of partnerships at the state, regional and local level.

Florida's state energy policy is intricately connected to the climate issue, but policies change over time. Legislators should be educated about current and local SLR issues so that they can make more informed policy decisions. It is important to maintain involvement at the state level and draw attention back to mitigation and energy policy.

As part of the State University System (SUS), Florida Atlantic University's (FAU) Climate Change Initiative showcased inter-university collaborations. Universities are organized to deal with specific problems and since climate change has such a complex nature it has required them to develop an interdisciplinary approach. The Florida Climate Institute is a collaboration of SUS universities including FAU, the University of FL (UF), FL State University (FSU), the University of Central FL (UCS), University of South FL and the University of Miami (UM). The organization promotes research and development of a climate-ready workforce and provides cutting edge information about the climate-related risks that are unique to our State.

At a regional level, the Southeast Florida Regional Climate Compact (Compact) was created for the four adjacent counties of Monroe, Miami-Dade, Broward and Palm Beach, to jointly address the common challenges of sustainability and climate issues. The Compact represents more than five million people and approximately 100 cities. It has been viewed as a very effective way of managing regional challenges and securing funds to address them. Former competitors have become collaborators. Accomplishments include mapping inundation prone areas, identifying regionally relevant infrastructure, creating a regional greenhouse gas inventory and a unified

sea level rise projection. The five year adaptation action plan was released in the fall of 2012. Through leadership, connections, commitment, and collaboration, the Compact has the flexibility to share resources to expand the capacity of all staff in the region, even in lean budget times. Members are dedicated to this effort. The Compact is serving as a successful model for the region, state and nation uniting the energy, climate and adaptation connections.

Future expansion of the Compact will include the three counties to the north (Martin, St Lucie and Indian River) as part of the Seven50 SE Florida Prosperity Plan. The South Florida and Treasure Coast Regional Planning Councils joined forces and received a grant for long range sustainability for the region that includes an element on climate resiliency.

In another successful example, the San Francisco Bay Area Plan depicts an adaptation strategy for the area. A map of the bay showed 240 square miles that were filled during development in the 1880s. Another map showed these developed areas would be submerged due to projected SLR. Their proposed adaptation is a triage-style solution in which areas are selected for focused growth or limited development. Communities like the Silicon Valley are building a political coalition and other partnerships, including academics, business, labor and equity organizations and government agencies to support this proactive plan.

To help unify efforts, some grassroots organizations like the CLEO Institute (Creative Learning and Engagement Opportunities) in Miami Florida promote a strong climate change message. One of CLEO's objectives is to amplify the climate change conversation, bridge the divide between science and society, and create an informed and engaged citizenry on this urgent issue. CLEO offers researched-based trainings, informal learning opportunities, and celebrates participation at every level. Instead of sensationalism, they discuss climate change adaptations as a part of the plans of local governments to provide proactive approaches to addressing critical issues such as SLR.

- ***It is important to create public/private partnerships to develop cost-effective best management practices to identify vulnerable communities and implement adaptation strategies that minimize risk.***



Michael Mann and Margaret Davidson were among many Summit participants who answered the CLEO Institute question on film: *What is climate change and what is my role?*

3.7 Session Seven: Public Engagement: Communication, Outreach and Education

The public engagement session examined the extent to which climate change is being addressed in our schools, as well as the projects and educational resources available to teachers and the general public. Several examples of successful pilot projects that address climate change in the educational K-12 school system, the university system, as well as outreach through informal venues such as museums, zoos and aquariums were discussed.

The National Science Foundation (NSF) funded the Coastal Areas Climate Change Education (CACCE) project whose goals were to create innovative approaches and effective educational resources for teaching and learning about climate change. Teachers are required to teach the state standards to prepare students for standardized tests. Survey results indicated that teachers' knowledge is lacking and one-fourth to one-third question sea level rise issues and the validity of climate science. In high school, there is the opportunity to address climate related topics in advanced courses, such as marine science. CACCE's research efforts hope to integrate climate change science into Florida's core standards for secondary science education.

"Climate Science Investigations (CSI): South Florida," is funded by the National Aeronautics and Space Administration (NASA) to develop an online (www.ces.fau.edu/nasa) interactive curriculum that uses NASA data to improve climate and science literacy for teachers and secondary students. In the lessons, students conduct research, then develop and deliver an argument regarding current climate change science and misconceptions. Four states have legislation that requires schools to teach the denial of climate change as a valid scientific concept. In a 2009 poll, more than 80% of teachers surveyed dealt with climate change skepticism from students and parents. The interactive, interdisciplinary CSI lessons allow students to conduct their own research using NASA climate data and then come to their own conclusions about the global climate. Students learn to develop a claim and must use scientific evidence to defend their argument regarding the issue of climate change. The scientific research and argumentation skills that the students develop to determine this conclusion are even more valuable than their results.



GOES View of Hurricane Sandy
Photo: NASA

At the university level, faculty from the Florida State University System (SUS) has developed a comprehensive analysis of interdisciplinary courses that address components of climate

change. The universities contributing to this analysis included FAU, UF, USF, FSU and The Florida Climate Institute. The white paper titled *Florida Climate Change Education and Training: State University System Cooperative Plan* summarizes all of Florida State University's environmental and sustainable courses that address climate change and sea level rise and can be found at: <http://floridaclimate.org/whitepapers/>. The white paper identifies action items that could standardize and enhance climate change education and expand course offerings in all of Florida's state universities.

The Florida Aquarium (www.flaquarium.org) provided many examples of outreach to families and the general public, reaching an audience of 75 million per year. They use animals to tell the climate change story and games for children to make decisions about climate change. Often, people feel empowered about wanting to help the environment after visiting museums, zoos and aquariums. These informal education venues are often overlooked when addressing outreach on climate change and should be included as valuable partners in future efforts.

The session concluded with examples of national climate change resources and networks that can be incorporated as models in Florida. The Climate Literacy and Energy Awareness Network (<http://cleanet.org/index.html>) is responsible for the development of the Climate Science Literacy Essential Principles that work with individuals, projects, and organizations to promote climate literacy. This is a national model that could easily be adapted to Florida.

- ***This session provided several examples of outreach to schools and local communities that deliver the climate change message by making it interesting and understandable to a wide range of audiences from students and teachers to decision makers and the general public.***

4.0 Conclusions

The Summit concluded with a presentation by prominent climate scientist Dr. Michael Mann, Professor of Earth Systems Science at Penn State University. Dr. Mann is the author of the first peer-reviewed article that documents that the level of carbon dioxide in the earth's atmosphere has been increasing more rapidly in the last 100 years, more than at any other time in history. The increased carbon dioxide levels are causing a rapid rise in atmospheric and ocean temperatures. There is thorough and scientifically sound evidence that global warming is happening. However, there are people that still believe that global warming is a myth and a fabricated story. Dr. Mann noted how these beliefs and the politicization of the issue is a serious challenge to climate scientists. He provided gripping examples from his work as a climate scientist that are summarized in his book "The Hockey Stick and the Climate Wars: Dispatches from the Front Lines" that he autographed for guests.

The Summit brought together a diverse audience of scientific, political, educational and managerial professionals from Florida and the nation. There was overwhelming enthusiasm and collaboration among presenters and guests. Each session addressed specific topics and brought together professionals that continue to work on interdisciplinary adaptation and resilience plans that address sea level rise impacts on the economy, built environment and vulnerable communities. The SLR messages were echoed in the media. Coverage by the local and national media enhanced SLR awareness in Florida and in the week following the Summit articles were published in: Tampabay.com, WPTV, Miami Herald, Fort Worth Star Telegram, The Florida Current, Charlotte Sun Herald, DeSoto Sun Herald, Englewood Sun Herald, Fort Meade Leader, Lake Wales News, North Port Sun Herald, Polk County Democrat, Gainesville Sun, and the Venice Gondolier.



Dr. Michael Mann

The Summit's key messages were: 1) the importance of education and outreach to increase SLR awareness, and thus, support; and 2) creating public/private partnerships to develop cost-effective best management practices to identify vulnerable communities and implement adaptation strategies that minimize risk. Florida's projections of sea level rise present a complex and dynamic challenge for municipalities, agencies and decision makers. Florida's unique location and geology require significant and innovative adaptations in the built environment's infrastructure as weather patterns change and sea level rises. Many of Florida's agencies,

institutions, and government organizations are already responding to the reality of sea level rise. The Center for Environmental Solutions and FAU's Climate Change Initiative will continue to work with our partners to identify and address the critical sea level rise issues discussed in each session. For updates on our climate change and sea level rise research, education and outreach efforts as well as the upcoming October 16 & 17, 2013 Sea Level Rise Summit: Resiliency in the Face of Change, please check online at www.ces.fau.edu and www.ces.fau.edu/SLR2013.



The banner features the Florida Center for Environmental Studies logo on the left, which consists of a blue circle with a white wave and a sun. To the right of the logo, the text "FLORIDA CENTER FOR ENVIRONMENTAL STUDIES" is displayed in a blue, serif font. Below this, a dark blue navigation bar contains the following links: "Home", "Program Locations", "Education", "Climate Change", and "Conferences". The main visual of the banner is a composite image: the left side shows a modern city skyline with a river, and the right side shows a satellite-style map of Florida with a red dot indicating a location. At the bottom left, the text "Climate Change" is written in a bold, white font, followed by "Addressing the impacts of climate change on Florida's natural and built environments: FAU's interdisciplinary multiagency research initiative" in a smaller white font.

For more information please contact Mary Beth Hartman, Conference & Outreach Coordinator
Center for Environmental Studies at Florida Atlantic University
mhartman@fau.edu or 561-799-8558