



# *Climate Change*

## CONFERENCE SUMMARY

May 9-11, 2007  
Tampa, Florida

Florida Center for Environmental Studies



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## Acronyms and Abbreviations

BOD	Biochemical Oxygen Demand
CCP	Cities for Climate Protection
CES	Florida Center for Environmental Studies
COD	Chemical Oxygen Demand
COOP	Continuity of Operation Plans
CUES	Center for Urban and Environmental Solutions
DCA	Department of Community Affairs
DEP	Department of Environmental Protection
ENSO	El Nino Southern Oscillation
EPA	Environmental Protection Agency
FAU	Florida Atlantic University
FIU	Florida International University
FPL	Florida Power and Light
GIS	Geographic Information System
ICLEI	International Council for Local Environmental Initiatives
INCR	Investor Network for Climate Risk
IPCC	Intergovernmental Panel on Climate Change
ITCZ	Intertropical Convergence Zone
LEED	Leadership in Energy and Environmental Design
LIDAR	Light Detection and Ranging
NAO	North Atlantic Oscillation
NGO	Non Governmental Organization
NOAA	National Oceanic & Atmospheric Administration
UCF	University of Central Florida
UF	University of Florida
USF	University of South Florida



## Preface

Focusing on Florida, the Climate Change Conference was held in Tampa, Florida on May 9-11, 2007. Nearly 300 attendees were presented with the latest scientific findings and information about Climate Change related impacts and the actions that should be taken to respond to climate change. Global, national, and state experts shared their perspectives with conference participants in both general and concurrent sessions. The Conference included eight plenary presentations, a series of parallel panels in two sessions, one on the science of climate change in Florida and the other on the impacts and responses, and finally three discussion group sessions. The three sessions explored ways climate change will impact Florida's environmental, economic and social sectors and what steps should be taken to both mitigate climate risk and adapt to the changing environment.

Beaches, coral reefs, swamps, lakes, rivers, springs, pine woods, caves, estuaries and islands have attracted a population of more than 18 million residents and 90 million visitors a year. The Floridian environment is simultaneously a joy and a problem. The problem is accommodating this human presence while maintaining the ecosystem services that we all depend upon.

This dynamic between people and environment is now heightened by the reality of climate change, both happening now and forecast for the future. The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) only confirms what many scientists and observers have postulated; climate change is here and real and that the main cause is the impact of human activity.

Documented results of climate change include global warming, increasing variability in rainfall and rainfall intensity, sea level rise and potentially greater hurricane intensity. All of these impacts are especially important to Florida both now and, increasingly, in the future. The Century Commission, formed by the Florida Legislature in 2005 to envision Florida's future, <http://www.centurycommission.org/overview.asp> has identified climate change as one of the most critical issues in assessing our State's future.

The Florida Center for Environmental Studies (CES) at Florida Atlantic University, and the Patel Center at the University of South Florida, as conference organizers, developed the program to address three issues:

1. Review our current knowledge of the impacts of climate change on Florida.
2. Discuss priorities in the need for action now to reduce and mitigate impacts.
3. Provide recommendations to the Century Commission and decision makers in the State on how best to integrate the dynamic of climate change in the environment, economy and social fabric of the State.

This report presents first the plenary sessions, then the results of the Science and Impacts panels and, finally, outlines the recommendations that flowed from the three discussion groups. Where power points were used they are available on the website at <http://www.ces.fau.edu/ccc/presentations.php>.



Since the conference, the discussion groups' report has been submitted to the Century Commission. Some of the discussion groups have spawned Working Groups to advance climate change response issues identified during the conference. CES continues to be involved in making information about climate change in Florida available via the Climate Change web site <http://www.ces.fau.edu/ccc/>. This summary document is intended to serve as another resource as Florida develops its climate change strategies.



## 1. Plenary Session Summary

The opening plenary session featured welcomes from Presidents **Frank Brogan** FAU and **Judy Genshaft** USF, who were followed by **Betty Castor** Executive Director of the Dr. Kiran C Patel Center for Global Solutions. All emphasized the importance of the conference to Florida especially in the light of Governor Crist's elevation of the topic to a State Priority.

Two perspectives from the Global level provided the context for this meeting. **Dr. Mohammed El-Ashry** Senior Fellow UN Foundation and former Chair of the Global Environmental Facility emphasized climate change is a serious and long-term challenge—one that is truly global in its causes, potential effects, and possible solutions. The impacts of climate change are already occurring and future damages are a certainty.

Globally, climate change is emerging as the most difficult energy-environment linkage. The production and use of energy contribute more than any other human activity to the buildup of greenhouse gases in the atmosphere and future energy trends will determine how quickly those levels continue to rise and by how much. The atmospheric concentration of CO<sub>2</sub> is already higher than it has been for at least 650,000 years and the average temperature of the earth is heading for levels not experienced for millions of years.

Significantly, a report commissioned by the US Center for Naval Analyses concluded that global warming “presents significant national security challenges to the United States” and called on the U.S. “to commit to a stronger national and international role to help stabilize climate change at levels that will avoid significant disruption to global security and stability.

It seems we now have a convergence of science, economics, technology and finance to guide international action to address climate change, but the window of opportunity for staying within an acceptable range of atmospheric carbon dioxide and other greenhouse gases (450-550 ppm) is closing, and the costs of mitigation and adaptation will rise substantially with time. However, under current conditions, it is clear that international negotiations to address global warming will not keep pace with the demand for concerted action.

The world needs a predictable and effective agreement beyond the Kyoto Protocol when the first commitment period expires in 2012. We know that much depends on the U.S. which is responsible for a quarter of all emissions. Without U.S. engagement, the chances of an effective international agreement are minimal. Similarly, without China, India, Brazil and South Africa engagement, countries whose emissions are growing rapidly, there can be no effective international agreement.

On the American scene outside Washington, an important new group of U.S. business leaders, the U.S. Climate Action Partnership, is calling for mandatory



controls on greenhouse gas emissions. They see the risk of global warming – and they also see the enormous economic opportunities that will be created by fundamental change in the world’s energy systems. The economic impact of the energy revolution of the 21<sup>st</sup> century will, in El-Ashry’s view, be as significant as the digital revolution of the 20<sup>th</sup> century.

El-Ashry sees that real progress has been made; the science is now clear. The Europeans are exercising some leadership and figuring out how to make the carbon market work. Major companies and financial institutions have signed on; and a significant number of Governors are on board, as over 400 mayors, along with State Legislators and County Commissioners.

The Century Commission, formed by the Florida Legislature, has identified climate change as one of the most important issues facing the state, and with Governor Crist’s emphasis on the importance of climate change to Florida we can see the prospect of linking city, county, state, national, and international efforts.

Humanity’s ability to tackle climate change is a test of its capacity to manage the consequences of its own actions. That requires bold policy actions, enhanced investments, genuine cooperation at the national and global levels, and above all, a long-term view and political will.

**Richard Benedick** U.S. Ambassador (ret) and Chair of National Counsel for Science and the Environment drew lessons on tackling climate change from his experience as the lead negotiator for the US on the Montreal Protocol.

Benedick warned that Planet Earth is trying to send us signals that a disaster is brewing. There are no easy solutions, but the stakes are very high for humanity. The planet will take care of itself, but the issue is saving ourselves in a decent way. We are facing the most serious challenge on the environmental front that we have ever faced. Protecting the environment used to be a bi-partisan effort. President Reagan became the first head of state to promote a strong ozone control policy (Montreal Protocol). Now, environmental protection is not in the vocabulary of those in Washington.

Science is now indisputable, and therefore climate change can no longer be treated as a “left-wing” topic. Theories behind the Montreal Protocol aroused a storm of controversy, but science discovered that chlorofluorocarbons (CFC) were lowering ozone levels dangerously. CFC’s were wonder household chemicals, but people listened to the science behind CFC’s affecting the ozone. The lesson learned for climate change is not to exaggerate and to rely on strong science.

Public interest had relaxed due to previous exaggeration of climate change in the late 1980s. Benedick pointed out that the Kyoto Protocol while strong in the short-term was weak in the long-term. Now a massive technological revolution is needed to meet the energy demands and still reduce emissions by 60-80% in this century.





Something on the scale of a space program is needed. As the science has grown stronger, there is a need to develop long term emission control backed by new and emerging technology, with agreement between the top 20 emission countries as a first step. Benedick suggested that we should not try to solve all the problems for all the countries at once. Focus on the largest emitters first. In the U.S., states, municipalities and private industries are taking the lead but this is not sufficient. We need to press for national standards. Benedick closed by saying he is optimistic that we are on the brink of transformation on how most consider climate change.

Florida Atlantic University's **Dr. Howard Hanson** reviewed the findings from the fourth assessment report of the Intergovernmental Panel on Climate Change as they relate to Florida. In addition to stating that "global warming is unequivocal" and that "warming is likely due to anthropogenic greenhouse gases," it also quantifies likelihood assessments. In addition greater emphasis is placed on timescales, particularly on multi-decadal change.

The report includes three models representing low, medium or high emission levels in the future. The high emission levels show a dramatic rise in temperature especially in the Arctic. Tropical precipitation is predicted to decrease as emissions rise, with Florida becoming hotter and drier. Sea level is predicted to rise slowly but appreciably. Hanson closed by saying there needs to be a greater understanding of the regional impacts of these changes and we need to develop both adaptation and mitigation strategies.

The opening plenary session closed with a presentation by **Dr. Thomas Crisman** of the Patel Center, who addressed evidence of climate change in Florida and gave some projections for the future.

While there are annual, decadal and long term cycles, Crisman pointed out that we are dealing with a human-industrial event. The assumption is if we take action there will be a decrease in impacts but we also need to prepare for change. Even with immediate action change will continue to occur and response times cannot be accurately predicted.

An important point for Florida is that it has rapid climate zone transitions, with north, central and south Florida having significantly different climates and different impacts of climate change. There are few geographic counterparts to Florida. One difficulty with using current climate change models is that their scale is too large to determine impacts to Florida's rapid zone transitions. Florida's dominance by coastal influences creates further modeling difficulties.

Among Florida impacts are changes in ecosystem structure and sea level rise, spread of exotic species northward, altered food webs, economic and social impacts including agriculture, tourism and insurance, changes in fire frequency, possible changes in migratory patterns of birds, changes in rainfall amount and intensities.



Crisman stressed that a zonal approach is important to Florida in terms of mitigation, while the implications of sea level rise are critically important.

Chief Financial Officer, **Alex Sink**, delivered an inspiring address as the luncheon keynote speaker on May 9<sup>th</sup>. Sink pointed out that part of the CFO's role is to think about the long term consequences of our actions - the long term risks. She reported that we have crossed a critical "tipping point" on awareness and action with climate change. Many have been studying and working on this issue for decades. Without them, we would never have reached this tipping point. We have you to thank for all the work you have done to get us here.

Sink feels that there has been a confluence of events that has brought us to this tipping point:

- The scientific consensus that has emerged to show conclusively how the climate is changing.
- The movie – An Inconvenient Truth – which brought this science of climate change to millions of people. The movie allowed people to understand just how critical this issue really is.
- Hurricane Katrina in August of 2005.
- The fires that have been raging the past few days in Florida.

Sink stated that the cabinet will play a critical role in how Florida responds to climate change. Over the past several years, Florida's leaders have not been leading on the issue of climate change. Unlike you all (audience) our state leaders have not even really been talking much about it. We have been on the sidelines on this issue as a State, while other states have been much more aggressive.

After all, Florida is the 4th largest state in the nation and the most vulnerable to the impacts of climate change. Florida is surrounded by water – no point in this state is more than 80 miles from either the Atlantic Ocean or the Gulf of Mexico.

Florida should be on the front lines in responding to climate change, and the Florida cabinet must be a leader in this response. That is one of the reasons why Sink was eager to start the cabinet work on this issue as soon as she took office.

The Florida cabinet serves as the board of trustees of the internal improvement trust fund. It is responsible for acquiring and preserving state lands. The cabinet members have a responsibility as leaders to think about the value and use of submerged lands, and how we can use our natural land to best offset carbon dioxide. We must be strategic and thoughtful in this process.

Sink announced a few weeks ago that she was the first Florida based institutional investor to join the Investor Network for Climate Risk (INCR). The INCR has about 50 institutional investors and \$3.7 trillion in assets, and is focused on the future financial risks posed by climate change. She also announced that Florida's state



board of administration - the best pension fund in the country – also joined the INCR. Sink joined the INCR on behalf of Florida because based on her analysis Florida has more to lose as a result of climate change than any other state.

Climate change is not only a financial issue for Florida; it is an issue that will have a critical effect on our insurance industry and the way we insure against risk. U.S. Insurers are skilled at assessing risk using modeling based on past events. But what about the effects of future events – like climate change? Sink has been meeting with folks from the insurance industry and challenging them on this issue. The State has to find creative ways to work with the insurance industry to respond to climate change, but at the same time continue to protect consumers by keeping rates low and working to keep insurance affordable and available in this state.

In closing, Sink said she believes that we have reached a watershed moment in terms of the public's understanding and awareness of this issue. It is now time for those of us who are elected leaders in this state to act.

**Michael Sole** Secretary of the Florida Department of Environmental Protection praised Governor Crist's proactive approval to climate control in his May 10<sup>th</sup> keynote address, and highlighted the state's need to understand the risks and challenges that surround climate change.

Sole emphasized that the debate on the validity of the science is over. But between 1990 – 2003, U.S. greenhouse gas emissions increased 17%, and Florida is ranked 5<sup>th</sup> in the nation in CO<sub>2</sub> emissions. He emphasized that Florida must demonstrate leadership in climate change now.

The global rush toward cleaner, greener technologies creates remarkable opportunities for the states that embrace carbon emission reductions early. Florida stands to benefit over the long run by being an early adopter. With 1,350 miles of coastline and most of its residents living in coastal communities, Florida is more vulnerable to the effects of climate change than any other state."

Secretary Sole offered his "first principles" on how Florida's climate policy should be built, which include avoiding emissions rather than offsetting them and encouraging market mechanisms that reach aggressive targets with the greatest efficiency. The DEP Secretary also emphasized the benefits of being on the front end of a cleaner Earth.

Florida can build on steps already taken to reduce greenhouse gas effects. Sole announced that just this week, Florida joined The Climate Registry, a multi-state compact that enables the state to work with other leading states and nations to craft emission reporting guidelines for industries. Earlier this year, Governor Crist announced plans to hold an environmental summit this summer to bring together experts to explore groundbreaking technologies and strategies to reduce greenhouse gases.



In addition, *Florida Forever*, the nation's largest land acquisition program, is already helping to prevent unnecessary growth and greenhouse gas emissions, preserving nearly 2.3 million acres. In total, there are more than five million acres of land in conservation, which is 15 percent of Florida's total land acreage.

Last year, the Florida Legislature passed the 2006 Florida Energy Act, a four year plan to diversify the state's fuel supply, decrease the state's dependence on fossil fuels and promote energy conservation and efficiency. It takes the first comprehensive step toward a diverse, reliable and cleaner energy future by providing rebates, grants and tax incentives to drive the development of alternative and low-emission fuel technologies. Since August 2006, Florida has provided nearly \$2 million in rebates to homeowners and businesses for investing in solar energy technologies.

Mr. **Thomas Pravda**, Advisor to the Special Representative for Climate Change in the United Kingdom addressed the conference on Thursday, May 10<sup>th</sup>, bringing the perspective of the UK to the conference. He pointed out that the difficulty is that climate change is not just a new problem, but a new kind of problem. There are no historical experiences that we as academics, policy makers or politicians can turn to for wisdom and guidance. We, as a global community, are beginning to build an understanding both of the challenge and the response. And this event – Florida's first climate change conference – is a valuable part of that process. It is hard to judge the scale of the problem we may be facing but it is big.

Climate change is not just a threat to our environment, but also to our economies and our security. And that is not to mention its potential impact on human health, on poverty alleviation, security of energy supplies, etc.

Last year, the former chief economist of the World Bank, Sir Nicholas Stern, published the most comprehensive and authoritative study yet of the economics of climate change. Stern described climate change as the biggest market failure in history. He concluded that the scale of the disruption to the global economy from climate change was potentially on a par with the disruption from the Great Depression and the two World Wars of last century.

Pravda went on to state; we are building a fuller picture of the challenge facing us. He then asked, what about the response, what do we need to do?

We need to stop destabilizing the climate. That means dramatically reducing levels of greenhouse gases in the atmosphere. The only way to do that is by taking the carbon out of our economies, which is not an easy task. It requires fundamental changes in how we produce and consume energy, how we move around, and how we use land. It means changing investment flows so they build infrastructure, technologies and products that are low carbon, rather than high carbon. To give you an idea of the scale here, the International Atomic Energy Agency estimates \$21



trillion will be invested in energy infrastructure alone by 2030. That is just some of the money we need to shift towards low carbon. So talk of a third industrial revolution is no exaggeration.

Pravda proposed we first expand the limits of possibilities by reframing the debate in line with the nature of the problem as we understand it. We need to communicate that it is not just long term environmental problem, but an immediate matter of security and prosperity. It is no secret that security issues mobilize political will and money on a totally different scale than environmental issues.

Second, we need to move from “burden sharing” to “opportunity.” There is a lot of money to be made here! Stern conservatively estimates that alternative energy market will be worth \$500 billion/year by 2050. There are also deeper opportunities here: building a “low-carbon world,” a new phase of civilization characterized by greater wisdom about our relationship with the earth, leading to richer sense of who we are and what we are doing here, perhaps even leading to a more harmonious way of living with the earth.

Third, we need to change the deeply antagonistic debate on climate between developed and developing countries. Global climate change is a shared threat and will require a shared response.

If we consistently re-frame climate in these ways, Pravda stated, we can build international political foundations sufficient to deliver responses with the scale and urgency needed.

In closing, Pravda provided the following:

- First, this is a “today” problem, not a “tomorrow” problem.
- Second, while the problem is not policy, but politics, we need to make sure the policy is ‘real’ not just a political gesture. How we arrive at a solution is just as important as what we do.
- Finally, to end with optimistic thought: we face an enormous, multi-faceted challenge, requiring an urgent and hugely ambitious, multi-track response. But if we get this right, we will not only solve climate change, but we will have made huge strides towards learning how to live and work together in an interdependent world: we, as a global community, will have come of age.

Senator **Michael S. Bennett** concluded the conference with an impassioned plea for Florida government and citizens to take a long view and work towards a sustainable Florida well able to deal with the important elements of climate change while working hard through a clean energy strategy to drastically reduce emissions.



He asked, "How do we want Florida to look in 25 or 100 years and how do we make that vision a reality?" While nothing moves fast in Tallahassee, the 2004 energy bill is a reality because the emphasis was on clean air, and independence from foreign oil.

We need to frame issues in terms of benefits to people and to our children, grandchildren and great grandchildren. It takes political courage to do the right thing and there is a need to start thinking outside of the box. One such initiative is the Renewable Energy Research Institute at the University of South Florida. If we look at the full range of renewable energy technologies and develop competition between them, the most economic and appropriate will emerge. Bennett said he has faith in "green," as an economic engine. We need to show that private industry can turn a profit from green technologies.

He closed by saying Florida is capable of supplying its own energy in the long term, and he urged attendees to remember -- the cleanest energy is the energy we do not use. Finally, he reminded the audience that involvement is important; we all have to be politically involved and get the message to Tallahassee.



## 2. Impacts and Responses Summary

The Impacts and Responses sessions were organized to identify climate change impacts and actions that should be taken to plan for and respond to them. The sessions included brief presentations, panel discussion and answers to audience questions.

### 2.1. Policy Issues

This session provided a brief history of climate change policy and an overview of current regional and national programs. It also focused on Florida-specific opportunities for developing effective climate change policies.

**Susan Glickman**, Natural Resources Defense Council, stated that while Florida has only a brief history of climate change policy the subject received much more attention in the recent legislative session. The Century Commission's first report identified climate change as the most pressing issue for Florida and called for the state to be a leader in this area. In his State of the State address Governor Crist said he was "persuaded that global climate change is one of the most important issues that we will face this century." Glickman noted that the Governor has taken several steps to begin to address climate change and alternative energy at the state level.

The Center for Climate Strategies is a non-profit organization that partners with states to develop climate action policies and plans. Information about the Center's activities was presented by Tom Peterson. States are important because 30 of them rank in the top 75 of world greenhouse gas emitters. A growing number of states are developing comprehensive state climate action plans which include a wide range of solutions which include energy efficiency and conservation, clean and renewable energy, transportation and land use efficiency, forest and agricultural conservation, waste management and industrial process improvement. A variety of implementation methods enable states to customize programs to their particular situation. These methods include voluntary agreements, technical assistance, financial assistance, targeted spending, establishing codes and standards, market based approaches, pilot projects, education programs, and research and development.

**Nick Bollman** of the Center for Urban and Environmental Solutions (CUES) at Florida Atlantic University reviewed California's AB32 legislation that was passed last year which targets greenhouse gas emission reductions and lays out a plan to move forward. It creates a set of activities and strategies including mandatory reporting by 2008, authorizes the establishment of regulations, establishes the opportunity for building market systems and regulatory mechanisms to achieve goals. Bollman offered seven strategies to achieve success in developing emission reduction policies:



- Build on current efforts
- Don't try to do everything with one program
- Legislation should be highly targeted – focus on big emitters
- Allow plenty of lead time for full implementation, work systematically
- Take a whole government approach; involve all state agencies
- Overcome the environment vs. the economy problem and allow the economy to transform itself in a new way
- Gubernatorial leadership is essential but government can not do this alone and the effort also requires contributions from business, NGOs, the faith community and universities.

**George Gonzalez**, University of Miami, speaking on urban sprawl, climate change and public policy, stated that the United States has the most sprawled urban zones in the world. It also has the highest automobile ownership. This combination, along with the preference for single family homes, has direct consequences for climate change. The US is the largest per capita emitter of carbon dioxide. Florida is among the top four states in energy consumption, ranking third in terms of both residential and transportation consumption. Gonzalez maintained that this is a direct result of pro-urban sprawl policies including mortgage subsidies, low energy taxes, cheap oil policies, aggressive road building and land use zoning practices. Gonzalez concluded by saying Florida needs a political commitment to dramatically reduce energy consumption, and redesign cities to be more compact.

## 2.2. Translating Science into Action

The focus of this session was moving climate change science into action in society, including infrastructure and design, building standards and education.

**David Major**, Columbia University, reported that the Intergovernmental Panel on Climate Change forecasts for 2090-2099 include warming of 3.2 to 7 degrees F, sea level rise of 7-23 inches, more droughts and intense precipitation events along with more intense tropical storms. Infrastructure is characteristically long lived, expensive, heavily regulated and requires a long lead-time for implementation. Due to these characteristics it is not too early to begin to incorporate climate change impacts into infrastructure planning, especially in coastal and other high-risk areas. As part of its Climate Change Program, the New York City Department of Environmental Protection is preparing a request for proposals to study the effects of rising sea levels on waste treatment plants, tide gates and other structures, and to develop and evaluate adaptations. Major provided guidelines for incorporating climate change into infrastructure design:

- Conduct an audit of existing infrastructure, lifetimes and rehabilitation cycles
- Compare this with climate change forecasts for the region/locality
- Design for thresholds and ranges of forecast temperature, sea level and hydrology





- Evaluate potential adaptations (cost/benefit, environmental impacts)
- Schedule (over decades)
- Review climate parameters every 3-5 years

In closing he cautioned that incorporating climate change into infrastructure engineering will require a paradigm shift; engineers must design on the basis of uncertain numbers.

Two damage components of Climate Change, sea level rise and temperature rise, are particularly relevant to building design criteria in Florida according to **Ricardo Alvarez**, Florida International University. The consequences of sea level rise include storm surges that are higher, stronger and reach further inland; higher waves and hydrodynamic pressure; larger floating debris; deeper flooding; higher hydrostatic pressure; and increased beach erosion. Design criteria responses must include elevated sites and buildings, surge deflectors and barriers, flood-proofing to higher levels, stronger structure and building envelope, impact protection and hardened outdoor infrastructure. The consequences of temperature rise include heat waves; extreme rain events; flooding, including flash floods; higher humidity and accompanying mold; drought; wild fires; air quality and water availability and quality issues. Design criteria to respond to temperature rise include roof drainage capacity, improved water penetration barriers, site drainage, increased cooling loads (electrical), additional insulation, water pressure boosters, water recycling and increased air conditioning and filtration needs.

Alvarez outlined an action agenda that included the development and adoption of design criteria, revision of building codes and the development and approval of new products and systems. He also warned that consideration must be given to the impacts on the construction industry and the increases in construction costs, not only for new construction but for retrofitting existing buildings. In some cases relocation of buildings may be more cost effective than retrofitting.

**Glenn Thomas**, Florida Atlantic University, described plans for the new Pine Jog Elementary School which will be Florida's first Leadership in Energy and Environmental Design (LEED) Certified Green School. The school will be located on the grounds of the Pine Jog Environmental Center and will actively teach science throughout the K-5 curriculum that will include field work on the grounds. The facility is a result of a partnership between the Palm Beach County School District, Florida Atlantic University's Pine Jog Environmental Center and the FAU Foundation. Some of the LEED elements include photovoltaic panels for energy generation, double metering for electricity, solar heated water, a solar sidewalk, water conserving fixtures, energy efficient appliances and Xeriscape landscaping. Thomas reported that construction will begin next week (May 2007) with completion by August 2008. The partnership will enable the university and the school district to share expertise in green building design and operation, as well as related educational programming and research. He closed with the observation that there appears to be a general cultural



movement toward “green” and the construction and operation of this school may lead to other green public buildings.

During the question and answer period Leonard Berry commented that incorporating climate change considerations into the built environment will require new partnerships (e.g. New York City DEP and Columbia University, FAU and Palm Beach County School System) and the need to build cultural change into these groups.

A newspaper editor stated that there was a public information challenge and asked how this information could best be disseminated. Major suggested small workshops and hands-on groups. Thomas said the message should be targeted around good science which promotes sustainability and economic viability. Alvarez mentioned the need to put things into a perspective that is meaningful to individuals and the need to engage and challenge policy makers.

Daniel Parker, Florida Department of Health, commented that in addition to economic benefits many of these changes will also result in health benefits including a healthier environment and more productivity.

Thomas was asked if LEED certification is really necessary. He replied LEED is a recognized and accepted standard and although a building built to these standards cost 2 – 5% more, that cost is recouped quickly in energy savings and productivity.

In response to a question about building design and sea level rise, Alvarez stated that in some cases the engineering challenges and costs involved may make certain sites unfeasible for development or retrofitting. While recognizing that adaptation requires a substantial investment, Major added that if we start now we have an opportunity to do things more cheaply than if we wait.

### **2.3. Planning for Climate Change**

Presentations focused on limiting the negative effects and adapting to climate change in Florida. Speakers addressed how responses should be determined and what kinds of decisions should take climate change factors into consideration.

A brief review of some of the data leading to predictions of decreased precipitation and increased drought was presented by **Paul Trimble**, South Florida Water Management District. Fifteen of the ocean-atmospheric models predict net rainfall in Florida to decrease significantly with global warming. This decrease may challenge us more quickly than rising sea levels. Trimble proposed the following recommendations:

- Regionally, nationally and globally steps need to be taken to slow, halt and if possible reverse global warming
- Regionally plan for more severe drought and floods



- Continue investing in more refined climate models and developing improved methods for up-scaling and downscaling climate data
- Invest in technology to slow global warming

**Phil Kramer**, The Nature Conservancy, described the Florida Reef Resilience Project as an example of developing adapting and coping strategies for climate change impacts to coral reefs. These impacts include warming seas, rising seas, disease, changing storm patterns and altered currents. The resilience program includes extensive monitoring to identify impacts and ecological resilience. The monitoring program includes divers from 12 agencies who are deployed during peak temperature stress periods. While this monitoring is valuable in studying particular events it does not capture data related to gradual changes. The program is also studying the effects of small scale adaptation strategies including the resilience of specific genotypes. He emphasized the importance of providing participatory mechanisms to include all stakeholders in developing the strategies.

The potential public health impacts of climate change were presented by **Andrew Reich**, Florida Department of Health. He reminded the audience that in addition to temperature, precipitation and coastal environment changes, Florida will also experience increased stormwater runoff, degraded water quality and decreased water availability. These conditions may result in increased waterborne pathogens and chemicals, more frequent harmful algal blooms, increases in vector born diseases (West Nile virus, Lyme Disease, Malaria, Dengue Fever, Hantavirus), heat stress and water quality-related diseases. In addition, there are health considerations related to climate change impacts to hazardous waste sites, sewage treatment sites and both groundwater and surface water drinking water supplies. Higher temperatures will also increase heat-related stress and deaths as well as contribute to thermal inversion and related air pollution. More frequent drought-related wildfires will also contribute to air pollution. Reich closed by stating that a strong public health system is required to combat these problems. That system must include not only disease protection and control, but also education programs for professionals, policymakers and the general public.

**Peter Merritt**, Treasure Coast Regional Planning Council, described a study which was undertaken by all the Regional Planning Councils in the state to raise awareness of sea level rise issues and stimulate local governments to begin planning for sea level rise. The study was initiated by the Environmental Protection Agency (EPA) to determine the impacts of sea level rise on the nation's economy. Using existing GIS maps the study mapped uplands from 0-10 feet in elevation and within 1,000 feet of shoreline. The study then identified the likelihood of protection based on land use. Conclusions included the finding that all coastal communities in Florida are likely to be impacted by sea level rise, local governments are encouraged to begin addressing sea level rise in Coastal Management Elements of their Comprehensive Plans and more detailed topographic data is needed to improve sea level rise planning.



The session then moved to a panel discussion during which Moderator Merritt asked, “What are the most important steps to be undertaken to plan for climate change?” The responses included the importance of getting the message out to people so that they understand what is happening. In doing so, it is important to assure that all socio-economic groups are educated about the issues. It is also necessary to have infrastructure in place to assess the impacts.

In response to the question, “What are the most critical types of data needed to address the issue?” the responses included mapping, modeling and monitoring data as well as the staff necessary to analyze the data. Collaboration among agencies and groups to share datasets is also important. The need for good surveillance information to track patterns of disease was also mentioned.

Finally, all agreed that there currently is not adequate funding for climate change planning in their areas.

During the audience question and answer period Kramer was asked if artificial reefs contribute to coral reef losses. He replied that artificial reefs are a different ecosystem and that they support fish but do not play a role in the long-term strategy for dealing with climate change impacts.

In response to a question about the cost of coastal protection, Merritt said that the study he spoke about did not include protection costs. EPA is currently looking at the economic impact of sea level rise.

When asked what can be done to get the public to understand the relationship between climate change and human health, Reich replied that primary care providers must recognize the nexus between climate change and disease. The health system must look for environmental connections and focus on causes as well as treatment.

Audience comments included:

- We need to show the economic value of natural areas so they also receive protection
- Need to get the Department of Community Affairs (DCA) involved to give local governments advice
- Counties need state and federal support for planning and protection
- Need to look at resources and capacity when setting protection goals
- Need to educate the public and the press

## **2.4. Current Initiatives and Technologies**

This session explored current initiatives and available and emerging technologies for reducing anthropogenic contributions to climate change.



Florida ranks 5<sup>th</sup> nationally in the amount of energy consumed per capita and it is 3<sup>rd</sup> in total energy consumption reported **James Fenton**, Florida Solar Energy Center. Residential use consumes 51% of the energy used in Florida with commercial use accounting for another 32%. Clearly, improving energy efficiency in these areas would have positive economic and environmental effects. Florida is the leader in new home construction in the U. S. with 160,000 new starts in 2003. Unfortunately, only 2,500 were Energy Star homes. Currently the EPA's Energy Star program includes windows, appliances, lighting and air conditioning. Florida built the first zero energy home that included photo voltaic cells, solar water heating and many other energy conserving features, demonstrating that technologies already exist that can greatly reduce energy consumption. As the Sunshine State, we should take full advantage of our ability to harness this clean, renewable resource. Fenton proposed that Florida develop a renewable energy incentive program modeled after California's program to fund the movement toward energy efficient homes and buildings.

Florida's Farm to Fuel Initiative has been developed to assure it does not use food crops for energy according to **Jay Levenstein**, Florida Department of Agriculture and Consumer Services. Florida is the third largest consumer of fuel in the United States and we depend almost exclusively on other states and nations for our supply of oil and gasoline. Agriculture will play an increasingly important role in energy production in the future. The Farm to Fuel Initiative partners with the 25 x '25 program which has the goal of having America's farms, ranches and forests produce 25% of the total energy consumed in the U.S. by 2025 while continuing to produce safe, abundant and affordable food, feed and fiber. This goal will be met by producing transportation fuels, harnessing wind energy, converting biogas emissions, capturing solar energy and providing biomass for generating heat and power. The Farm to Fuel Initiative promotes the production and distribution of renewable energy from Florida-grown crops. It provides matching grants for bioenergy projects and includes ethanol, cellulose ethanol, biodiesel and biogas fuels.

Florida may not have oil but we are the "Middle East of waste," according to **Ann Wilkie**, University of Florida. We should begin to look at waste products as resources which can produce energy. Through anaerobic digestion organic waste produces biogas which can then be converted into electrical or thermal energy. Feedstocks include animal manures, agro-industrial wastewaters, municipal wastewaters, municipal solid wastes, biofuels by-products, energy crops and crop residues. Anaerobic digestion benefits include renewable energy, BOD/COD reduction (improved water quality), odor reduction, pathogen reduction, nutrient conservation and greenhouse gas reduction. Biogas is a sustainable energy source that is renewable, carbon dioxide neutral and locally based.

**Rayburn Butts**, Florida Power and Light (FPL), stated that FPL is the leading U.S. generator in clean energy. It is among the largest wind generators in the world and operates the largest solar field in the world in the Mohave Desert. FPL has joined the U.S. Climate Action Partnership, a business and NGO partnership that recommends legislation to slow, stop and reverse the growth of greenhouse gas emissions. It has



committed to a 15% improvement in generation efficiency by 2020 from a 2000 baseline year. Florida's residential customers use about 30% more electricity than 20 years ago. Coupled with the state's rapid growth this makes reduction goals difficult to achieve. FPL supports the regulation of carbon dioxide that involves a price signal in the economy. This carbon fee should be used for research to improve existing technologies and create new technologies.

Moderator Barry Heimlich asked what can be done to meet Florida's need for power without building new coal plants? Butts stated that we probably cannot move forward without additional coal plants. He further said we need a price signal for carbon in the U.S. economy, which should increase gradually over time to fund programs for research. Fenton said we need to focus on efficiency pointing out that energy consumption per capita has been flat in California while it is rising in Florida.

## **2.5. Partnerships for Success**

This session focused on which agencies and entities are the most appropriate to address impacts on the natural and human systems resulting from climate change. It also looked at ways people, groups and agencies must work together to solve these challenges.

**Kevin Rosseel** of the U. S. Environmental Protection Agency's Climate Change Division explained that the Division's mission included implementing voluntary programs to reduce non-carbon dioxide emissions, analyzing greenhouse gas emissions and reduction and adaptation options, communicating strategies to policymakers, building international capacity to reduce greenhouse gas emissions, and educating the public. They have over 20 partnership programs that deal with climate change. These range from the Energy Star Program that was mentioned in the previous session to industry-specific programs for agriculture, transportation and other sectors. The Clean Energy-Environment State Partnership provides assistance in evaluating strategic and programmatic options, targeted guidance and analysis, state to state peer exchange and communication support and information about funding opportunities and related clean energy resources. The Cities for Climate Protection Campaign includes 212 cities, including nine in Florida. To date, 413 mayors have signed the U.S. Mayors Climate Protection Agreement, including 31 municipalities in Florida. Rosseel closed by inviting attendees to contact the U.S. EPA about climate change and partnership programs. Key EPA resources can be found at [www.epa.gov/climatechange](http://www.epa.gov/climatechange) and [www.energystar.gov](http://www.energystar.gov).

**Richard Owen**, Southwest Florida Water Management District, opened by saying that the five water management districts are not considering climate change to a great extent in their day to day decisions, but that he would present information on some approaches that could be applied to climate change issues. They include regional and adaptive approaches as well as partnership agreements.



The Central Florida Coordination Area includes 5-6 counties and 3 districts and can serve as a model for ways in which regional partnerships can solve resource problems. The Central Florida Coordinated Action Plan has three components, regulatory, planning, and modeling and predictive tools. By working together the districts protect groundwater resources, provide equitable distribution of available groundwater and provide expedited development of alternative water supplies, thus providing consistent results across district boundaries.

To illustrate how partnerships can be used to address regional issues Owen described the Northern Tampa Bay watershed partnership agreement, which reduced groundwater pumping and developed alternative water supplies. This agreement between Tampa Bay Water and the Southwest Florida Water Management District includes a new regional surface water treatment plant, new regional pipelines, a new seawater desalination plant, and a new regional surface water reservoir.

Adaptive management is used in the Surface Water Improvement and Management Program. Scientists are incorporating sea level rise into their plans for these habitat restoration projects, assuring that the environmental benefits will be maintained even with sea level rise.

**Nichole Hefty**, Miami-Dade Environmental Resources Management, spoke about effective partnerships in Miami-Dade County's climate change initiatives. In 1991 Miami-Dade was one of the first 12 international jurisdictions participating in the International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Change Program. The program goal was to reduce carbon dioxide emissions by 20% of the 1988 baseline by 2005. Although this goal was not met, emissions were reduced by 34 metric tons.

Participating organizations included local gas and electric utilities, state universities, local business groups, environmental organizations, staff from key county departments, NOAA and ICLEI. Hefty emphasized that partnerships and collaborations are critical to get the whole picture and to leverage additional resources. The Climate Change Advisory Task Force was officially established by Ordinance in July 2006 and some five to seven committees will address climate change adaptation and mitigation issues.

Hefty emphasized that partnerships are the key to their success. They add value by providing regional and community perspectives, sharing expertise in specific areas, greatly expanding resource opportunities, facilitating education and increasing public involvement and providing local and regional buy-in.

The city of Tampa's quest for a sustainable government was presented by **David McCary**, Director of the Department of Solid Waste and Environmental Program Management. Mayor Pam Iorio recently signed the U.S. Conference of Mayors Climate Protection Agreement.



Central to plans to create a sustainable city is the belief that government has a responsibility to lead by example. Education is the key to making Tampa a leader in greening Florida. As part of the strategic plan the city has created a Green Team for each environmental element. The core elements are water quality, greenways and trails, green policy (purchasing and procurement), air quality, green building and renewable energy and recycling.

In addition Mayor Iorio is establishing an Environmental Roundtable with eight focus areas:

- Potable water conservation and supply
- Transportation including roads, bike paths and sidewalks
- Health of the Hillsborough River
- Infrastructure, particularly stormwater management
- Air and groundwater pollution
- Green buildings
- Sustainable development
- City department compliance and enforcement issues

McCary closed by saying that the program will offer a common sense approach to environmentalism. It is designed to help awaken environmental consciousness and help change behavior in a positive way. It seeks to inspire, inform, and enable our communities to improve their quality of life and increase economic prosperity through environmental responsibility.





### 3. Science Summary

The Science sessions were organized to present and discuss the technical significance of climate change as it relates to Florida. Brief presentations, panel discussions, and question and answer sessions facilitated the dissemination of information on past and current research in the field.

#### 3.1. Historical Perspectives

Several speakers gave a scientific historical account of Florida's climate, geology, and archaeology to develop a background for the climate issues that we are experiencing today.

**John Jaeger**, University of Florida, speaking on Florida's transformation over geologic time, explained the implications for Florida of interplay between tectonics, climate change and the sea level. There are two primary factors that determine whether or not a geographic area will be above or below sea level – vertical tectonic motion and sea level change. Because Florida is situated in the middle of a tectonic plate and is relatively stable, the primary factor that determines Florida's terrestrial area is sea level change. Sea level changes take place in a cyclical pattern of highstands and lowstands. The transition from “global icehouse” to “global hothouse” drives this cycle by causing melting and freezing of ice to change the volume of the earth's oceans. The most recent highstand was approximately 120,000 years ago, as evidenced by Key Largo's limestone deposits, buried barrier islands 10 meters inland from the coast, and buried corals that are believed to exist beneath the Everglades. During a sea level highstand, most of the Florida peninsula becomes covered with water. Even though this cycle occurs over extended periods of time (on a human scale), it is believed to have been historically caused by naturally occurring volcanic activity releasing green house gases into the atmosphere. Jaeger concluded that large releases of such gases into the earth system in excess of natural releases may accelerate the chronology of events that leads toward a sea level rise.

**Phillip van Breynen** of the University of South Florida explained and analyzed drought conditions in Florida over the past 2000 years in order to ultimately explain what we can expect from future conditions. C14 and O isotopic analyses were used to determine historical precipitation rates in Central Marion County, located in Central Florida. This method was used to determine that Florida entered a much wetter period approximately 1000 years ago, caused by a shift in the Intertropical Convergence Zone (ITCZ). This trend has somewhat subsided, and Florida now experiences a drought interval of roughly 100-140 years. Breynen ultimately concluded that El Nino Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO) are the two primary factors that influence precipitation patterns. However, ENSO has only a weak influence on Florida's precipitation, with NAO having a much



stronger impact on precipitation patterns in the state. The next 40-50 years should be drier than the average in Florida.

**Nancy White** of the University of South Florida lent historical enlightenment on the topic of people and climates throughout 12,000 years of Florida's prehistory. Archaeological findings show that humans were in Florida as early as 12,000 years ago, just 3,000 years after the first humans are believed to have entered the continent. As the ice age ended and a period of warming began, a shift in tools clearly shows that hunters switched from targeting mega-fauna to smaller fauna. Interestingly, aboriginal Floridians chose not to live near shorelines. They understood better than our present culture that these shorelines were dangerous locations to settle and only came to the shoreline during the winter season. A study of soil erosion has also led to an interesting discovery. Barrier islands are usually shaped and formed by hurricanes, but archaeological evidence of occupation has been found to line the bay side of some islands. However, in just the past twenty years nearly four feet has been eroded away from the bay side of these islands. Such erosion would not allow for archeological preservation, meaning that something has changed in the last twenty years. White hypothesized that this could be due to anthropogenic changes.

**Mark Brenner**, University of Florida, added to the scientific historical perspective by explaining holocene climate change in Florida. The biggest problem with establishing a historical timeline for holocene climate change is that records only date back about 100 years. Far more is known for areas such as the Caribbean and Yucutan than is known for Florida. Even though isotopes can be used as a natural archive to piece together information, it has historically been quite difficult to get accurate data in wet climates due to problems with tree ring analyses. Brenner stressed that without this type of work we are prone to surprises from the climate that we could have predicted if the proper research and data existed. Tree ring analyses and lake core samples are now being taken in Central Florida, but the research is not yet complete.

### **3.2. Sensitive Ecosystems and Components**

**Mark C. Eakin** from NOAA lent valuable expertise on coral bleaching within Florida's coral reefs. Coral reefs can be considered a "canary" acting as an indicator for ecosystem health. Reefs are an important part of our environment and our economy. They are worth \$375 billion globally and are home to some of the most diverse species on the planet. For these reasons alone they deserve to be well-taken care of. The top threats to reefs include human population growth, overfishing, coastal development, lack of laws/enforcement, lack of education, nutrient loading, and coral reef bleaching. Reefs may undergo bleaching when they are subjected to temperatures above a certain threshold value. These higher temperatures can cause severe stress which ultimately results in the ejection of symbiotic zooxanthellae. Coral can usually recover from minor stress, but severe stress may cause death. NOAA's Coral Reef Watch Program, which uses satellites to monitor reef systems, is now showing unprecedented bleaching rates worldwide. In the Virgin Islands, for



example, bleaching rates of 71-96% have been documented, with less than a 50% recovery rate. Florida has been spared the worst due to a series of hurricanes that hit the state. These hurricanes managed to reduce temperatures quickly enough to prevent permanent damage to most coral reefs in and around Florida. However, the IPCC predicts that coral bleaching will continue to be even more prevalent in future years. This is not due to just the expected increases in temperatures, but also due to expected increases in airborne carbon. As airborne carbon increases, much of it is absorbed by the oceans. This causes pH levels to rise, resulting in an unfavorable environment for coral. Even though some coral types can withstand these stresses without succumbing to bleaching, it is important to maintain a diversity of coral populations. This requires immediate action and management. Some proposals that have been suggested include shading reefs, increasing mixing, improving water quality, reducing the prevalence of diseases, and coral gardening to replace lost reefs.

**Bill Causey**, NOAA, examined the potential impacts of climate change on the coral reef ecosystem components. He discussed the likely impacts of climate change on the Florida Keys. Causey pointed out that while coral species have some capacity to recover from bleaching events, this ability is diminished with greater frequency or severity of bleaching. As a result of climate change it is likely that The Florida Keys and regional coral reef biodiversity will be seriously reduced by the elimination of sensitive species along the Florida coastal areas. Since the 1970's, Causey has observed and recorded changes in the coral reef ecosystem of the Florida Keys as a result of increasing sea surface temperatures. These changes came in the form of an intensification of coral bleaching events and the secondary impacts of coral diseases in response to the stress of bleaching. As a result of climate change it is likely that we will observe a reduction in local and regional coral biodiversity, as sensitive species are eliminated.

**Dennis Hardin** from the Florida Department of Agriculture and Consumer Services Division of Forestry explained how climate envelope models are predicting the effects of warming and drying scenarios on Florida ecosystems. The data used to build these models are from range maps of 125 tree species, compiled species lists for 36 areas, and over one hundred climate data stations. It was determined from this data that moisture balance and precipitation during the dry season as well as temperature increases are the basic variables responsible for distribution throughout Florida. He specifically noted that this does not include CO<sub>2</sub> enrichment, fires, competition, predation, disease, transitions, and other more specific variables. After comparing data with another climate and data range source (Little), many species show little change under varied scenarios while others are heavily affected, especially under drying scenarios. The models show that entire ecosystems shift with temperature and moisture changes. Specifically, under a warming and drying scenario, the models predict that Florida's ecosystems will shift northward to a more agreeable climate. Hardin recommends that extensive management will be needed to overcome this – management that we are unlikely to have the manpower or resources for. Therefore, it may be advisable to preempt this process and begin



selectively moving ecosystems to the north such that this process is more agreeable to human needs.

**Stephen Mulkey**, University of Florida, closed the Wednesday session with a talk on the realities and opportunities of climate change for Florida. This is an area that bridges the gap between science and policy. With the release of the IPCC's recent reports, it is now clear that we must plan for and expect climate change to occur. Mulkey stated that we should expect a sea level rise of at least 7-23" by 2100, but possibly as much as three feet. This number excludes ice and sea level feedbacks, so the rise may actually be substantially higher. A sea level rise of even a couple feet will be very detrimental to Florida. Coastal cities will be forced to make major expenditures, beachfront property will be lost, business expenditures will skyrocket near the coasts, regional water shortages will become more prevalent, Florida may become less desirable to tourists, insurance costs will likely increase, coral bleaching and increased ocean acidity may devastate sport and commercial fishing in the area, and an untold number of species may in fact go extinct if they are unable to cope with a quickly changing climate.

Recent research also suggests that an increase in global temperature may spark more intense and more frequent hurricanes. Put simply, the costs associated with climate change will be higher in Florida than in any other state. With this said, Mulkey then delved into the details of how we could mitigate these impacts and even use climate change to the advantage of Florida – if we begin planning now. If an international agenda can be agreed upon and followed that reduces greenhouse gas emissions by at least 60% by the year 2050, then we will have successfully mitigated the worst of the possible climate changes and should be able to continue on with business as usual. This is by far the least expensive course of action for Florida. Because of the state's particularly precarious location for a climate change event, the costs of active mitigation fifty years down the road are substantially higher than the costs of working to proactively mitigate climate change now.

Nonetheless, Mulkey recommends that Florida begin to take preemptive action with the assumption that international mitigation may not occur in time. He recommends action be taken in the following areas: land use and management, marine and reef management, reliance upon alternative or renewable sources of energy. He stressed that land use and management is extremely important – by 2060, seven million additional Florida acres are expected to be lost to human development.

Mulkey also noted that Florida is extremely well suited for solar energy development. Currently, over half of all U.S. solar equipment exports go straight to Germany, where their installation is heavily subsidized. However, solar radiation received in Germany is roughly equal to that received in Alaska. This is one area that Florida could and should use to its advantage.



### 3.3. Evidence for recent climate change

**Danny Coenen** of the University of Florida's Howard T. Odum Center for Wetlands opened the Thursday morning session with a talk on lake temperature trends as indicators for climate change. He explained that lakes offer an excellent source of temperature data for this type of purpose because of their high thermal inertia. His team found that even though lake temperature is primarily controlled by latitude, North Florida lakes are just as warm as South Florida lakes. Coenen also explained that summer lake temperature averages have not changed much over the past thirty years, but winter average temperature has increased by about one degree, with decadal oscillations in temperature procession and regression. These higher than average winter temperatures may have ecological implications of facilitating northward expansion of sub-tropical species. Should winter temperatures continue to trend upward, as evidenced by lake temperatures, cold weather species may be limited to north-central Florida only. This is based upon a three degrees Celsius temperature increase causing much of South and Central Florida to become tropical while causing much of North Florida to be converted to a sub-tropical climate.

**Hillary Swain**, representing the Archbold Biological Station, continued the Thursday session by discussing the immediate climate change impacts that the Biological Station has witnessed over the past 20 years. One of the interesting findings of the Station is that temperatures in and around Archbold have actually decreased, as shown by an increase in the average total number of annual freeze days. Swain showed that while most of South Florida has experienced average temperature increases, areas close to Lake Okeechobee have actually encountered the opposite effect. This is based on data dating back to the mid 1930s. This cooling trend is thought to be due to a loss of nearby wetlands, which serve to keep temperatures stable due to their higher thermal inertia. As these wetlands have been converted to dense development and agriculture, this thermal inertia has been lost. Ultimately, she concluded that simplistic predictions of increased temperature are not detailed enough to explain the whole picture. She also concluded that land use changes seem to have the largest impacts on climate in Florida.

**Frances E. Putz** of the University of Florida then closed the morning's science session with a talk on sea level rise and coastal forest decline along Florida's Big Bend. According to research conducted at Cedar Key, a mean sea-level rise of 2.4 mm/yr has been taking place for at least the past 50 years. This rise has caused the area to undergo a transition to salt marsh, causing the death of Cabbage Palms – usually the last species to die. He believes that data collected from this site can be used to estimate where coastal forests will be lost due to the expected effects of climate change.



### 3.4. Climate Variability: Initiating a Social Science Paradigm Shift

**Ana Puszkin-Chevlin** of Florida Atlantic University opened the final afternoon's science session by introducing and explaining the importance of translating the hard science explained by previous speakers into social science action. What talks to policy makers, she asked? Dollars and death (human health). By framing this conference in terms of scientifically backed economic impacts and human health impacts, it is hoped that science can be turned into policy.

**Elizabeth L. Malone** of the Joint Global Change Research Institute was the first to speak on this key subject, explaining why climate change is in fact a social issue. Citing the Chesapeake Bay as an example, she believes that politicians will be hastened to action if science issues are framed as human, social issues that directly affect their constituents. Because climate change affects natural systems which eventually affect humans, focusing on human change is also desirable. How can we mitigate something that we are uncertain about? Therefore, she advocates keeping the "climate dimension in human change research" as opposed to the other way around. If we do this, she believes that politicians may be compelled to act much more quickly.

The final speaker for the Science Session was **Samuel D. Brody** of Texas A&M's Environmental Planning and Research Sustainability Unit, speaking on local commitment to climate change policy in the United States. The primary question that he brought to bear on the audience was "if major incentives exist for localities to not pursue climate change mitigation (free-riding of other localities, no federal incentives, one locality doesn't matter), then why have so many local communities, towns, and cities joined climate change mitigation efforts?" In particular, why have over 100 counties in the U.S. joined Cities for Climate Protection (CCP). His research team concluded that the most important variables in determining this are: (1) degree to which a local area is susceptible to climate change and (2) the "social capacity" of an area to politically react to risk from climate change. Brody then proceeded to show a series of maps depicting the strength of these incentives throughout the United States. Brody illustrated a major disconnect between different types of localities. The cities that are causing climate change are not joining the CCP while the cities that are at the greatest risk generally do join the CCP. However, because the stressors and those at greatest risk are not usually the same cities or geographic areas, CCP is not as effective as it could be. He gave the example of Goshan, Indiana as the greatest stressor and Miami-Dade as the city at greatest risk. Interestingly, even though Florida is shown to be at greater threat level from climate change than any other state and even though Florida contains a much higher than average social capacity to react to this problem, Florida (as of 2005) was one of the states lagging the farthest behind in climate change mitigation efforts. Furthermore, even though some Florida counties and municipalities have joined the CCP, the number that have done so does not yet correlate with the number that should have joined. Thus, Brody sees Florida as a CCP recruiting opportunity.



## 4. Discussion Group Reports

### 4.1. Introduction

On the afternoon of May 10<sup>th</sup> attendees participated in one of three working groups to discuss the environmental, social and economic aspects of climate change. Outcomes from those discussions were presented during the plenary session on May 11<sup>th</sup> and were presented to the Century Commission for their consideration. A brief description of each group is given below.

#### **Environmental** – Facilitated by Nick Aumen, Everglades National Park

The climate change discussion group focused on environmental issues assessed what was presented and learned during the preceding days of the conference, and analyzed and synthesized the information in a group setting. The goal was to identify, discuss, and refine a number of issues related to achieving environmental sustainability within the context of global climate change. Particular attention was paid to the overlapping and sometimes competing issues of Florida's rapid population growth, sufficient quantity and quality of drinking water, food and energy needs, and efforts to conserve, protect and restore natural lands and waters.

#### **Social** – Facilitated by Art Evans, Florida Atlantic University

The discussion included the anticipated social effects of climate change within the state of Florida, including impacts to critical institutions such as health, housing, disaster preparedness, education and transportation. Special consideration was given to Florida's diverse population and the necessity of enhancing the resilience of communities to respond to climate change.

#### **Economic** – Facilitated by Chris Walker, The Climate Group

This group focused their discussion on the economic dimensions of climate change for the state of Florida. Identifying the financial threats and opportunities facing the State, its ability to grow and its key industries in a climate changed future. The goal was to identify, discuss, and refine the activities that make the most economic sense for the State to simultaneously mitigate climate risk while adapting to a climate changed environment.

The outcomes and recommendations from each of the discussion groups are presented in the following sections.



## **4.2. Environmental Discussion Group**

### **4.2.1. Introduction**

Approximately 40 individuals convened on May 10-11 as part of the Climate Change Conference to provide environmental recommendations. These persons represented a very broad range of expertise, knowledge, and interests, including local, county, state, and federal governments, non-governmental organizations, academia (faculty and students), and the private sector. At a broad level, the group first identified a range of environmental issues (Section 5.1.2) that should be considered to address climate change in Florida. Even though there might not be specific recommendations under every topic, the group felt that the Commission should use these as a framework for future discussions. After discussing these topics at a broad level, the group developed approximately 35 specific recommendations (Section 5.1.3). Once these recommendations were listed and further considered, the group organized them into three tiers using a voting process. All recommendations are listed below.

### **4.2.2. Environmental Issues**

Environmental topics, linkages, and processes

- Freshwater ecology
- Marine ecology
- Coastal ecology
- Terrestrial ecology
- Built environment
- Exotic species
- Species of conservation concern
- Wildlife migration
- Climate/meteorology
- Hydrology (surface and ground water)
- Fire
- Water (drinking, irrigation)
- Connectivity
- Carrying capacity

Land use

- Agriculture
- Urban/rural
- Conservation
- Transportation
- Planning

Energy (including alternative energy sources)





Florida's regional context (e.g., specific climate zones)

Incentives/Disincentives

Catastrophic Events

Florida-specific research needs

Adaptive design and adaptive management

Outreach/Communication

#### **4.2.3. Prioritized Specific Recommendations**

After consideration of all suggested recommendations, each member of the group was given 3 votes to allocate among their top 3 choices (one vote each). The list below is prioritized by tiers according to the voting. The group felt that every recommendation listed, even if not in the first tier, should be communicated to the Commission for their information and possible use.

##### **First tier:**

1. Florida's growth management and land use planning must result in a connected, ecologically functional network of conservation areas buffered by land uses consistent with fire and other land management needs. This approach is critical to ensure persistence of Florida's biological communities resilient to climate change.
2. Measure the synergistic effects of climate change and increased human population on quality of life, environmental quality, cost of living, and economic opportunities.
3. Determine the carbon cycle (including all needed accompanying data) for each land use type and its associated plant communities, with the goal of establishing incentives to conserve areas of high carbon sequestration capacity.
4. Plan ahead for climate change and sea level rise to allow migration of communities and ecosystems (e.g., establishment of greenways, reduction of barriers for migration).
5. Charge an independent entity to establish an adaptive, clean energy strategy to mitigate climate change. Require science-based justification and validation incorporating clear benchmarks.



6. Establish an integrated network of early warning sites on protected lands to track long-term changes in biological communities and processes; establish a Center for Climate Archives for baseline and associated data.
7. Fully fund and support the 2008 (and beyond) Florida Ocean and Coastal Resources Council research plans emphasizing monitoring, mapping, and modeling.

**Second tier:**

1. Reduce carbon emissions, and take local management actions for carbon emission mitigation and adaptation.
2. Develop and implement a comprehensive education and outreach strategy to create awareness and foster measurable behavior change of citizens, governments, businesses, and institutions.
3. Develop a model set of state, regional, and local comprehensive plan goals, objectives, and policies to address climate change across jurisdictions.
4. Develop new technologies and partnerships to reduce impermeable surfaces; provide incentives to reduce runoff and to enhance aquifer recharge.
5. Invest in emergency response and mitigation strategies for extreme environmental events likely to be exacerbated by climate change.
6. Mandate mass transit incentives.
7. Address synergistic effects of multiple stressors impacting coral reefs; examine climate change-related ocean temperature rise and acidification in addition to other anthropogenic factors such as nutrification and increased suspended sediments.
8. Establish a long-term vision for healthy and vibrant beach dune communities that will be affected by sea level rise.
9. Develop a process for early detection, evaluation, and handling of emerging environmental issues.
10. Fund more aggressive invasive species research and control/eradication programs that take into account climate change scenarios.



11. Assess the impacts of climate change on potable water supply, infrastructure, and increased salt water intrusion in coastal well fields.
12. Freeze controllable greenhouse emissions and control energy growth; include a regulatory structure for decentralized energy sources, allowing utilities to be managers.
13. Provide developer and community incentives to achieve water use best practices based on local ecology and biological communities.
14. Provide incentives for existing homeowners to implement green building concepts, including deviations from existing deed restrictions and encouragement of Florida- friendly landscapes.
15. Assess the impact of climate change on microbial communities and processes across all of Florida's ecosystems.

**Third tier:**

1. Mandate climate change-integrated conservation management and restoration plans within an adaptive management framework.
2. In consideration of Florida's emerging urban forest, develop a prioritized research agenda for public universities based on resource managers' science needs.
3. Restore flow by completing the Comprehensive Everglades Restoration Plan; it will create a fresh water head to slow salt water intrusion, will allow species to adapt, and will provide habitat to migrate.
4. Consider the built environment when developing ecosystem corridors.
5. Identify and provide additional protection for natural areas and species that inherently are resilient to climate change and local stresses.
6. Identify species and ecosystems of conservation concern, emphasizing their overall services and benefits; prioritize protective strategies for them in response to climate change.
7. Establish specific reduction targets for carbon emissions by specific dates through the formation of state, national, and international partnerships; promote one, unified market mechanism.
8. Fund university research on a multi-year basis to promote long-term ecological research related to climate change.



9. Fund research on alternative fuels such as hydrogen with low carbon footprints; develop infrastructure for alternative fuels use.
10. Given recent changes in climate patterns, update state-wide rainfall intensity and distribution maps.
11. Determine the conditions under which it will be necessary to limit the growth of Florida's human population.
12. Develop a process to ensure ongoing science input to the Century Commission and to broader policy-making in general.



### **4.3. Social Issues Discussion**

A group of more than 30 individuals met on May 10-11 to provide recommendations regarding social issues related to climate change. In the short period of time it was difficult to prioritize all of the complex issues involving Florida's diverse population and social structure as they relate to climate change. To enable the group to address the numerous social issues in the allotted time, the issues were grouped as follows:

- Housing/Transportation/Energy Efficiency
- Disaster Preparedness/Recovery/Coastal Development/Security
- Population Growth
- Health/Water
- Education

Overarching issues:

- Climate change may drastically change existing socio-economic structure in Florida and the world.
- There is a need to ensure, as much as possible, that current social divisions and stresses are not made more divisive as a result of climate change.
- Planning and preparation should enhance the resilience of communities to respond to climate change.

Recognizing that each issue deserves a more thorough analysis, the group established this preliminary list of immediate recommendations:

#### **4.3.1. Housing/Transportation/Energy Efficiency**

- Create more energy cost effective communities through community design, green building and energy efficient vehicles, including public transportation
- Promote green building alternatives through education, taxing incentives, building and design standards, green-lending
- Develop and adopt housing design criteria to deal with the consequences of more intense hurricanes and possible sea level rise
- Change building codes to promote energy efficient building; good energy efficiency also aids in disaster preparedness
- Work on guidelines and incentives for Homeowner's Associations and individual homeowners for mitigation and adaptation measures
- The lack of public transportation alternatives is a major obstacle that must be overcome through light rail and other methods
- Change to energy efficient busses and taxis, including biofuels
- After providing alternative transportation, consider congestion zone tolls in larger cities
- Subsidize retrofitting buildings for energy efficiency



- Promote green roof technology through building codes
- Partner with utility companies to educate the public on energy efficiency and expand and increase incentives to homeowners (free/low cost loans for photovoltaic systems, net metering, solar panels)

#### **4.3.2. Disaster Preparedness/Recovery/Coastal Development/Security**

- Need vulnerable lands acquisition program similar to the natural lands acquisition program
- Need to include climate change in all nine components of local comprehensive plans
- Examine the reality and economics of insuring in coastal flood zone
- Need vulnerability assessment of our assets, and find a way to quantify these coastal assets – both natural and man made
- Need stringent policy at the state level to curtail seawalls and official policy of strategic relocation/retreat; develop a triage system to decide what will be saved and what will be given up to the sea
- Need new innovative programs and ideas regarding transfer of development rights for coastal lands susceptible to climate change impacts
- Need to retool the coastal high hazards area legislation
- Need better data for assessments (aerial photos need to be digitized to know where on a parcel an asset is located)
- Develop better integrated data systems for disaster preparedness, coastal development and recovery
- Need for better LIDAR data to measure coastlines and water depths
- Need to move from paper to digitized data
- Expand state incentive program to help people retrofit homes for disaster preparedness
- Need a carbon fee

#### **4.3.3. Population Growth**

- Promote smart, climate change conscious growth
- As 90% of Floridians live within 10 miles of the coast, we need to plan for regional relocation and displacement
- Need to consider climate change in long-term regional planning
- Consider sea level rise impacts to the Bahamas the Keys and immigration and migration effects for Florida
- Plan for agricultural impacts affecting local food providers as well as rising transportation costs for food grown outside Florida
- Expect there will be less food, both to import and export
- Promote local food providers and community gardens
- Values might change as to what constitutes “wealth” and how that relates to the economy



- Plan for demographic changes and increased cost of living
- Promote “communities” not “neighborhoods”

#### **4.3.4. Health/Water**

- Encourage water conservation – permanently
- Build Xeriscaping into codes and educate Homeowners Associations regarding principles and benefits
- Have municipalities lead by example in using Xeriscape landscaping
- Promote native vegetation and storm resistant tree canopy
- Charge impact fees for St. Augustine lawns
- Encourage/require grey water use through incentive programs
- Need more water retention areas for aquifer recharge
- Eliminate flat rate water billing and re-price water on a sliding scale incorporating drastically increased cost for large consumption
- Provide rebates for installation of low flow technology along with a progressive water pricing program
- Develop surveillance systems for monitoring tropical diseases
- Need research and action plan for tropical diseases
- Move health facilities out of vulnerable zones; provide distributed health services
- Need research on heat waves and affects/treatments for vulnerable citizens
- Add climate change health issues to state mandated Continuity of Operations Plans (COOP)
- Research possible asthma increase due to climate change and identify indicators
- Determine how climate change will affect exercise and recreation and the resulting impacts to health

#### **4.3.5. Education**

- Need to educate the public about the positive impacts that personal actions have on climate change; small changes can make a difference – multiplier effect
- Need to educate Home Owners Associations and have them adopt and promote climate friendly and energy efficient practices
- Create awareness through other community organizations; churches, clubs etc.
- Need to involve all educational stakeholders
- Model proper environmental policies in schools
- Need incentives for schools to develop climate-wise buildings or retrofit programs
- Test current student knowledge on global climate change



- Talk to curriculum development personnel, make sure curriculum that includes global climate change is being developed at every grade level from K-12
- Create Florida-specific text books on climate with recognition of regional differences within the state
- Sunshine State Standards must include global climate change





#### **4.4. Economic Discussion Group**

A group of 44 individuals met to provide economic recommendations related to climate change. Action on these recommendations will move Florida from “the sidelines” towards leadership on Climate Change. The overarching theme was the need for Florida to have a Clean Energy Strategy, which includes:

- Comprehensive planning across various agencies, possibly through a Climate Czar. Elements to include an incubator/clearinghouse of clean energy strategy and the development of a comprehensive plan element related to Climate Change by the Department of Community Affairs.
- Economic analysis of options for the legislature
- Must reflect and emphasize a level playing field and societal cost for energy types
- Consideration of full life cycle impacts of the proposed policy options

The group also made the following observations:

- There is currently a lack of business engagement
- Business lacks an understanding of the problems and opportunities
- Carbon must have a price!
- There is an urgency to act. Initial actions should have a 5-year horizon, with longer-term projects investigated and infrastructure established during the initial 5 years.

The group’s recommendations were classified as Mitigation or Adaptation.

##### **4.4.1. Mitigation Economics**

To reach 80 percent reduction in emissions for the state the Florida “Wedges” would include:

- Biofuels – Ethanol, Bio diesel
- Solar
- Harnessing of Gulf Stream
- Energy Efficiency
- Green Buildings especially considering sprawl prevention/smart cities
- Transportation – to also consider mass transit

The abatement technology, the five-year plan as well as the impediments to the implementation of such plan for the six wedges are presented in the following table.



<b>FLORIDA WEDGES</b>	<b>ABATEMENT TECHNOLOGY</b>	<b>5 YEAR HORIZON</b>	<b>IMPEDIMENTS ETC.</b>
Biofuels	Ethanol, bio gas Bio Diesel	Renewable fuel standard	Distribution
Solar	PV and thermal, distributed generation	Bond or innovative financing, public benefit fund	Upfront costs prohibitive, needs net metering
Harnessing of Gulf Stream	Ocean current turbines	Research and pilots	Support for existing grants
Energy Efficiency	Appliances, CHP, insulation, water heaters, etc.	Process for raising efficiency on appliances	Require Energy Star compliance, public education
Green Building	Construction code, lighting standards, CFLs	Updating of building codes	Expansion of LEED cert. requirement to private sector
Transportation	Natural gas powered vehicles, raise mpg, hybrid	Sprawl abatement	Long-term horizon consider Hydrogen

#### **4.4.2. Mitigation Recommendations**

- Prioritize conservation initiatives
- Research carbon sequestration and postpone any new coal power plants until carbon sequestration is proven
- Duplicate My Safe Florida program with a matching My Energy Efficient Florida program
- Develop Environmental Benefit fund similar to other states Clean Energy Funds including funds for:
  - Education of business and consumers
  - Incubation of innovations and job creation in Florida
  - Research and development of longer term strategies

#### **4.4.3. Adaptation Economics**

- State should promote opportunity to incorporate energy efficiency and adaptation to climate change conditions. Consider an Energy Procurement Plan for Florida
- Land Preservation, mangroves etc. should be considered as part of the mitigation/adaptation strategy
- Need to build defenses – requires funding
- Plan for a hotter, dryer, more intense rain events, sea level rise and storm prone region



#### **4.4.4. Business Responses and Opportunities**

- General concern with lack of business engagement
- Business needs to be engaged regarding measurement and require reporting of emissions, information and planning for greenhouse gas constraints, both marketing mechanisms and carbon taxation need to be considered
- Business opportunities
- Need to investigate the opportunities for Florida to establish Clean Energy industry
- State Green/low carbon consumer engagement plan needs to be developed



## 5. Future Actions and Recommendations

### 5.1. Future Actions

Participants in each group expressed interest in working together to begin to address issues raised during their discussions. CES will serve as secretariat to organize working groups and facilitate ongoing discussion and activities to advance this work. Further information on how to get a Working Group Started and the kind of support to be expected from CES can be found on the Center's Climate Change website [www.ces.fau.edu/ccc](http://www.ces.fau.edu/ccc).

### 5.2. Recommendations

The “big” messages out of the conference which pervaded the presentations, panel discussions, and the working groups were:

- Climate change is not a future issue; it is happening now and we need to both reduce emissions to limit future change and also plan to respond to inevitable change.
- Climate change is not just an environmental issue, it affects all elements of society and most institutions and organizations
- Florida is the most vulnerable state in relation to the impact of sea level change. We need to develop specific risk assessments for Florida's coastline.
- Different zones in Florida will be impacted differently (e.g. winter warming will be a bigger factor in the north) we should take a regional approach in planning for mitigation.
- We need to prepare for a generally hotter, dryer climate, with periods of more intense rain and perhaps more severe storms. All water agencies should be planning for this.
- Florida's growth management, planning, and natural lands acquisition and management programs must result in a connected, ecologically functional network of conservation areas buffered by land uses consistent with fire and other land management needs. This approach is critical to ensure the persistence and resistance to climate change of Florida's biological communities.
- Climate change issues should be a part of planning at city, county and regional levels including the siting of infrastructure and power systems.
- There is high priority for a statewide clean energy strategy – to be implemented ASAP.
- Develop and promote Florida-specific alternative energy technologies on a broad base. While some technologies already exist, additional basic research and experimentation is needed.
- The need to develop a comprehensive intermodal transportation plan that includes effective mass transit (light rail etc.) in urban areas, evaluation of the



vulnerabilities of current transportation infrastructure, the development and promotion of renewable fuels and energy efficient vehicles, and a move toward sprawl abatement.

- Business in Florida must be much more engaged in this issue.
- Broad-based education, both formal and informal, is essential to developing effective climate change policies and practices, as well as changing individual and group behavior.



## 6. Appendix

### 6.1. Agenda

**Conference on Climate Change in Florida  
May 9 – 11, 2007 - Renaissance Hotel, Tampa, Florida**

<b>Wednesday, May 9</b>	
<p>9:00 – 11:00am</p> <p style="padding-left: 40px;">Welcome</p>    <p style="padding-left: 40px;">General Session</p>	<p>Conference Facilitators: Leonard Berry, Center for Environmental Studies at Florida Atlantic University and Thomas L. Crisman, Dr. Kiran C. Patel Center for Global Solutions, University of South Florida            President Frank Brogan, Florida Atlantic University            President Judy Genshaft, University of South Florida            Executive Director, Betty Castor, Dr. Kiran C. Patel Center for Global Solutions</p> <ul style="list-style-type: none"> <li>• Mohamed El-Ashry, Former Chief Executive Officer and Chair, Global Environmental Facility, “The Challenge of Responding to Climate Change”</li> <li>• Richard E. Benedick, U.S. Ambassador (ret.), “New Approaches to Climatic Change: Lessons from Ozone History”</li> <li>• Howard Hanson, Associate Vice President for Research, Florida Atlantic University “Intergovernmental Panel on Climate Change 2007 Setting the Stage”</li> <li>• Thomas L. Crisman, Patel Professor of Environment, Dr. Kiran C. Patel Center for Global Solutions at University of South Florida “Florida Climate Change”</li> </ul>
<p>11:00-11:15am</p>	<p>Refreshment Break</p>



11:15 - 12:15pm Concurrent Sessions		
	<b>Science</b>	<b>Impacts &amp; Responses</b>
	<p><i>Historical Perspective</i></p> <ul style="list-style-type: none"> <li>• The Interplay of Tectonics, Climate Change and Sea Level: Florida's Transformation over Geologic Time John Jaeger, University of Florida</li> <li>• Reconstructing Drought for Central Florida: The Last 2,000 Years Philip van Beynen, University of South Florida</li> </ul> <p>Moderator: Mark Brenner, University of Florida</p>	<p><i>Policy Issues</i></p> <ul style="list-style-type: none"> <li>• History: Susan Glickman, Natural Resources Defense Council</li> <li>• State Programs: Tom Peterson, Center for Climate Strategies</li> <li>• Policy Making: George A. Gonzalez, University of Miami</li> <li>• AB 32 – Global Warming Solutions Act: Nick Bollman, Center for Urban and Environmental Solutions, Florida Atlantic University</li> </ul> <p>A brief history of climate change policy and an overview of current regional and national programs. This session will also cover the economic considerations that must be addressed when developing policy and the various policy options for addressing climate change. In covering these topics the session will focus on Florida-specific opportunities for developing effective climate change policies.</p> <p>Moderator: Jim Murley, Center for Urban and Environmental Solutions at Florida Atlantic University</p>
12:15– 1:30pm Lunch - Keynote Speaker: Alex Sink, Chief Financial Officer, State of Florida		



1:30- 2:30pm Concurrent Sessions	
<p><i>Historical Perspective continued....</i></p> <ul style="list-style-type: none"> <li>• People and Climates Over 12,000 Years of Florida Prehistory Nancy White, University of South Florida</li> <li>• Holocene Climate Change in Florida Mark Brenner, University of Florida</li> </ul> <p>Moderator: Mark Brenner, University of Florida</p>	<p><i>Translating Science into Action</i></p> <ul style="list-style-type: none"> <li>• Infrastructure: David Major, Columbia University</li> <li>• Building Design Criteria for Climate Change: Ricardo Alvarez, Florida International University</li> <li>• Education: Glenn Thomas, Director, University School, Florida Atlantic University</li> <li>• Insurance: Alex Sink, Chief Financial Officer, State of Florida</li> </ul> <p>Moving climate change science into action in society--infrastructure design, building standards, insurance, and education.</p> <p>Moderator: David Major, Columbia University</p>
2:30-3:05pm Refreshment Break	
3:05-4:45pm Concurrent Sessions	
<p><i>Sensitive Ecosystems and Components</i></p> <ul style="list-style-type: none"> <li>• Climate Change, Coral Bleaching and Florida's Coral Reefs: The Canaries are Dying C. Mark Eakin, NOAA</li> <li>• Intensification of Climate Change Impacts on Ecosystem Components of the Florida Keys Billy Causey, NOAA</li> <li>• Climate Envelope Model to Predict Effects of Warming and Drying Scenarios on Florida Ecosystems, Dennis Hardin, Florida Division of Forestry</li> <li>• The Realities and Opportunities of Climate Change for Florida, Stephen Mulkey, University of Florida</li> </ul> <p>Moderator: Lakhdar Boukerrou, Center for Environmental Studies</p>	<p><i>Planning for Climate Change</i></p> <ul style="list-style-type: none"> <li>• Water: Paul Trimble, South Florida Water Management District</li> <li>• Florida Reefs: Phil Kramer, The Nature Conservancy, Florida Reef Resilience Project</li> <li>• Climate and Public Health - Potential Impacts: Andy Reich, Florida Department of Health</li> </ul> <p>Minimization and adaptation in Florida; limiting negative affects and adapting to climate change. How do we respond to areas of concerns and what kinds of decisions should be made that include climate change factors.</p> <p>Moderator: Peter Merritt, Treasure Coast Regional Planning Council</p>
4:45 – 6:30pm Welcome Reception – Exhibits (technology, energy, etc) and Posters	





<b>Thursday, May 10</b>	
7:15 – 8:15am Refreshments	
8:15 – 8:45 am General Session – Climate Change: Challenge and Response Thomas Pravda, Advisor to Special Representative for Climate Change in the United Kingdom	
9:00 – 10:15am Concurrent Sessions	
<p><i>Evidence for Recent Climate Change</i></p> <ul style="list-style-type: none"> <li>• Lake Temperature Trends as Indicators for Climate Change in Florida, Danny Coenen, University of Florida</li> <li>• Simplistic Predictions, Confounding Effects, and Complex Responses; Climate Tales from Archbold Biological Station, Hilary Swain, Archbold Biological Station</li> <li>• Sea Level Rise and Coastal Forest Decline Along Florida’s Big Bend, Frances E. Putz, University of Florida</li> </ul> <p>Moderator: Hilary Swain, Archbold Biological Station</p>	<p><i>Current Initiatives and Technologies</i></p> <ul style="list-style-type: none"> <li>• Energy: Florida Solar Energy Center, James Fenton</li> <li>• Agriculture: Florida Farm to Fuel Initiative, Jay Levenstein, FDACS</li> <li>• Biogas and Energy: Ann C. Wilkie University of Florida</li> <li>• Energy: Florida Power and Light, Rayburn L. Butts</li> </ul> <p>A look at current initiatives and available and emerging technologies for reducing anthropogenic contributions to climate change. (reduction of emissions, technological change, alternative fuels)</p> <p>Moderator: Barry Heimlich, Florida Climate Imperative</p>
10:15 – 10:35am Refreshment Break	
10:35 – 12:15pm Concurrent Sessions	
<p><i>Climate Variability: Initiating a Social Science Paradigm Shift</i></p> <ul style="list-style-type: none"> <li>• Introduction: Ana Puszkin-Chevlin, Center for Urban and Environmental Solutions at Florida Atlantic University</li> <li>• Climate Change as a Social Issue: Elizabeth L. Malone, Joint Global Change Research Institute</li> <li>• Explaining Local Commitment to Climate Change Policy in the United States: Samuel D. Brody, Texas A&amp;M</li> <li>• Linking Planning to Sustainability: Joyce Levine, Florida Atlantic University</li> </ul>	<p><i>Partnerships for Success</i></p> <ul style="list-style-type: none"> <li>• EPA Climate Protection Partnerships, Kevin Rosseel, Environmental Protection Agency</li> <li>• A Regional Perspective, Richard Owen, Southwest Florida Water Management District</li> <li>• Climate Change Mitigation and Adaptation Efforts in Miami-Dade County, Nichole L. Hefty, Miami-Dade Environmental Resources Management</li> <li>• City of Tampa, Mayor Pam Iorio</li> </ul>



	<p>Social science disciplines have begun to address climate variability. How can social science research facilitate a paradigm shift in public policy?</p> <p>Moderator: Ana Puszkin-Chevlin, Florida Atlantic University</p>	<p>Which agencies and entities are the most appropriate to address impacts on the natural and human systems resulting from climate change and how do people/groups/agencies work together</p> <p>Moderator: Leonard Berry, Center for Environmental Studies</p>
<p>12:15 – 1:30pm Lunch – Keynote Speaker: Michael Sole, Secretary, Florida Department of Environmental Protection</p>		
<p>1:30 – 2:00pm Century Commission for a Sustainable Florida: Steve Seibert, Executive Director Overview and Invitation to Participate in Discussion Groups: Leonard Berry, CES</p>		
<p>2:00 – 5:00pm Three concurrent workshops:</p> <ul style="list-style-type: none"> <li>- Environmental Facilitated by Nick Aumen, Everglades National Park</li> <li>- Economic Facilitated by: Chris Walker, The Climate Group</li> <li>- Social Facilitated by: Arthur Evans, Florida Atlantic University</li> </ul>		
<p><b>Friday, May 11</b></p>		
<p>7:15 – 8:15am</p>	<p>Refreshments</p>	
<p>8:15 – 9:15am</p>	<p>Reports on Discussion Group Outcomes (Nick Aumen, Chris Walker, Arthur Evans)</p>	
<p>9:15-10:15 am</p>	<p>Century Commission Overview - Discussion and Recommendations</p>	
<p>10:15-10:30am</p>	<p>Refreshment Break</p>	
<p>10:30-11:30am</p>	<p>“Building Climate Change into Florida’s Future” Senator Michael S. Bennett, Florida Senate District 21</p>	



## 6.2. Conference Attendees List

Alison Adams, Tampa Bay Water  
Keith Allan, Her Majesty's Consul General, Miami  
Ricardo A. Alvarez, Florida International University  
Kelley Anderson, College of Marine Science, University of South Florida  
Gary Appelson, Caribbean Conservation Corporation  
Traci Arnold  
Carol Auer, National Oceanic and Atmospheric Administration  
Nick Aumen, Everglades National Park  
Vivian Bacca,  
Dyan Backe, Hillsborough County Planning and Growth Management  
Canan Balaban, University of Florida  
Richard Benedick, National Council for Science and the Environment  
Frederick Bennett, Lykes Bros. Inc.  
Michael Bennett, Florida Senate District 21  
Nikki Benoit  
Chris Bergh, The Nature Conservancy  
Leonard Berry, Florida Center for Environmental Studies  
Mechelle Best, University of Florida  
Bart Bibler, Florida Department of Health  
Holly Binns, Environment Florida  
Greg Blanchard, Manatee County Environmental Management Dept.  
Nicholas Bollman, Florida Atlantic University  
Lakhdar Boukerrou, Florida Center for Environmental Studies  
Mark Brenner, University of Florida  
Norman Breuer, University of Miami  
Gary Brinkworth, City of Tallahassee  
Tammy Brister, Walt Disney World  
Sam Brody, Texas A&M University  
Frank Brogan, Florida Atlantic University  
Gary Brooten, Florida Atlantic University  
Robert Brown, Manatee County Government  
David Bruderly, Clean Power  
Kristy Buckley, Climate Institute  
Karen Burns, RA - Energy  
Byron Burrows, Tampa Electric Company  
MaryBeth Burton, Florida Atlantic University  
Ray Butts, Florida Power & Light Company  
Penelope Canan, University of Central Florida  
Paul Carpinone, Tampa Electric Company  
Edward Carter, St. Johns River Water Management District  
Betty Castor, Dr. Kiran C. Patel Center for Global Solutions  
Billy Causey, NOAA/NOS/Southeast Atlantic, Gulf of Mexico and Caribbean Region  
NMSP



Thomas Chesnes, Palm Beach Atlantic University  
Shannon Clounts, Florida Atlantic University  
Danny Coenen, University of Florida  
Charles Collins, Florida Fish and Wildlife Conservation Commission  
Andrew Collins, FL Department of Environmental Protection  
Philip Compton, KBI Flexi-Pave Nature Coast  
Jeff Conley, Sequil Systems, Inc  
Xenia Conquy, Broward & Palm Beach Community Colleges  
Michael Crane, US Geological Survey  
Thomas L. Crisman, Dr. Kiran C. Patel Center for Global Solutions  
Laura Crouch, TECO Energy  
Dian Deevey, Alachua County Environmental Protection Advisory Committee  
Amanda Demopoulos, U.S. Geological Survey, FISC  
Doreen DiCarlo, Florida Center for Environmental Studies  
Ben Diamond, Special Council to CFO, Alex Sink  
Mallory Dimmitt, Lykes Bros. Inc.  
Pete Dunkelberg, Florida Citizens for Science  
C. Mark Eakin, National Oceanic and Atmospheric Administration-Coral Reef Watch  
Thomas Eason, Florida Fish and Wildlife Conservation Commission  
Serena Edic, Florida Center for Environmental Studies  
Bill Engel, University of Florida TREEO Center  
Cristina Espinosa, Institute for the Study of Latin America and the Caribbean  
Frederic Essien, Florida A&M University  
Arthur Evans, Florida Atlantic University  
Kye Ewing, Archbold Biological Station  
Stephanie Fauver, National Oceanic and Atmospheric Administration-Coastal Services Center  
Niklas Federwisch  
Irene Federwisch  
James Fenton, Florida Solar Energy Center  
Howell Ferguson, Lykes Bros. Inc.  
Roberta Fernandez, Environmental Advocacy  
Mark Ferrulo, Environment Florida  
Dave Finnigan, Climate Change is Elementary  
Casey Fitzgerald, St. Johns River Water Management District  
Elijah Fleishauer, Florida Department of Environmental Protection  
Shane Forsythe, Florida Center for Environmental Studies  
Rowena Garcia, The Nature Conservancy  
Richard Garrity, Environmental Protection Commission  
Judy Genshaft, University of South Florida  
Laura Geselbracht, The Nature Conservancy  
John Glass  
Susan Glickman, Natural Resources Defense Council  
Kofi Glover, University of South Florida  
Allanna Glusica, Environmental Protection Commission  
Robert Goldschmidt, Florida Tropical Fuels



Irma Gomez, The Early Development Global Education  
George Gonzalez, University of Miami  
Doria Gordon, The Nature Conservancy  
Natrevia Gradney, Florida Department of Environmental Protection  
Sarah Gray, Florida Center for Environmental Studies  
Chad Grecsek, CEPEMAR  
Phyllis Green  
Jennifer Green, Liberty Partners of Florida, LLC  
Holly Greening, Tampa Bay Estuary Program  
Jamie Gutierrez, Dodge University of Central Florida  
James Haggard, Florida Solar Energy Center  
Craig Hall, Sun Energy Solar, Inc.  
Yvette Hammett, The Tampa Tribune  
Sharon Hanna-West, University of South Florida  
Howard Hanson, Florida Atlantic University  
Dennis Hardin, Florida Division of Forestry  
Debbie Harrison, World Wildlife Fund  
Frank Hartvelt, Water and Environmental Management  
Donald Harwig, Hillsborough County Facilities Mgmt Division  
John Haynes, WINDHUNTER Corporation  
Robbie Haynes, WINDHUNTER Corporation  
Nichole Hefty, Miami-Dade County- Dept. of Environmental Resources Management  
Barry Heimlich, Broward County Audubon Society  
Barbara Heineken, City of Tampa Department of Solid Waste  
Mercedes Hernandez, The Early Development Global Education  
Michelle Hershel, Florida Electric Cooperatives Association  
Albert Hine, University of South Florida  
George Hochmuth, University of Florida/IFAS  
Jill Horwitz, N.P.C.A.  
Annette Hugues, British Consulate General Miami  
Robert Hyman, Cambridge Systematics  
Maryann Illingworth, WINDHUNTER Corporation  
Joseph Illingworth, WINDHUNTER Corporation  
Keith Ingram, Southeast Climate Consortium  
Pam Iorio, City of Tampa  
John Jaeger, University of Florida, Geological Services  
David Jellerson, The Mosaic Company  
Jim Jensen, Environemtnal Credit Corp  
MacKay Jameson, WRS Infrastructure & Environment  
Jo Ann Jolley, Florida Center for Environmental Studies  
Mike Kennedy, Progress Energy  
Loisa Kerwin, Florida Center for Environmental Studies  
Shana Kinsey, Florida Department of Environmental Protection  
Randy Klindworth, Hillsborough County Facilities Mgmt Division  
Phyllis Kolianos, Pinellas County  
Susan Korzenewski, Korzenewski Foundation



Philip Kramer, The Nature Conservancy  
Greg Krasovsky  
Michael Kruk, National Oceanic and Atmospheric Administration-Coastal Services Center  
Tom Krumreich, WINDHUNTER Corporation  
Ilsa Kuffner, U.S. Geological Society  
Julie Lambert, Florida Atlantic University  
Karen Landers, WINDHUNTER Corporation  
Betsy Landon  
Terrie Lee, U.S. Geological Survey  
Barbara Leiby, Hillsborough County Planning Commission  
Sue Leitholf, University of Central Florida  
Jay Levenstein, Florida Department of Agriculture & Consumer Services  
Barbara Linkiewicz, Florida Power & Light Company  
Sharon Lobello, Florida Fish & Wildlife Conservation Commission  
Janet Lopez, Consulate General of Canada  
Margaret Lowman, New College of Florida  
David C. Major, Columbia University  
Elizabeth Malone, Joint Global Change Research Institute  
Athena Mann JEA  
Nathalie Manzano, City of Miami  
David McCary, City of Tampa Department of Solid Waste  
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