

ADAPTATION PATHWAYS 1.0

A Guide for Navigating Sea-Level Rise in the Built Environment

August 25, 2016



This guide was developed as the synthesis of CES' *3rd Sea Level Rise Summit: Connected Futures from Alaska to Florida*, held May 3-5, 2016 in Fort Lauderdale, Florida.

The Summit was organized by:

FAU
FLORIDA CENTER FOR
ENVIRONMENTAL STUDIES
Charles E. Schmidt College of Science
Florida Atlantic University

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Acknowledgements

This “Adaptation Pathways” document is not the start of our march towards resilience, nor is it the end. But the insights generated by our May 2016 event mark an important stage in the process of community engagement on sea-level rise and coastal erosion. Our Summit would not have happened without the strong and selfless contributions of many people, beginning with our Steering Committee. In addition, we recognize the sponsors and other supporters listed below, who provided instrumental support. Special thanks are due to three individuals who made particularly robust and productive contributions: Arctic 21’s Rafe Pomerance, who lent his tireless international leadership linking Arctic science and policy; FAU Associate Provost Anthony Abbate, who provided constant community leadership in Broward County; and Dr. Len Berry, who launched not only FAU’s Florida Center for Environmental Studies but also the Center’s Sea-Level Rise Summit series, of which this May 2016 event is the third installment.

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Section I: Executive Summary

This report summarizes the 3rd Sea-Level Rise Summit organized by the Florida Center for Environmental Studies at Florida Atlantic University. The event, subtitled “Connected Futures from Alaska to Florida,” was held May 3-5, 2016, at the Ft. Lauderdale Hyatt Pier 66. In recent years, many conferences and meetings have identified the problems we face, and outlined some theoretical solutions. What we lacked was guidance for implementing specific adaptations. The goal of the Summit was to produce a first-generation roadmap for adaptation, by translating our knowledge and ideas into action. Our resulting **Adaptation Pathways** (see Section III of this report) have emerged as the product of intense and sustained interactions with Summit participants, representing a broad cross-section of society.

There are three principal take-away messages from the Summit:

1. The environmental changes underway in the subtropics and in the Arctic are not unfolding in a vacuum. Our communities also face other challenges, such as the availability of good jobs and rising summertime temperatures. Any new efforts to enhance sea-level or coastal erosion resilience should support not degrade other features of socio-ecological resilience.
2. To advance along our adaptation pathways, all four sectors of society – private sector, public sector, academia, and civil society – must interact more often. Stakeholders need to build trust and a shared awareness. The goal of these interactions should not be to achieve perfect consensus, but instead a greater ability to collaborate on potential solutions.
3. There appear to be six groups of problems linked to sea-level rise and coastal erosion in our two regions, each with an associated generalized adaptation pathway for implementing solutions (see Section III):

	PROBLEM DOMAIN		ADAPTATION PATHWAY
1	Community Engagement	→	Listening & Partnering
2	Public Health, Science & Metrics	→	Novel Measuring & Monitoring
3	Financial Policies & Building Regulations	→	Aligning Incentives
4	Hard Infrastructure	→	Supporting Public-Private Partnerships (P3's)
5	Soft Infrastructure	→	Green Landscaping
6	Relocation	→	Multi-Level Coordinating

Finally, it is important to recall that the environmental changes unfolding today – at both low and high latitudes – are dynamic. As such, the insights generated by this Summit will need to evolve to keep pace with changing conditions on the ground. Hence the suffix “1.0” in the name of this document: we expect to update and expand this information as time passes. We invite you to contribute to that conversation by telephone (954-236-1104), email (arctic-florida@fau.edu), or social media.

Section II: Summit Chronology

The presentations and discussions at the Arctic-Florida Sea-Level Rise Summit covered a broad set of topics. We started with science on Day 1, and then turned to social and policy dimensions on Days 2 and 3.

Day 1: The Science Linking High-Latitude Warming to Ecosystems Near & Far

Recent scientific findings on land-ocean-atmosphere interactions paint a troubling picture for coastal communities. The first day of the Summit provided an overview of the science linking warming to ocean levels and coastal ecosystems both in the Arctic and in Florida. This information provided the technical foundation to explore adaptation pathways as the conference progressed in Days 2 and 3.

Global Glacial Melt

- Alex Gardner, PhD, NASA-Jet Propulsion Lab



Photo Credit: FAU Creative Services

Dr. Gardner described how land ice across the world is rapidly melting. Combined with future scenarios for a much warmer Arctic, we should anticipate significant sea-level rise – even if the Greenland and Antarctic ice sheets do not collapse. In recent years, ice sheets and glaciers have contributed ~ 0.79 mm/year and ~ 0.71 mm/year, respectively, for a total of ~ 1.5 mm of sea-level rise/year. This rate translates into between one-half and two-thirds of the observed sea-level rise between 2003 and 2009. Some of the melting appears to have not immediately manifested in higher ocean levels, as some of the water may have replenished depleted aquifers.

Q: How does recent land ice loss vary across the Earth?

A: Global Glacier loss is -259 ± 28 Gt/year

- The Canadian Arctic loss is -60 ± 8 Gt/year
- Alaska loss is -56 ± 10 Gt/year
- Patagonia loss is -29 ± 10 Gt/year
- High Mountain Asia loss is -29 ± 13 Gt/year
- Peripheral Glaciers:
 - Greenland loss is -38 ± 7 Gt/year
 - Antarctica loss is -6 ± 10 Gt/year

Sea-Level Rise Observations

- Gary Mitchum, PhD, University of South Florida

Dr. Mitchum explained how sea level rise is measured by tide gauges, and the issues related to the distribution and data collection methods for tide gauges worldwide. He also showed that the tide gauge measurements are consistent with modern satellite altimetry methods. Further, GRACE measurements of the ice melt contribution and Argo measurements of the thermal expansion contribution combine to give nearly identical estimates of the global mean sea level change. The agreement of these different measurement systems gives us a great deal of confidence in our observations of sea level change.

Arctic Ecosystem Impacts

- Nic Kinsman, PhD, National Oceanic Atmospheric Administration

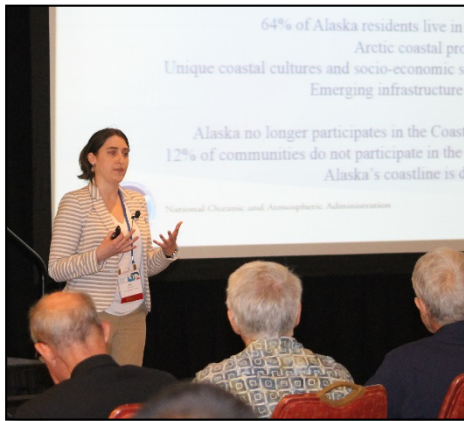


Photo Credit: Andrew Kamerosky

Dr. Kinsman spoke on the complexity of monitoring coastal conditions in Alaska. Alaska, for its size, has far too few long-term oceanographic data collection stations. Increasing the density of data collection in Alaska is crucial since we know that in some parts of the state's coastal zone, we are observing sea-level declines (due to isostatic rebound and other factors), whereas in other locations we are recording increases. Expanding the observational record will help researchers of Arctic ecosystems to identify tipping points for vulnerable species. Nesting habitat data on several species of birds are being collected by the Fish and Wildlife Service to produce predictive maps of nesting surfaces in various sea-

level rise scenarios. Dr. Kinsman also emphasized the collaborative research environment in Alaska, including coastal resiliency workshops and an ongoing webinar series. Alaska's Landscape Conservation Cooperatives (LCC) (<https://www.fws.gov/alaska/lcc/>) network promotes the coordination, dissemination, and development of applied science to inform landscape-level conservation in the face of a changing climate and related stressors. With close to two-thirds of Alaska's residents living in coastal communities, it is potentially concerning that Alaska no longer participates in the Coastal Zone Management Program, and that a significant share of communities do not participate in the National Flood Insurance Program.

Community-based observing network systems have started to fill the gaps in Alaska's data including baseline values for elevation, bathymetry, water levels, and shoreline position.

Florida Ecosystem Impacts

- *Steve Traxler, PhD, U.S. Fish & Wildlife Service*

Dr. Traxler explained how sea-level rise threatens critical coastal refuges in South Florida. With 1 meter of sea-level rise, Crocodile Lake National Wildlife Refuge could be 90% underwater, Everglades National Park could be 75% underwater, J.N. Ding Darling National Wildlife Refuge could be 95% underwater, and Key Deer National Wildlife Refuge could be 80% underwater. Some potential solutions to these threats include listing four Florida Keys plants as threatened or endangered: sand flax, Big Pine partridge pea, wedge spurge, and Blodgett's silverbush. He suggested continued collaborative work among the three Florida Landscape Conservation Cooperatives (LCCs) as a piece of the adaptation puzzle. Florida is split into three Regional LCCs: Gulf Coastal Plains and Ozarks (Northwest Florida), South Atlantic (East Panhandle), and Peninsular Florida. Resources to support research and conservation efforts might come from the Florida Water and Land Conservation Initiative, Amendment 1, or BP oil spill reparations payments. Dr. Traxler also recommended that cities form adaptation plans and implement "good urban planning" to accommodate the impending increase in human population across the state. Such planning might focus on redevelopment featuring densification, easements, land acquisition, and green infrastructure.

Peninsular Florida's Landscape Conservation Cooperative (LCC) has a Conservation Planning Atlas available at:

<http://pflcc.databasin.org>

Learn more about LLC's at:

<https://lccnetwork.org/>

Day 2: Defining Our Challenge & Motivation

Day 2 of the Summit was designed to expand on the scientific challenges presented in Day 1, outlining how our changing world might affect people and ecosystems in our two regions.

Setting the Stage: What's at Stake & Why We Should Care

- Dan Flynn, PhD, Florida Atlantic University Vice President for Research
- Colin Polsky, PhD, FAU Center for Environmental Studies & Geosciences

The opening plenary of Day 2 argued that whatever the hurdles facing both Florida and the Arctic, there are benefits to taking action now to increase the resiliency of our communities. The attendees were asked to momentarily set aside the science, remove politics from the equation, and avoid the paralyzing undertones of doom and gloom. The speakers asked participants to focus instead on the development of new and collaborative solutions. By focusing more aggressively on anticipatory adaptation, speakers framed sea-level rise not as the *existential crisis* of our time, but rather a *generational opportunity* to collectively diminish our coastal vulnerabilities.



Photo Credit: FAU Creative Services

Infrastructure: What's Happening to Our Buildings, Roads, Sewers & Water

- Fred Bloetscher, PhD, Florida Atlantic University Civil Engineering
- Bill Schnabel, PhD, University of Alaska-Fairbanks Environmental Engineering

Rather than dwelling on regional differences, the speakers of this plenary highlighted similarities between issues facing the Arctic and Florida. As Florida struggles with an increased upwelling of groundwater and



Photo Credit: FAU Creative Services

saltwater intrusion, regions of the Arctic face new patterns of thawing permafrost and “ice jam” flooding. Both scenarios lead to significant degradation of vital transportation networks, corrosion of utility lines, and concerns regarding the structural integrity of buildings. Engineers have innovated to overcome major hurdles before; they can help us meet these challenges, too. That said, meeting these challenges would require a paradigm shift. Engineers would need to add a new layer of uncertainty and flexibility to their design and building processes because the rates of coastal changes are uncertain. A longer-term planning horizon would also be needed, coupled with expanded collaboration networks.

Health: New Illness Risks to Manage

- *Roderick King, MD, Florida Institute for Health Innovation*
- *Craig Stephen, PhD, University of Saskatchewan & Canadian Wildlife Health Cooperative*

One of the greatest challenges confronting the healthcare industry is understanding the inextricable link between human health and our ecosystems. Factors that contribute to current risks and that deserve additional study in our new context of changing environmental conditions include pre-existing health complications, level of education, poverty, availability of food and water, and access to health services. Summit participants were told that physicians recognize a general link between climate and related processes such as sea-level rise on the one hand, and health outcomes such as respiratory conditions or vector-borne disease transmission on the other hand. But the specifics of how these relationships operate in different geographic and social settings are poorly understood. The general public also appears to exhibit a limited understanding of these relationships.



Photo Credit: Andrew Kamerovsky

Redesign: A New Vision for Parcels, Neighborhoods & Cities

- *Anthony J. Abbate, FAU Associate Provost for Broward Campuses & Professor of Architecture*
- *Jeff Huber, Florida Atlantic University Architecture*
- *Nathalie Olijslager, Consul-General of the Kingdom of the Netherlands in Miami*



Photo Credit: FAU Creative Services

Building design experts illustrated how our built environment might be redesigned to coexist alongside more water and coastal erosion. Design responses included the utilization of both hard and soft armoring, raising and weatherproofing our structures, and fostering a mentality of working with, rather than against, the hydrologic features in our communities. Notable successes include strategies that focus on resilient cities, such as the flood control provided by the Zuiderzee infrastructure of the Netherlands, and other purpose-driven landscape designs such as “Low-Impact Development” (LID). The LID design approach embraces vegetation as an ecological and aesthetic asset, to be exploited for social, ecological, and financial benefit.

Private Sector: Law, Finance & Insurance as Levers of Change

- *Wayne Pathman, Pathman Lewis, LLC*
- *Mitch Chester, Law Office of Mitchell A. Chester, P.A.*
- *Rowan Douglas, Willis Re*
- *John Englander, Oceanographer, Author*

During this open discussion, three representatives of the private sector argued that the cost of confronting sea-level rise is lower than the cost of not confronting sea-level rise. This was a call to action for the business community. One speaker highlighted the necessity of revamping existing building codes, citing several current development projects on Miami's coastline that do not conform to adequate standards of resiliency based on projected sea-level rise. Others called for an increased level of engagement by lenders, investors, insurers, and re-insurers, citing the need to consider longer planning horizons and incorporation of climate risks into decision making. Ample capital is available to support these adaptation efforts. The challenge lies in connecting the capital with the projects, which in turn would require a greater depth of communication between the public and private sectors.



Photo Credit: Andrew Kamosky

DAY 2: PARALLEL SOLUTIONS SALONS

<p style="text-align: center;">HEALTH SOLUTIONS SALON</p>	<p><i>Moderators - Hon. Daniella Levine Cava, Miami-Dade County Commissioner; Roderick King, MD, Florida Institute for Health Innovation</i></p> <p>The Health Solutions Salon identified a wide array of health risks, some restated and emphasized messages from the plenary sessions, and others previously undiscussed. Some discussed solutions focused on emergency preparedness and response, educating the public about health risks and interconnectedness with climate change and sea-level rise, and educating healthcare professionals. Being aware of vulnerability differences across society will be important. Some groups of people would be inherently less resilient than others due to existing factors, such as income, language barriers, physical location, and means of mobility.</p> <p>Progress can be made by engaging a variety of groups, including the APHA and OSHA, local business leaders, community religious groups, educators, and children. Looking to natural systems for protection from air and water contamination would be beneficial, and can provide positive reinforcement to economic health. New research is needed to test the hypothesis that the anticipated or observed environmental changes affect human health. Before the research can launch, significant data gaps on human health need to be filled. Social and environmental justice emerged as significant themes in this Solutions Salon as well (e.g., the need to prioritize attention to regions or neighborhoods of low socio-economic status).</p>
<p style="text-align: center;">BUSINESS, LAW & FINANCE SOLUTIONS SALON</p>	<p><i>Moderators - Hon. Walter Duke, III, Walter Duke + Partners, Inc.; Nancy Scanlon, PhD, Florida International University</i></p> <p>The Business Solutions Salon focused on existing economic activity in South Florida, especially the tourism industry and its corresponding property development, the two principal contributors to the region’s GDP. How can South Florida adapt to sea-level rise without threatening these industries? Engaging the business community is vital. Suggestions included marketing green development and sea-level rise resiliency to customers/consumers, voluntary commitments to reduce carbon emissions, and encouraging moral/ethical considerations leading to sea-level rise clauses for the real estate industry.</p> <p>This business dimension also extends to coastal Arctic communities, where tourism and real estate development are also crucial to local populations. Local businesses cannot thrive if erosion heightens flooding and other risks. Can policymakers encourage developers to guarantee buildings for longer than ten years? If resilient buildings can generate more revenue by lasting longer and requiring fewer retrofits, then businesses and developers may be swayed.</p>

**ARCHITECTURE & REDESIGN
SOLUTIONS SALON**

Moderators - Ricardo Alvarez, President Mitigat.com, Inc.; Jason Chandler, Florida International University

In Wednesday's Redesign Solutions Salon, individual teams of participants were given a scenario and asked to allot a hypothetical \$10 billion over the course of five years to adapt to the effects of sea-level rise. The focus of each team varied. Some participants suggested that priority should be given to improving infrastructure resilience via coastal armoring, and utilizing techniques such as bioswales, intracoastal lagoons, and deeply buried seawalls. Other participants suggested that money would be best allocated toward developing more sophisticated vulnerability assessments and planning for eventual and necessary mass relocations. Several other common suggestions included building flood accommodations into our transportation networks, addressing the public via public service announcements, and working toward revamping present zoning regulations.

Mitigation: Recalling the Long-Term Solution

- *Ed Strobel, President, Sunshine Solar Services*
- *Delaney Reynolds, Palmer Trinity High School Student*



Photo Credit: Andrew Kameronosky

The Summit reconvened in plenary session immediately following the Day 2 Solutions Salons. Both speakers encouraged attendees to take individual actions toward resiliency. Home and business owners can effectively increase the resiliency of their properties and their communities by advancing the sustainability of their buildings through the use of renewable energy, flood- and wind-proofing, and water reclamation techniques. Community engagement is vital as well, with special emphasis on outreach and education programs for children. The speakers stated that mainstreaming the concepts presented at the Summit should generate greater acceptance of these issues, and facilitate the implementation of associated adaptations.

Day 3: Preparing Our Adaptation Pathways

The third day of the Summit focused on how communities are currently experiencing and adapting to sea-level rise and coastal erosion, and what kind of responses, both global and local, are needed for the future.

Adaptation as a Generational Imperative & Leadership Opportunity

- Admiral Robert J. Papp, Jr., USCG (Ret.), U.S. State Department Special Representative for the Arctic
- Dan Reifsnnyder, PhD, U.S. State Department Deputy Assistant Secretary for Environment

This session focused on national and international efforts to understand and respond to environmental changes. The Arctic Council, a Ministerial-level forum of the eight Arctic Nations and regional indigenous communities, was highlighted as an important example of coordinated strategic planning with a commitment to peaceful international cooperation. At the global-scale, the recent COP21 Paris agreement is a reflection of how, eventually, even complex issues with many competing interests can generate (what appears to be) a meaningful treaty. Such processes require massive effort, and must be consistently nurtured. The relocation of climate change refugees was argued to be an especially urgent aspect of adaptation, one that sea-level rise will likely bring to the fore in the near future.

Where goes the Arctic, there goes Miami.
- Ret. Admiral Robert Papp

Successful Responses & Indicators

- Hon. Kristin Jacobs, State Representative for Florida's 96th District
- Jennifer Jurado, PhD, Broward County Environmental Planning & Community Resilience Division
- Jayantha Obeysekera, PhD, South Florida Water Management District
- Jacquelyn Overbeck, Alaska Department of Natural Resources

Several agencies and institutions in our two regions have already been activated to implement monitoring or adaptation plans. The Southeast Florida Regional Climate Change Compact is a national leader in this field. This collection of sustainability and resilience staff from four metropolitan South Florida counties models trans-boundary collaboration activities. Their success is driven by a solutions-oriented, non-partisan approach. One such activity is the strategizing and implementation of "Adaptation Action Areas" (AAAs) in high-risk locations. AAAs are neighborhoods designated by local government for funding priority to improve infrastructure related to inundation. Broward County in particular already has 38 projects planned or underway, spanning 16 AAAs. The South Florida Water Management District, which manages canals, pumps, green infrastructure, wellfields, and other assets for ~7 million people across 16 counties, has been actively modeling changes in water resources as a function of sea-level rise for several years. In Alaska, there is a sophisticated and expanding array of monitoring stations, but the coastline is so vast that much remains to be learned before comprehensive adaptation plans can be generated. One novel approach to filling this data gap is the use of a smartphone app to enable citizens to upload their observations.



Photo Credit: Andrew Kamerovsky

Home: Changes to Where We Live & What We Do

- *Hon. Jim Cason, Mayor, Coral Gables*
- *Captain Dan Kipnis, Miami Beach*
- *Steve Ivanoff, Bering Straits Villages*
- *Robin Bronen, JD, PhD, Alaska Institute for Justice*
- *Robert Corell, Global Environment & Technology Foundation; Center for Energy & Climate Solutions*

Speakers in this session described local- and individual-level perspectives on the impacts from, and responses to, environmental changes. Summit participants learned that a high-income small city in the Miami area has recently commissioned a major sea-level rise vulnerability assessment. These actions demonstrate cross-party support for protecting our valuable resources, and for elected leadership to take such steps even when the constituents are unaware of a risk. We also learned about what may be the earliest case of a Miami resident selling his home due to sea-level rise risks. Early sellers in this process may realize substantial gains before the market catches on. Three specific Alaskan villages were introduced as having already undertaken significant coastal erosion mitigation efforts, including consideration of relocation options for the communities. The process of relocation raises legal concerns. The media has started to portray communities on the move for environmental reasons as “climate change refugees.” Such a term may not only be misleading but also counter-productive. The term refugee connotes an antagonistic relationship between a community and their government, which is not necessarily the case for all communities needing to relocate due to sea-level rise or coastal erosion. Summit attendees were also reminded of the reality of the environmental processes underway: high-latitude land ice is melting very fast. The recent uptick of anecdotes about coastal people and communities struggling to maintain their livelihoods and homes is not a coincidence. High-latitude warming is real, which is leading to large-scale land ice melting. Eventually that pulse of water will make its presence felt worldwide.



Photo Credit: Andrew Kamerovsky

DAY 3: PARALLEL SOLUTIONS SALONS

<p>RESPONSES & INDICATORS SOLUTIONS SALON</p>	<p><i>Moderators: David Prodder, British Consul-General Miami; Katherine Hagemann, Miami-Dade County Sustainability Initiatives</i></p> <p>This Solutions Salon identified several successes, barriers, and solutions associated with recent adaptation efforts.</p> <p>Local successes included:</p> <ul style="list-style-type: none"> • Establishment of the Regional Climate Action Plan, Unified Sea Level Rise Projection, and other accomplishments by the Southeast Florida Regional Climate Change Compact • Everglades restoration initiatives including the Comprehensive Everglades Restoration Plan (CERP) and Central Everglades Planning Project (CEPP) • The implementation of Adaptation Action Areas (AAAs) <p>Barriers included:</p> <ul style="list-style-type: none"> • Lack of engagement with the private sector and philanthropic organizations • Lack of inter-agency coordination • Lack of capacity for outreach • The fallacy of the silver bullet (focus on a single aspect of adaptation) <p>Solutions included:</p> <ul style="list-style-type: none"> • Tax breaks to businesses • Utilizing memorable advertising slogans • Top-down teaching methods to promote the spread of ideas • Promoting efficient use of resources • A focus on implementing small policy changes rather than monumental ones.
<p>INFRASTRUCTURE SOLUTIONS SALON</p>	<p><i>Moderators: Fred Bloetscher, PhD, Florida Atlantic University; Bill Schnabel, PhD, University of Alaska-Fairbanks</i></p> <p>These Solutions Salon participants discussed issues with current infrastructure, the need to modify codes and developing more resilience-based policies, and suggestions for new infrastructure. Attendees placed heavy emphasis on natural armoring versus hard infrastructure, and the need for detailed and updated vulnerability assessments, i.e., maps of where exposure and sensitivity are high, and adaptive capacity is low.</p>

Pivoting to Next Steps and CES' 4th Sea-Level Rise Summit

- Colin Polsky, PhD, FAU Center for Environmental Studies & Geosciences
- Hon. Ted Deutch, U.S. Congressman for Florida's 21st District
- Richard S. Olson, PhD, Florida International University Extreme Events Institute

The Summit concluded with a session on future directions. The theme of the next FAU-CES Sea-Level Rise Summit was revealed to also have a twin geographic focus: Florida and the Caribbean/Latin America. Pairing Florida with the Arctic for this 3rd Summit proved productive. By viewing different places through the same lens, new insights and collaborations have been generated. A similar approach with some of Florida's neighbors will be taken at the next Summit.

Building on the Caribbean/Latin American theme, the audience learned how these countries are facing not only sea-level rise but other social, economic, and geologic stressors. Like Florida, they face hurricane and ocean-based risks, but unlike Florida they also experience seismic activity. Moreover, these countries tend to have less adaptive capacity in the form of government support for hazard preparedness and response infrastructure, technology, and personnel.

The Summit drew to a close by situating the event within the rapidly-evolving national political context. U.S. Congressman Ted Deutch described the Climate Solutions Caucus,¹ which he and fellow Florida Congressman Carlos Curbelo co-founded in 2016. This ground-breaking group of U.S. Representatives aims to develop and promote mainstream awareness of climate change causes, impacts, and cost-effective and socially equitable responses. At present, the group has approximately 16 members, equally divided between Democrats and Republicans. In fact, one criterion for membership is that a prospective new member cannot join alone; he or she must first recruit a member from the other party to join as a pair. This approach ensures bipartisan attention to the issues.

¹ <http://www.bloomberg.com/news/articles/2016-02-11/can-only-congress-prevent-climate-change>

Section III: Our Adaptation Pathways

The presentations and discussions at the Arctic-Florida Sea-Level Rise Summit covered a broad set of impacts and adaptation topics, described in Section II above. Participants were encouraged to discuss our challenges and associated potential solutions, as is common in meetings of this nature. But proposing solutions is only part of the adaptation process. Solutions define goals, but the goals beg the question, How do we get there from here? We needed to know how to move from a position of risk to a position of resilience. In this section, we synthesize the Summit’s dominant themes into an action-oriented roadmap for advancing towards resilience, called “Adaptation Pathways.” These first-generation Adaptation Pathways are organized into 6 general problem domains, with a total of 16 partially-overlapping focal areas.

PROBLEM DOMAIN		ADAPTATION PATHWAY
1	Community Engagement	→ Listening & Partnering
2	Public Health, Science & Metrics	→ Novel Measuring & Monitoring
3	Financial Policies & Building Regulations	→ Aligning Incentives
4	Hard Infrastructure	→ Supporting Public-Private Partnerships (P3’s)
5	Soft Infrastructure	→ Green Landscaping
6	Relocation	→ Multi-Level Coordinating

Problem Domain 1: Community Engagement

The classic model of academic engagement beyond university walls has been to give knowledge to stakeholders, rather than to co-produce it with stakeholders. This model is changing to a more collaborative mode. All four sectors of society – private sector, public sector, academia, and civil society – each have valuable insight and resources to offer. The problem is that such conversations are difficult to launch and sustain.

Addressing the General Public, Business Owners & Policymakers

Our society is unfamiliar with these environmental changes and therefore lacks a common vocabulary to describe what is happening, and what we should do about it. Stakeholders can gain an improved understanding through public service announcements, free or low-cost webinars, interactive and validated maps, or easily accessible online databases. When discussing sea-level rise adaptations, the following co-benefits of resiliency may be realized: increased biodiversity through the use of soft infrastructure, reduced electric bills through the use of clean energy, employment growth linked with urban greening, or overall productivity increases as a result of fewer floods and enhanced natural systems.

Communicating with Younger Generations

One stakeholder group of particular concern identified during the Summit was K-12 students and their teachers. Because sea-level rise would continue to affect our communities for generations, addressing this group is necessary. School curricula currently do not address the science or socio-economic factors associated with sea-level rise and coastal erosion. Easily understood educational materials, both print and digital, are needed to encourage discussion among young adults and their parents, youth groups, and volunteer organizations. Of course, university students (undergraduate & graduate) also need this background for the new economy. So what is typically viewed as a “K-12” domain is really one continuous “K-20” continuum of learning.

Politics & Cooperation

Summit participants learned that however daunting our challenges may seem, from an organizational perspective, there are precedents to model and leverage. At the international-scale, negotiations framed around resilience, whether implicitly or explicitly, are increasingly common. In the US, multiple Federal agencies are launching resilience efforts, and there are encouraging examples at the state and local levels. In all cases, what appears to be a necessary ingredient for success is avoiding polarized viewpoints and assertions of impending doom and gloom. Positive messaging and removing politics from the discussion, especially in the media and when discussing the science, should accelerate positive change. Adopting this tone does not mean pretending there are no serious problems to address. Instead, it simply means assuming good intent in other stakeholders, and focusing on implementing solutions. As the U.S. State Department’s Dr. Dan Reifsnyder put it, we also need to change the dialogue to emphasize sea-level rise and coastal erosion as “our” problem, rather than “their” problem. The effects are evident where we live, in both Florida and the Arctic, not just in distant places.

*How do we get there from here? Adaptation Pathway 1:
Listening & Partnering*

Successful community engagement will require fostering networks of open discussion both within and among the academic community, civil society, the private sector, and policymakers. Such interactions can be launched using high-tech (e.g., blogs, social media) or low-tech means (e.g., giving presentations at local Rotary Club meetings). When speaking with members of various stakeholder groups, experts should aim to balance lecturing with listening: few examples of metropolitan-scale redevelopment and redesign initiatives exist as templates for devising and implementing solutions to combat sea-level rise, so soliciting broad input may uncover the solutions best tailored for a given place. Community engagement is an ongoing process. Therefore, to maximize the impact of any single event, organizers should close with a call for interested parties to propose future learning and action opportunities.



Photo Credit: Andrew Kameronosky

Problem Domain 2: Public Health, Science & Metrics

The continued advance of scientific research by both the academic community and private sector are imperative for promoting a sustainable future in the Arctic and the subtropics. Additionally, we need to standardize our metrics of vulnerability to compare across regions, and to measure progress over time. Presently, substantial data gaps present a major obstacle to advancing baseline knowledge.

Closing Data Gaps & Supporting Continued Research

Addressing existing data gaps was frequently cited as a priority, especially in the Arctic regions. Several professionals suggested that in some cases entire sectors have wide data gaps, regardless of geographic region. This challenge can be addressed by increasing the use of remote sensing systems. Public health professionals were especially emphatic about knowledge gaps, calling for more research on the link between climate, sea-level rise, and human health. For example, a flooded property may release carcinogenic materials from degraded buildings, standing water may serve as an effective incubator for vector-borne or bacterial diseases, and involuntary relocation from one's home can generate severe emotional distress and loss of culture. Yet the precise extent and ways in which these processes unfold in the Arctic, Florida, or elsewhere are under-researched. Engineers and architects from both South Florida and the Arctic noted a lack of data regarding the costs and ROI timelines for resilient buildings. New research is needed to address the most robust infrastructure designs, placements, and construction materials available.

Several Summit attendees stressed the need to ensure that scientific efforts continue developing both climate change mitigation and adaptation strategies. Reducing greenhouse gas emissions to reduce future climate warming and follow-on impacts (mitigation) must be coupled with devising specific means for coping with existing warming and follow-on impacts (adaptation). Mitigation and adaptation strategies at times overlap, with amplifying or conflicting outcomes, depending on the case. For example, building large pumps to increase drainage capability (an adaptation) would increase energy consumption and thus promote a larger carbon footprint, thereby producing more greenhouse gas emissions and therefore by extension ocean rising (conflicting with mitigation goals, unless the pumps are powered by renewable energy).


Standardizing Metrics & Indices to Better Analyze Vulnerabilities

Developing a unified system of metrics to assess and analyze vulnerabilities may be useful for recognizing successful overarching adaptive strategies while still focusing on region-specific implementations. Necessary measures include socio-economic metrics, such as population demographics and economic activity, in addition to ecological metrics such as habitat availability, air and water quality, soil nutrient levels, and biodiversity. Conceptualizing and measuring a region's adaptive capacity may help distinguish why, in the face of similar challenges, some places succeed but others struggle. A recent project by the Florida Institute for Health Innovation produced a first-generation Vulnerability Index². This experience

² <http://filhealthinnovation.org/sea-level-rise-mapping/>

uncovered a significant hurdle for relying on such indices to support resilience-building: a severe lack of available data. The health outcome measures for which data currently exist are typically aggregated to a level that precludes meaningful insight for this purpose. Specifically, these processes unfold at the household-level, but to protect patient privacy health data are provided to researchers as neighborhood-level averages.

***How do we get there from here? Adaptation Pathway 2:
Novel Measuring & Monitoring***



Simply put, more research is needed, which means more data are needed. Filling these needs is typically the role of federally and state-funded agencies and institutions. Therefore, continued efforts to acquire data and research support from such groups is essential. However, success in acquiring these funds depends on the availability of local academics and appropriately tailored grant opportunities. There is a ceiling to the adaptation such support can enable, because many funding agencies are experiencing declining research budgets. Accordingly, new funding streams for data and research need to be activated. This means engaging the public sector (already a common approach, for example when a county agency commissions a feasibility study), as well as civil society, philanthropists, and the private sector (less common). Social media and ‘big data’ present an excellent, new opportunity for relevant data to be acquired on a sustained basis. Such public data collection can be implemented on relatively thin budgets, and can be effective when quick or widespread samplings are required. While these social media-driven sampling methods are not error-free, they can generate valuable insights to help translate knowledge into promoting community action toward preparedness. In the public health domain, new access to existing data may need to be negotiated to support research while respecting privacy.

Problem Domain 3: Financial Policies & Building Regulations

As described in the above Problem Domains, one of the immediate challenges presented by sea-level rise is cost. But such challenges also present opportunities for improving the financial bottom line. Yet the unprecedented scale of the needed adaptations means that new incentives are needed to launch the resilience innovations required to meet the new risks.

Tools for Funding & Incentivizing: SLR IRAs, Resiliency Bonds & Modified Lending Structures

The costs we face are substantial. The good news is the U.S. has devised market-based financial instruments to meet similar long-term financial challenges in the past. The U.S. Congress created Individual Retirement Accounts (IRAs) and 401(k) accounts in response to the anticipated long-term deleterious effects of households failing to save for retirement. The Federal government also created the “Superfund” program to help pay for the long-term cleanup of toxic waste locations – even those not yet identified. In addition, several state legislatures have adopted novel programs to finance the purchase and installation of solar panels on residential properties (e.g., the Property Assessed Clean Energy (PACE) program in place in a growing number of U.S. states).

It seems fair to ask why a similar financial instrument could not be created by Congress or other bodies for our 21st-Century sea-level rise and coastal erosion challenges. If households, businesses, and local governments do not save today for tomorrow’s environmental challenges, then the necessary adaptation measures would not be affordable. As a result, insurance companies would refuse to underwrite new development, which means banks would refuse to award mortgages. Several agencies are advancing this type of conversation, including the Office of Economic Resilience at the U.S. Department of Housing and Urban Development.

The private sector can also be leveraged in another way: by engaging with the reinsurance industry. These firms, who insure the insurers, need to invest the revenue they receive. They therefore share an interest in protecting the very assets their clients are protecting – the properties, buildings, and cities now at risk to sea-level rise and coastal erosion. One of our speakers suggested that reinsurance companies and local stakeholders collaborate to launch “Resiliency Bonds,” a form of public-private partnership designed to collect and distribute the massive sums required in the cases of major infrastructure redesign and redevelopment. In addition, it may be feasible to incentivize banks to negotiate credit forgiveness when relocation is necessary. The details for such funding ideas have not been fully enumerated or tested.

Building Code Updates

Historically, Florida’s building codes have been updated in response to disasters such as hurricanes. Significant code changes have been made to mitigate wind damage, but fewer provisions protect against storm surge and extreme tides. At a minimum, the building code standards for wind, flooding, and erosion need to be updated regularly, given the rapidly evolving nature of the environmental conditions and features of the built landscape.

Insurance & Risk Management Reform

Markets work best when there is a free flow of information about the costs and benefits of different purchasing options. In that way, consumers can make informed decisions. Properties with higher risk should have higher prices to reflect the higher costs. The ideal system gives objective information on risk to consumers, who, if they elect for high-risk investments, also carry the cost burden of the higher risk. The result is to incentivize low-risk investments, and discourage high-risk investments. Yet our current property markets appear to exhibit two fundamental market failures. First, the National Flood Insurance Program (NFIP) subsidizes premiums in risky coastal areas, which means the cost of living near the coast often does not reflect the actual risks. Moreover, NFIP flood zones do not adequately account for contemporary sea-level rise. Consequently, the NFIP, while successful in some regards, has produced what is termed a “moral hazard,” or a situation where an action unintentionally increases the risk it is intended to reduce. More people and property are exposed to a risk about which they are unaware, because the flood zones do not reflect actual risk. Second, our property markets already require that sellers disclose certain property risks, such as the presence of toxins on site. It stands to reason that disclosing knowledge about the incidence of past flooding and the risk of flooding from future sea-level rise would also be legal requirements during the property marketing process. The legal and ethical details of this new wrinkle have yet to be ironed out. Clarifying the dimensions of this liability is a major priority.

Adaptive Planning & Zoning Tools

In addition to the private sector avenues for adaptation described above, there is also an important role for the public sector, specifically local governments. One such path-breaking example is Florida’s Adaptation Action Areas (AAAs), regions identified as especially susceptible to flooding due to extreme high tides and storm surge, with the intention of prioritizing adaptation funding. Broward County has already implemented its first AAA, the Sand Bypass Project Area at Port Everglades³. The City of Fort Lauderdale has designated 16 AAAs and is using them to support 38 improvement projects.

³ https://southeastfloridaclimatecompact.files.wordpress.com/2014/08/aaa-fort-lauderdale-case-study-draft-8_23.pdf

How do we get there from here? Adaptation Pathway 3:

Aligning Incentives



The public and private sectors are currently misaligned in significant ways regarding sea-level rise and coastal erosion. This is a multi-scaled situation, touching individual parcels, entire neighborhoods and cities, state legislatures, the U.S. Congress, and even global capital markets. Realigning incentives and modifying market structures to reflect true risk would therefore require, for example, legislation that permits consumers and investors to properly gauge their risks and returns. In turn, legislation is only likely to be produced if local private and public sector leaders communicate amongst themselves, and with lawmakers.

Problem Domain 4: Hard Infrastructure

Much of the present hard infrastructure in South Florida, the Arctic, and other coastal communities worldwide may be inadequate for the challenges associated with sea-level rise and coastal erosion. Therefore, we may need to re-engineer our buildings, utilities and transportation networks, and shoreline protection methods.

Buildings

Both the continued upwelling of groundwater in South Florida and the thawing of permafrost in the Arctic would have substantial impacts on the foundations of our buildings and other components of the built environment. Multiple speakers described the risks we face linked with toxic detritus of destroyed buildings contaminating our ecosystems upon their eventual teardown or collapse. One potential solution to this problem is to use less toxic construction materials. Several attendees at the Infrastructure Solutions Salon noted the importance of variable permeability in our roads, sidewalks, parking lots, and other paved surfaces; in some cases, allowing water to be absorbed by a surface is advantageous, while other times permeability may promote groundwater upwelling.

Utilities & Transportation Networks

From flood-vulnerable transportation networks to corroding utility lines, the list of potential re-design and re-development hurdles facing our infrastructure networks is extensive. Our communities would require updated sewer, electrical, and water systems to deal with saltwater intrusion and enhanced erosion. One potentially straightforward solution is to use corrosion-resistant materials to ensure longer lifespans of these networks. Several speakers suggested prioritizing the resilience of our most vital transportation routes, including major highways, rail lines, and waterways. Of particular importance are those routes that link people to essential services like hospitals and grocery stores, or those that would be necessary during evacuation events. Attendees of both the Infrastructure and Redesign Solutions Salons discussed the fragility of our present roads, citing the almost certain breakdown of the foundations of these networks under projected sea-level and groundwater rise inundation scenarios. Some suggestions included incorporating more permeable and robust materials into roadway foundations, advancing the drainage capabilities of these networks, and shifting toward more walkable urban designs, rather than continuing to perpetuate auto-centric planning. These engineering solutions are proven to ameliorate the effects of sea-level rise. Implementing them, however, requires political and financial resources that may not yet exist.


Hard Armoring

The audience was reminded about the centuries-long Dutch experience with water management, citing a culture that provides “room for the river.” The Netherlands has long based planning and infrastructure around the hydrologic features of the region rather than trying to eliminate the pre-development hydrologic features. The result is infrastructure intended to absorb flood waters and surge during storms. Structures and communities built to accommodate flood waters have been successful for hundreds of years, through the use of dikes, polders, and specifically zoned flood plains. Some of these solutions may be transferable to locations in Florida or the Arctic. The South Florida Water Management District already employs a vast network of canals, pumps, and floodgates. Such systems protect coastal communities by initiating pre-storm draw-downs and pumping excess water when needed. In Alaska, fortification strategies such as sheet piling walls and homes elevated via pilings are becoming more common. Other suggestions included deeply seated underwater and underground seawalls to prevent flooding and intrusion, coupled with offshore wave attenuators. In both the Redesign and Infrastructure Solutions Salons, effective urban planning was viewed as central for addressing future vulnerabilities; adapting and armoring beforehand was suggested to be more cost-effective than rebuilding or relocating after disaster. Again, the engineering part of this equation is well-defined compared to the social dimensions.

*Work with water,
not against it.*
- Salon participant

How do we get there from here? Adaptation Pathway 4:

Supporting Public-Private Partnerships (P3's)



Funding is needed to enhance the engineering of more robust buildings and structures, utilities and transportation networks, and the resiliency of the shoreline through soft- and hard-armoring. The funding required may in some cases be significant. Public-Private Partnerships (P3s) appear more likely to provide the needed resources than relying on the public sector alone. To make P3s work, the public needs to be engaged, as some of these projects might need to be considered on a public referendum. The Return On Investment (ROI) needs to be clearly communicated against the alternative of doing nothing. Elected officials and policy-makers will need to collaborate with each other, with private sector stakeholders, and with members of civil society (e.g., neighborhood groups, non-profits). There is a pressing need to engage with the business community. The goal is to protect existing jobs, while creating new opportunities for employment.

Problem Domain 5: Soft Infrastructure

Typical contemporary urban environments are dominated by impervious surfaces (i.e., streets, sidewalks, parking lots, rooftops). Our coastal environments are also largely characterized by cement or stone structures, such as seawalls, jetties, and riprap. Such a design approach negatively affects our living conditions, water supply, water quality, and infrastructure expenses. Yet these features of our built environments can include much more vegetation – and fewer impervious substances – without compromising our quality of life. In fact, expanding the extent of our soft infrastructure could even reduce the cost of running our cities, while enhancing aesthetics, habitats, and property values.

Bioswales & Tree Filter Boxes


Bioswales are open, gently sloped vegetated channels designed to treat and absorb stormwater runoff, commonly built alongside roads and parking lots. Tree filter boxes are containers filled with amended soil, planted with a tree or hardy shrub which has gravel/rocks and an underdrain at the bottom. These design features filter and reduce stormwater runoff. They also reduce the heat island effect through evaporative cooling and shading. These features need not occupy otherwise economically productive space. The city of Louisville, KY is exploring how to plant trees in existing parking lots without reducing the number of parking spots. The tree bases would be placed below the parking surface.

Living Shorelines

Living shorelines are natural design features that minimize coastal erosion and flooding by minimizing the use of cement and stone. Strategies include utilizing, for example, native plants, mangrove buffers, and oyster beds, in conjunction with conventional hard infrastructure where needed. Living shorelines typically require fewer permits to construct and less long-term maintenance than traditional hard armoring features. Living shorelines can also restore habitat, and improve water quality.

How do we get there from here? Adaptation Pathway 5:

Green Landscaping



Redesigning our cities to have more vegetation involves attention to permitting detail. In the case of bioswales and tree filter boxes, progress can be made by altering municipal shielding and landscaping codes and designs. Tree filter boxes can be utilized on a small or large scale without much involvement of multiple parties. A city's landscaping department would institute the additional container and gravel into their new plantings. This design can be used on private property without additional permitting or approval. In South Florida, codes usually dictate that >50% of trees or plants in a new landscaping project must be native. To create a living shoreline, several agencies may be involved in the planning, building, and maintenance. Funding may be available from NOAA, ACOE, Systems Approach to Geomorphic Engineering (SAGE), state and local government, and other sources. Permitting can be the most cumbersome step in building living shorelines. One must apply for a DEP Exempt Permit, a general permit or restoration/enhancement permit, an ACOE federal dredge-fill or Wetland Impact Permit, as well as local permits regarding bulkhead codes. Additionally, if the living shoreline includes living oyster reef, authorization is also needed from DEP, ACOE, and FWC.

Problem Domain 6: Relocation

Not all communities can adapt to their growing sea-level rise and coastal erosion challenges while continuing to live in the places they currently call home. Coastal communities, not only in South Florida and Alaska, but also in coastal Louisiana, Virginia, Maryland, and Washington State, are facing the prospect of needing to relocate. In the case of a growing number of coastal Alaskan communities, planning for relocation is well underway. In South Florida this topic receives less attention, but is increasingly prominent.


Government Funding & Support

There is no recognized legal structure for defining or supporting people relocating due to climate change in general, or to sea-level rise or coastal erosion in particular. Historically, government aid has only been provided to environmental migrants after discrete, short-lived events (e.g., hurricanes, tornadoes), not for victims of environmental changes extending over long periods of time. Federal policy on this front has recently started to evolve, experimenting with supporting communities in Alaska and Louisiana, to try to maintain their livelihoods in new locations. In the case of Unakaleet, Alaska, recent Federal aid for maintaining roads and infrastructure has been instrumental in permitting the community to thrive while it builds new settlements on higher land.

Maintaining Impacted Communities

People who decide to relocate may face an unintended consequence: the public financial support for maintaining their current infrastructure might diminish or cease altogether. Supporting the infrastructure of a place that will soon lose its inhabitants may seem to decision-makers like a poor use of scarce resources. But of course people still need services where they live, even if they have decided to leave soon. This tension represents a social hardship. In addition, the communities where the relocating people are moving to may require assistance (e.g., increasing housing and food supplies, meeting the new demand for temporary social services).

*How do we get there from here? Adaptation Pathway 6:
Multi-Level Coordinating*



Recognizing that in some cases sea-level rise and coastal erosion may require households, or even entire communities, to eventually relocate means many actors need to coordinate their response. Few historical analogues exist for guidance. Yet getting this process right is of paramount importance, as relocating would surely initiate a vast and cascading set of legal, financial, social, and economic impacts. At a minimum, Federal agencies and policy-makers would be engaged, at least for the cases that involve Native American communities. In all cases, state, county, and municipal policy-makers would be involved, so they can deliver services to residents both during and following the transition. Community and advocacy groups would need to make their voices heard, to give ground-level reality checks. The local business sector and outside investors could be instrumental in shaping livelihoods before, during, and after the physical transition, by bringing in new visions and experiences for place-building, while still respecting local traditions. In short, the relocation process affects potentially a complete cross-section of society, but the means for orchestrating this process have not yet been specified and tested. Ideally, relocation should be a voluntary process; for those households or communities wishing to relocate, a near-complete engagement of society would be required.

—End of document; Appendices follow—

Appendix A – Summit Agenda



Tuesday, May 3

The Science Linking High-Latitude Warming to Ecosystems Near & Far

Location: Windows on the Green (Ground Level)

3:00 pm **Exhibit & Poster Session Opening**

Location: Crystal Ballroom, Salon I-II

4:00 pm **Global Glacier Melt**

- Alex Gardner, PhD, NASA-Jet Propulsion Lab

4:30 pm **Sea-Level Rise Observations**

- Gary Mitchum, PhD, University of South Florida

4:50 pm **Arctic Ecosystem Impacts**

- Nic Kinsman, PhD, National Oceanic Atmospheric Administration

5:10 pm **Florida Ecosystem Impacts**

- Steve Traxler, PhD, U.S. Fish & Wildlife Service

5:30 pm **Audience Q & A**

5:45 – 7:30 pm **EVENING RECEPTION** *Location: Pier Top Ballroom (17th floor of main Hyatt bldg.)*

Wednesday, May 4

Defining Our Challenges, Exposures and Motivations

7:30 am **REGISTRATION & CONTINENTAL BREAKFAST** *Location: Crystal Ballroom Atrium*

Location: Crystal Ballroom, Salon I-II

8:45 am **Welcome**

- Dan Flynn, PhD, Florida Atlantic University Vice President for Research

Setting the Stage: What's at Stake and Why We Should Care

- Colin Polsky, PhD, FAU Center for Environmental Studies & Geosciences

9:15 am **Infrastructure: What's Happening to Our Buildings, Road, Sewers & Water**
Florida

- Fred Bloetscher, PhD, Florida Atlantic University Civil Engineering

Arctic

- Bill Schnabel, PhD, University of Alaska-Fairbanks Environmental Engineering

9:45 am **Health Plenary: New Illness Risks to Manage**

Florida

- Roderick King, MD, Florida Institute for Health Innovation

Arctic

- Craig Stephen, PhD, University of Saskatchewan & Canadian Wildlife Health Cooperative

10:15 am	BREAK Location: <i>Windows on the Green (Ground Level)</i>
10:30 am	<p><i>Location: Crystal Ballroom, Salon I-II</i></p> <p>Redesign: A New Vision for Parcels, Neighborhoods, and Cities Setting the Stage</p> <ul style="list-style-type: none"> • Anthony J. Abbate, FAU Associate Provost for Broward Campuses & Professor of Architecture <p><i>Florida</i></p> <ul style="list-style-type: none"> • Jeff Huber, Florida Atlantic University Architecture <p><i>Arctic</i></p> <ul style="list-style-type: none"> • Nathalie Olijslager, Consul General of the Kingdom of the Netherlands in Miami
11:00 am	<p>Private Sector: Business, Law, Finance, & Insurance as Levers of Change</p> <ul style="list-style-type: none"> • Wayne Pathman, Pathman Lewis, LLC • Mitch Chester, Law Office of Mitchell A. Chester, P.A. • Rowan Douglas, Willis Re • Fireside Chat Moderator: John Englander, Oceanographer, Author
11:45 pm	LUNCH Location: <i>Panorama Ballroom, Salon A-B & Patio</i>
1:00 pm	<p><i>Location: Crystal Ballroom, Salon III, Salon IV (Lobby Level) & Chairman's (Ground Level)</i></p> <p>Parallel Solutions Salons</p> <ul style="list-style-type: none"> • Health: Moderators - Hon. Daniella Levine Cava, Miami-Dade County Commissioner & Roderick King, PhD, Florida Institute for Health Innovation • Business/Law/Finance: Moderators - Hon. Walter Duke, III, Walter Duke + Partners, Inc. & Nancy Scanlon, PhD, Florida International University • Architecture/Redesign: Moderators - Ricardo Alvarez, Mitigat.com, Inc. & Jason Chandler, Florida International University
3:30 pm	BREAK Location: <i>Windows on the Green (Ground Level)</i>
3:45 pm	<p><i>Location: Crystal Ballroom, Salon I- II</i></p> <p>Plenary Regroup & Synthesis: Reporting from Moderators</p>
4:15 pm	<p>Mitigation: Recalling the Long-Term Solution</p> <ul style="list-style-type: none"> • Ed Strobel, Sunshine Solar Services • Delaney Reynolds, Palmer Trinity High School
4:45 pm	Closing Remarks
5:00 – 7:00 pm	EVENING RECEPTION Location: <i>Crystal Ballroom Atrium</i>



Thursday, May 5
Preparing Our Adaptation & Resilience Pathways

7:30 am	REGISTRATION & CONTINENTAL BREAKFAST <i>Location: Crystal Ballroom Atrium</i> <i>Location: Crystal Ballroom, Salon I - II</i>
8:45 am	Adaptation as a Generational Imperative & Leadership Opportunity <ul style="list-style-type: none">• Admiral Robert J. Papp, Jr., USCG (Ret.), U.S. State Department Special Representative for the Arctic (video)• Dan Reifsnnyder, PhD, U.S. State Department Deputy Assistant Secretary for Environment
9:30 am	Successful Responses & Indicators <i>Florida</i> <ul style="list-style-type: none">• Hon. Kristin Jacobs, Florida House of Representatives, 96th District• Jennifer Jurado, PhD, Broward County Environmental Planning & Community Resilience Division• Jayantha Obeysekera, PhD, South Florida Water Management District <i>Arctic</i> <ul style="list-style-type: none">• Jacquelyn Overbeck, Alaska Department of Natural Resources
10:15 am	BREAK <i>Location: Crystal Ballroom Atrium</i> <i>Location: Crystal Ballroom, Salon I - II</i>
10:30 am	Home: Changes to Where We Live & What We Do <i>Florida</i> <ul style="list-style-type: none">• Hon. Jim Cason, Mayor, Coral Gables• Captain Dan Kipnis, Miami Beach <i>Arctic</i> <ul style="list-style-type: none">• Steve Ivanoff, Bering Straits Villages• Robin Bronen, JD, PhD, Alaska Institute for Justice• Robert Corell, Global Environment and Technology Foundation & Center for Energy and Climate Solutions (US)
11:45 am	LUNCH <i>Location: Panorama Ballroom, Salon B & Patio</i> <i>Location: Panorama Ballroom, Salon A & Salon C - D</i>
1:00 pm	Parallel Solutions Salons <ul style="list-style-type: none">• Responses & Indicators: Moderators - David Prodger, British Consul General Miami & Katherine Hagemann, Miami-Dade County Sustainability Initiatives• Infrastructure: Moderators - Fred Bloetscher, PhD, Florida Atlantic University & Bill Schnabel, PhD, University of Alaska-Fairbanks
3:00 pm	BREAK <i>Location: Panorama Ballroom Pre-function Area</i> <i>Location: Panorama Ballroom, Salon B</i>
3:15 pm	Plenary Regroup & Synthesis: Reporting From Moderators
4:15 – 4:30 pm	Pivoting to Next Steps & CES' 4th Sea-Level Rise Summit <ul style="list-style-type: none">• Hon. Ted Deutch, U.S. Congressman for Florida's 21st District• Caribbean & Latin America: Richard S. Olson, PhD, Florida International University Extreme Events Research

Appendix B – Summit Satisfaction Survey

CES surveyed attendees during the last session of the Summit as well as post-event. To view the results in a graphic form, click [here](#). 74 people responded in total. The following is a summary of the results:

- 90% of respondents stated the Summit increased their knowledge & understanding
- 93% said the format of the Summit worked well
- 96% said the topics were relevant to the Summit's theme
- 100% said presenters were knowledgeable & able to successfully convey their key ideas
- 89% said they can see ways to incorporate learning from the Summit in their work
- 95% said the facilities met their expectations
- 100% said that conference staff was helpful and friendly
- 97% said that they would recommend the Summit to a colleague
- 93% said they would be interested in attending the next Summit
- Suggested opportunities for improvement included:
 - Submission of text questions to speakers for easier moderating so more people can speak up and ask questions
 - Open some of the sessions to the public for free so that we get engagement and education on the issues
 - Invite local grassroots individuals and Native American populations
 - Include agriculture as a panel
 - Hold the conference at a facility that is either LEED certified or has other sustainable infrastructure or technologies
- Overall the best part of the Summit according to respondents was:
 - Solutions Salons
 - Positive discussion focused on adaptation
 - The fact that it was a more solutions-oriented than other sea-level rise conferences
 - The Business/Finance discussions
 - Perspectives from Alaskans
 - The diversity of perspectives presented



CES Staff pictured from left to right: Serena Hoermann, Mary Beth Hartman, Vince Edwards (back), Charlene Hickson, Alana Edwards, Dr. Keren Bolter, Alyssa Wood, Kimberly Vardeman, & Dr. Colin Polky. Photo Credit: Andrew Kameronky

CONTACT INFORMATION:

We invite you to contribute to the conversation started at the
3rd Sea-level Rise Summit: Connected Futures from Alaska to Florida.

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Summit webpage: <http://www.ces.fau.edu/arctic-florida/>

Facebook: <https://www.facebook.com/SeaLevelRiseSummit/>

Twitter: https://twitter.com/FAU_CES

“The measure of intelligence is the ability to change.” — Albert Einstein