Ad Hoc Expert Meeting on

Climate Change Impacts and Adaptation: A Challenge for Global Ports

29 – 30 September 2011

United States Ports: Addressing the Adaptation Challenge

Presentation by

Mr. Mike Savonis
Policy Analyst
ICF International

This expert paper is reproduced by the UNCTAD secretariat in the form and language in which it has been received. The views expressed are those of the author and do not necessarily reflect the views of the UNCTAD.

U.S. Ports: Addressing the Adaptation Challenge

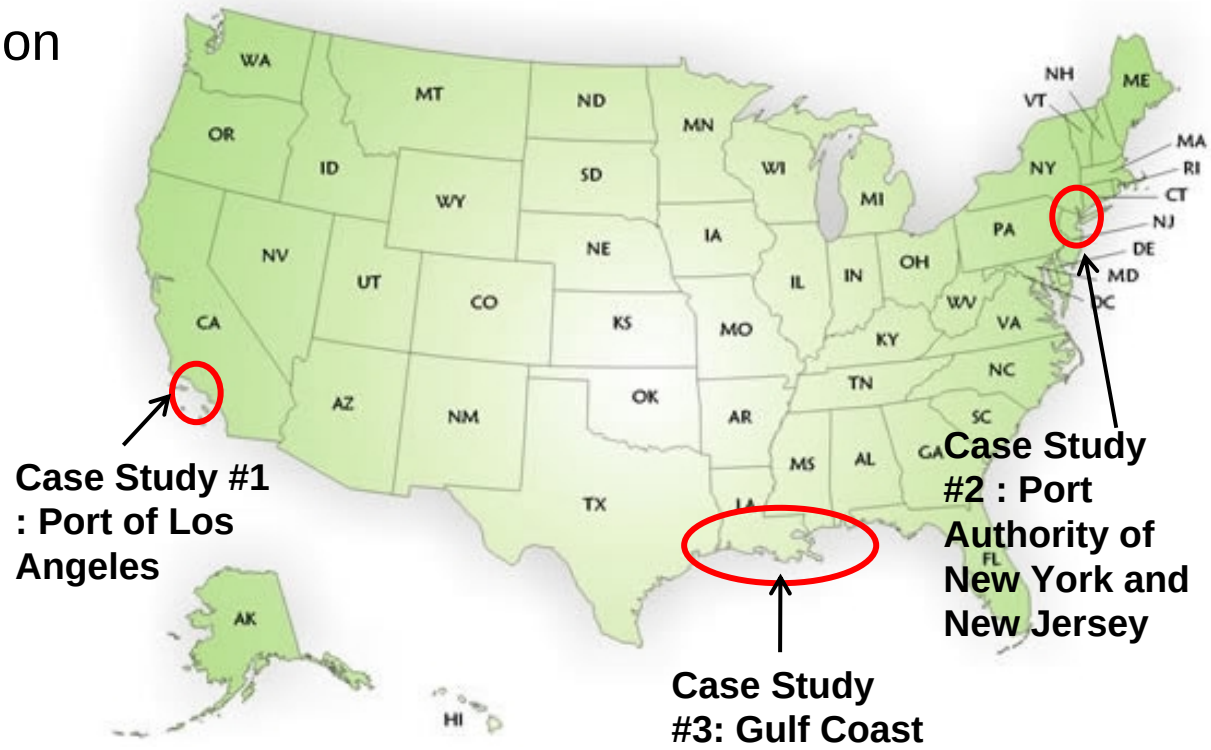
UNCTAD Ad Hoc Expert Meeting

Michael Savonis
ICF International

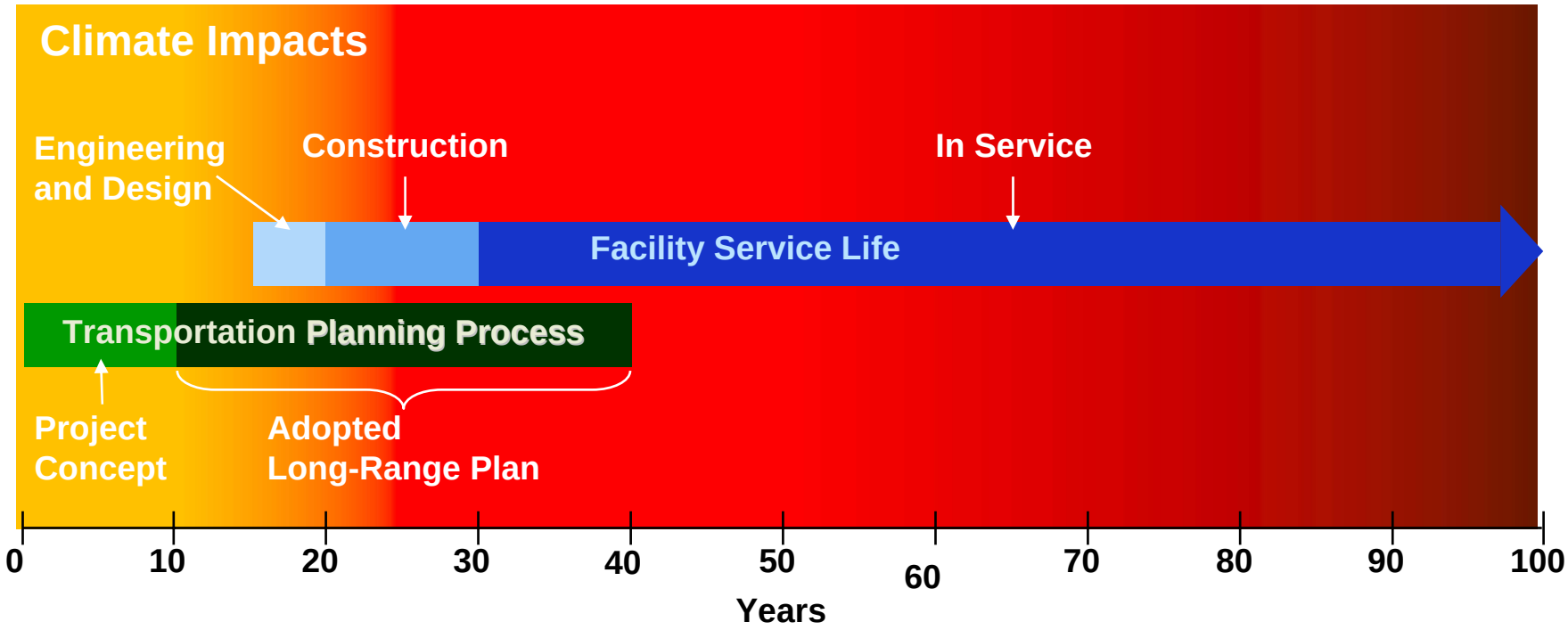
September 29, 2011

Outline

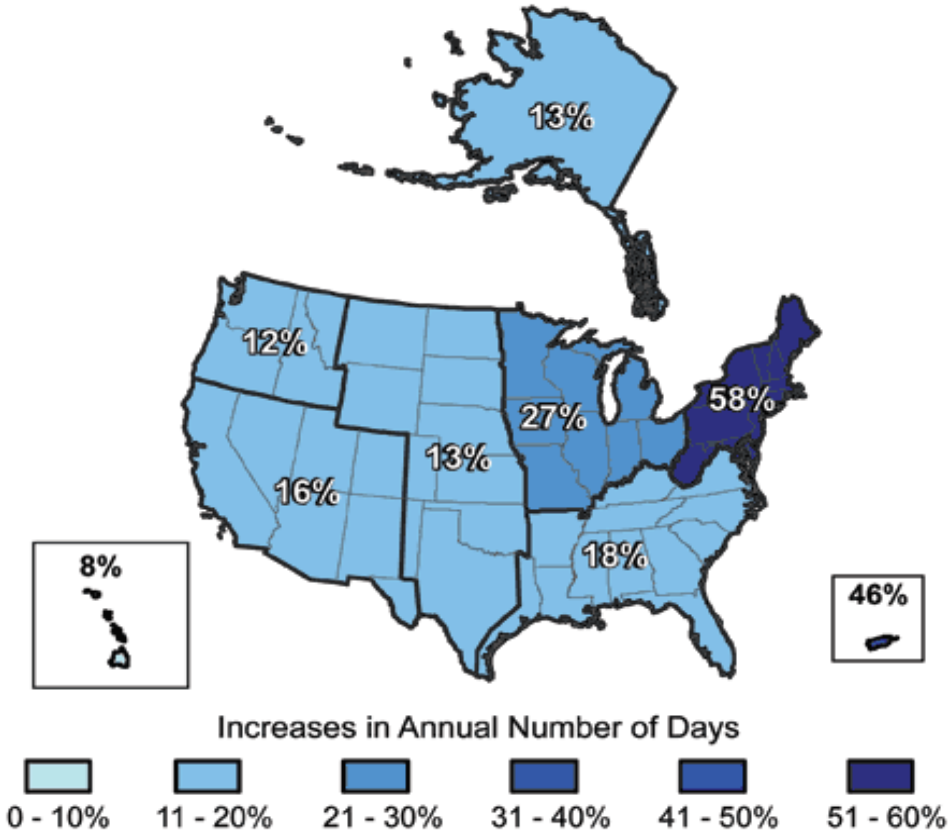
- Climate Change Impacts and Transportation
- Case Study #1: Port of Los Angeles
- Case Study #2: Port Authority of New York and New Jersey
- Case Study #3: The Gulf Coast Study
- Adaptive Transportation Planning



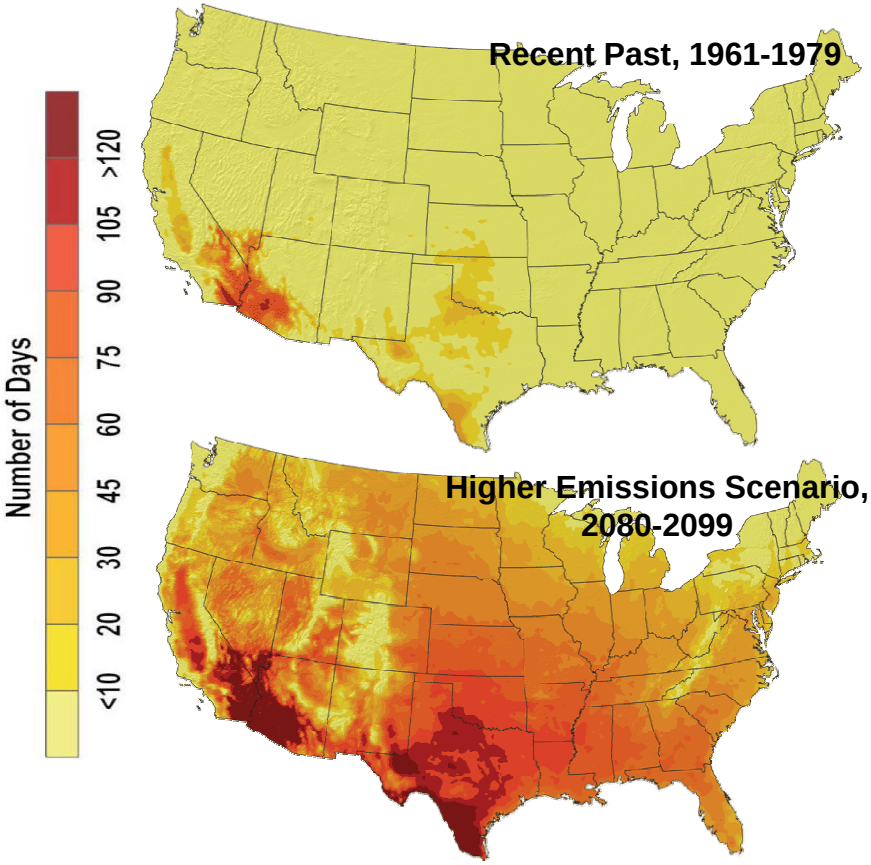
Transportation Timeframes vs. Climate Impacts



Climate Changes: Heat and Precipitation*



Increases in Very Heavy Precipitation Days, 1958-2007



Number of Days Over 100ºF

*Source: "*Global Climate Change Impacts in the United States*," U.S. Global Change Research Program, 2009

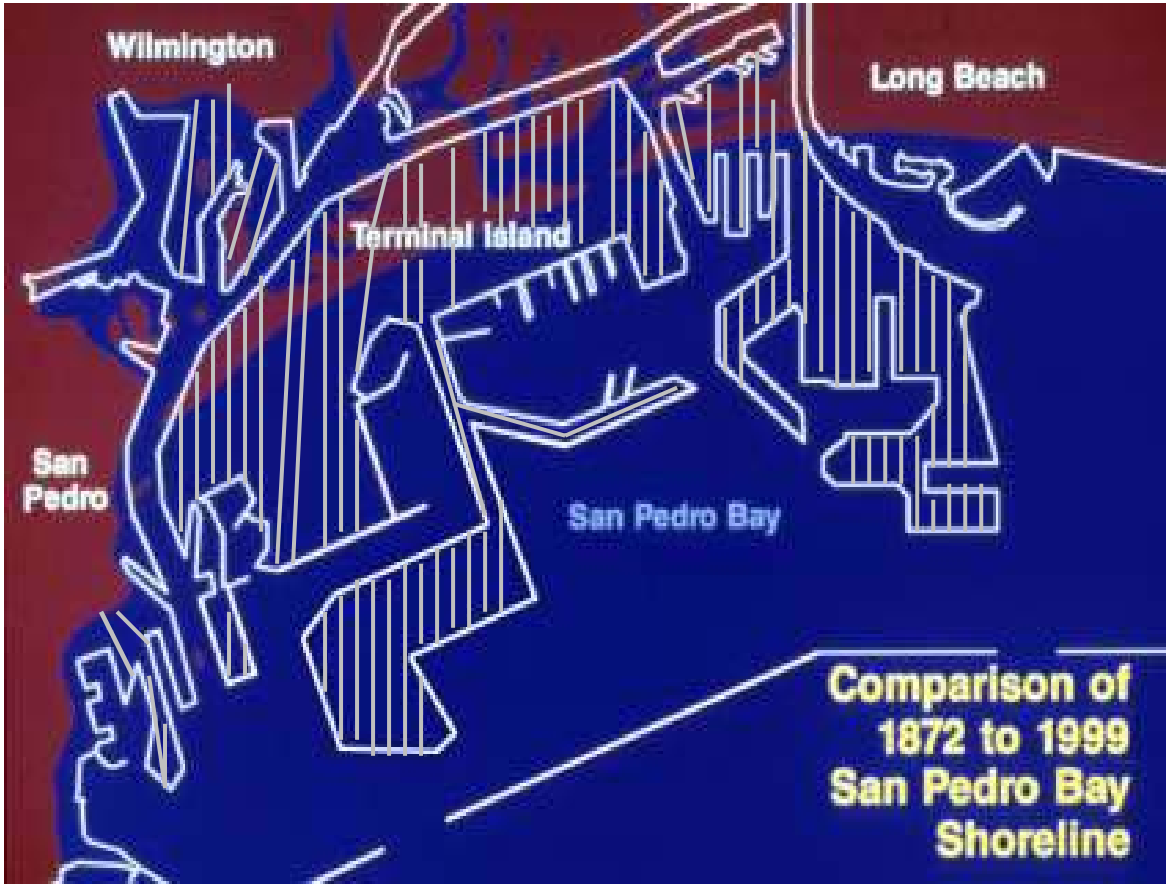
Why this matters: Port Impacts*

CLIMATE EFFECT	IMPACTS
More hot days	• Asphalt deterioration • Thermal expansion of bridge joints, paved surfaces • Pavement & structural design changes
Wind speeds	• More frequent sign damage • Need for stronger materials
More frequent, intense precipitation	• Increased flooding • Increased peak stream flow could affect scour rates • Standing water could affect structures adversely
Increased coastal storm intensity	• Increased storm surge and wave impacts • Decreased expected lifetime of structures • Erosion of land supporting coastal infrastructure
Sea level rise	• Permanent inundation • Erosion of road base • May amplify storm surges in some cases • Changes in port competitiveness

*Sources: "*The Gulf Coast Study, Phase 1,*" Climate Change Science Program, 2008 and *"Assessing the Need for Adaptation,"* Courtesy of Carter Atkins, 2011.

Case Study #1: Ports of Los Angeles*

- Founded in 1907
- 69 km of waterfront
- 3,035 hectares of land and water
- 26 major cargo terminals

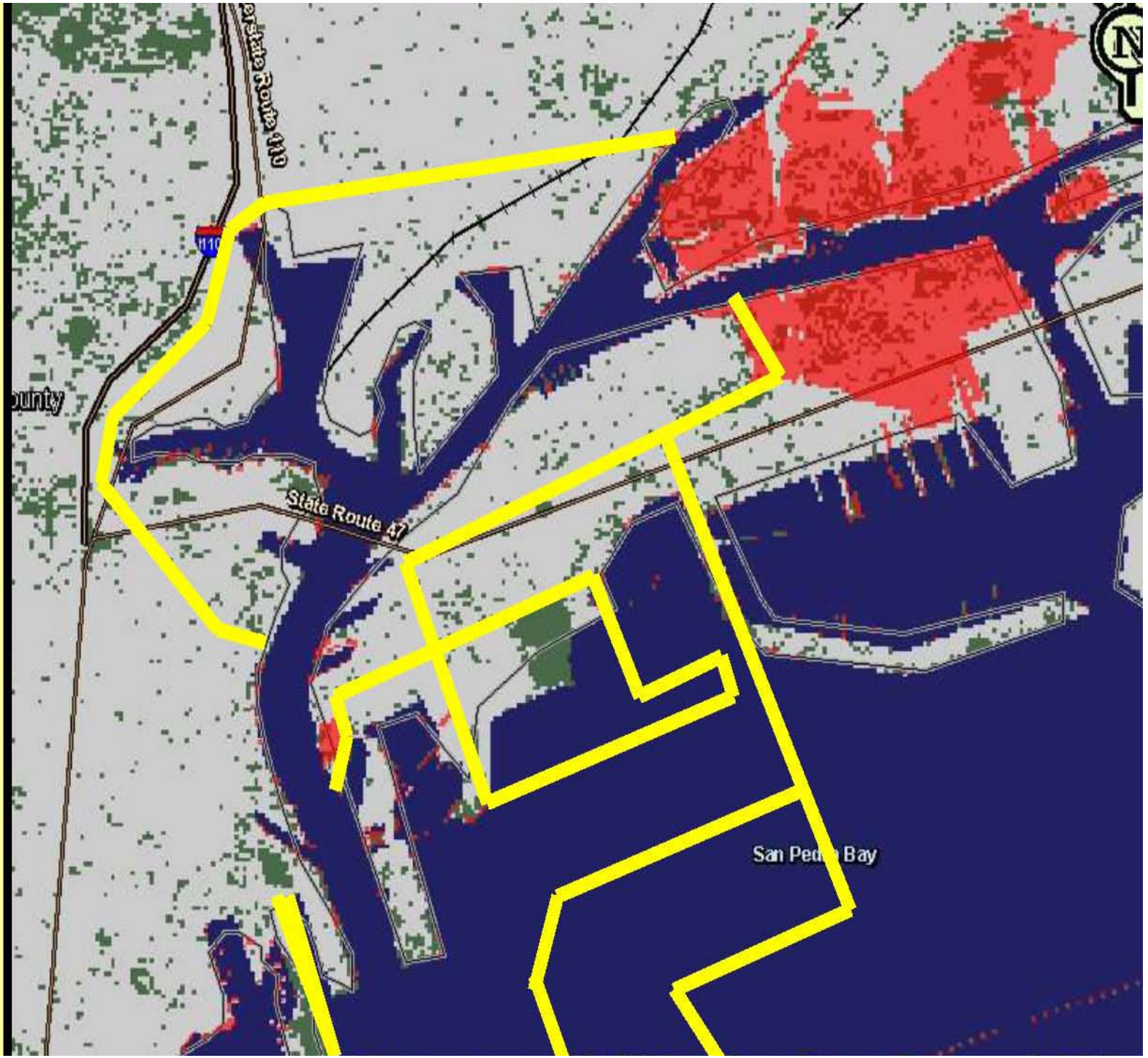


*Adapted from "*Assessing the Need for Adaptation: The Port of Los Angeles/ RAND Corporation Study,"* Courtesy of Carter Atkins, 2011.

No SLR

1 Meter SLR

SLR Affected Areas



2 Meter
SLR

SLR Affected Areas

3 Meter SLR

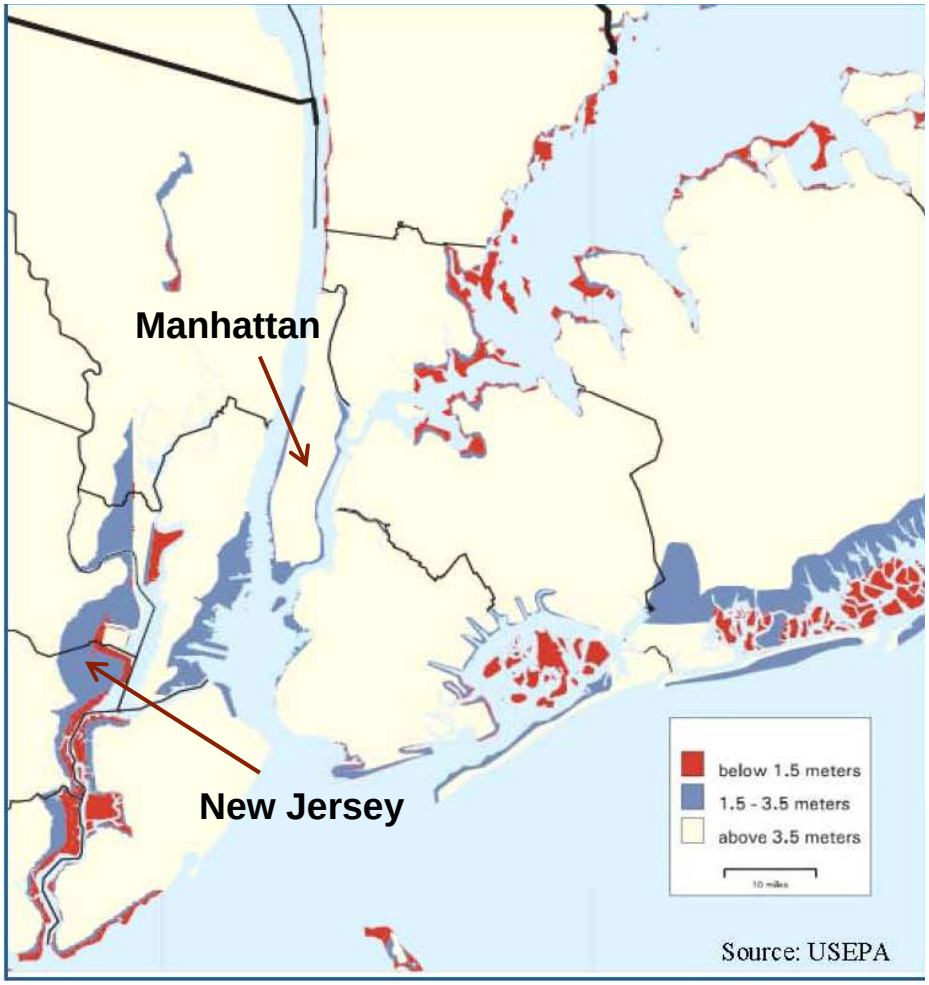
SLR Affected Areas

Case Study #2: Port Authority of New York and New Jersey (PANYNJ)*

- PANYNJ infrastructure is coastal.
- Over **half** of PANYNJ facilities are potentially vulnerable
  - Sea level rise
  - Storm surges
  - Increased precipitation
  - Wind
- Some of these issues are not new

*Source: "*Adapting to Climate Change: Practical Strategies of the Port Authority,"* Courtesy of Christopher Zeppie, 2010.

Climate and Impact Predictions for the NY/NJ Area



New York City	Baseline[1] 1971-2000	2020s	2050s	2080s
Air temperature Central Range[2]	53° F	+1.5 to 3.0° F	+3.0 to 5.0° F	+4.0 to 7.5° F
Precipitation Central Range	47 in	0 to +5 %	0 to +10 %	+5 to 10 %

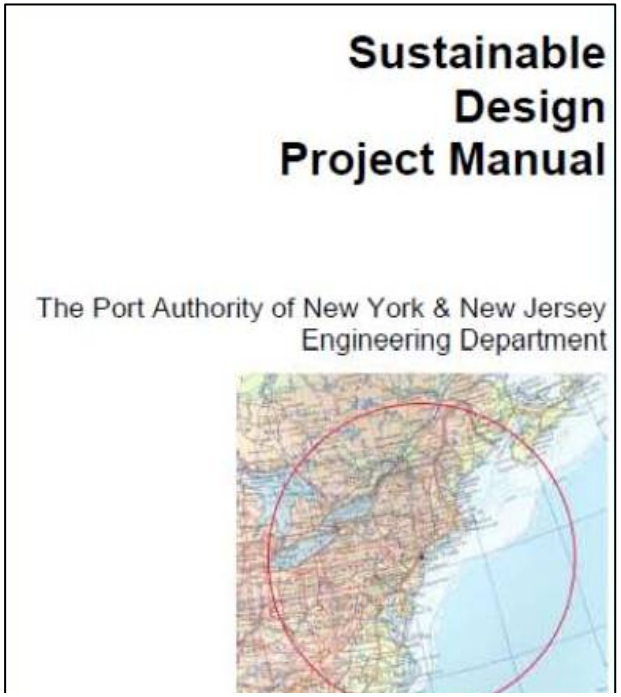
Stations used for Region 4 are New York City (Central Park and LaGuardia Airport), Riverhead, and Bridgehampt

Planning for the Future

- Projected Growth in Demand

Forecasted Increase in Demand for Port Authority Transportation Services 2005-2020[3]

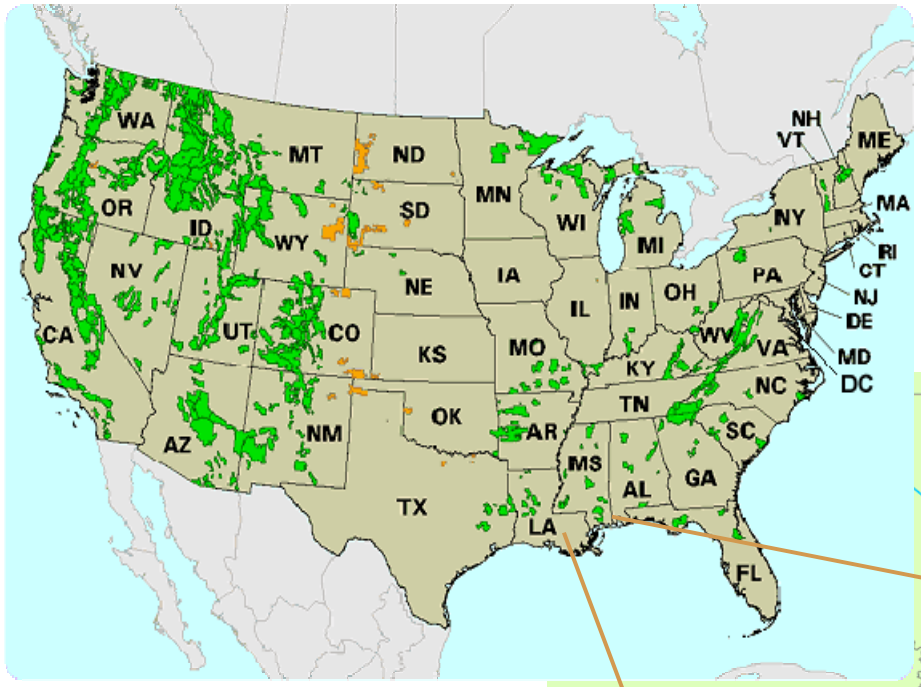
Air Passenger	40%
Air Cargo (by volume)	70%
Port Cargo (by volume)	100%[4]
PATH Passenger	60%
Truck and Bus Traffic, Tunnels and Bridges	20%
Auto Traffic, Tunnels and Bridges	16%

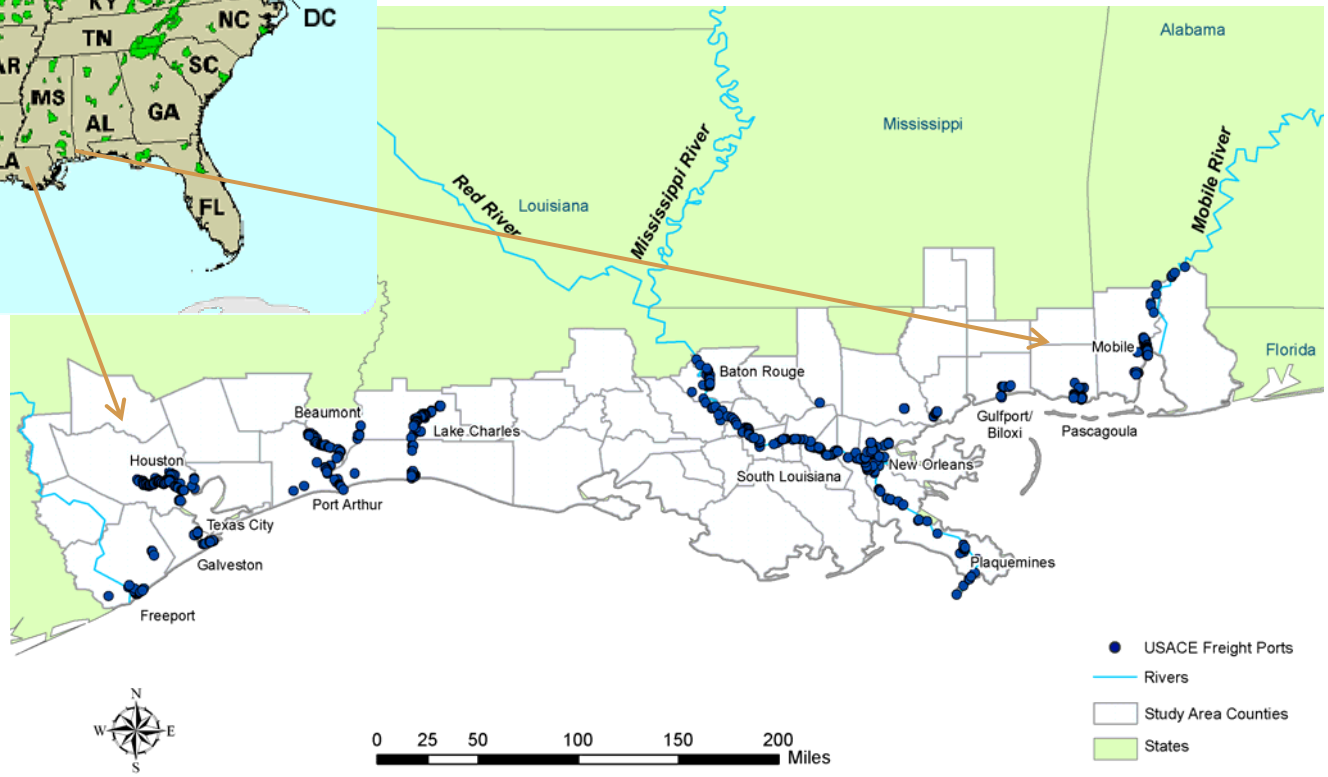


- Sustainable Design Manual
  - Sustainable Design Guidelines
  - Sustainable Infrastructure Guidelines
  - Includes adaptive design measures

Case Study #3: Gulf Coast*

- 40% of US marine tonnage
- 60% of energy imports





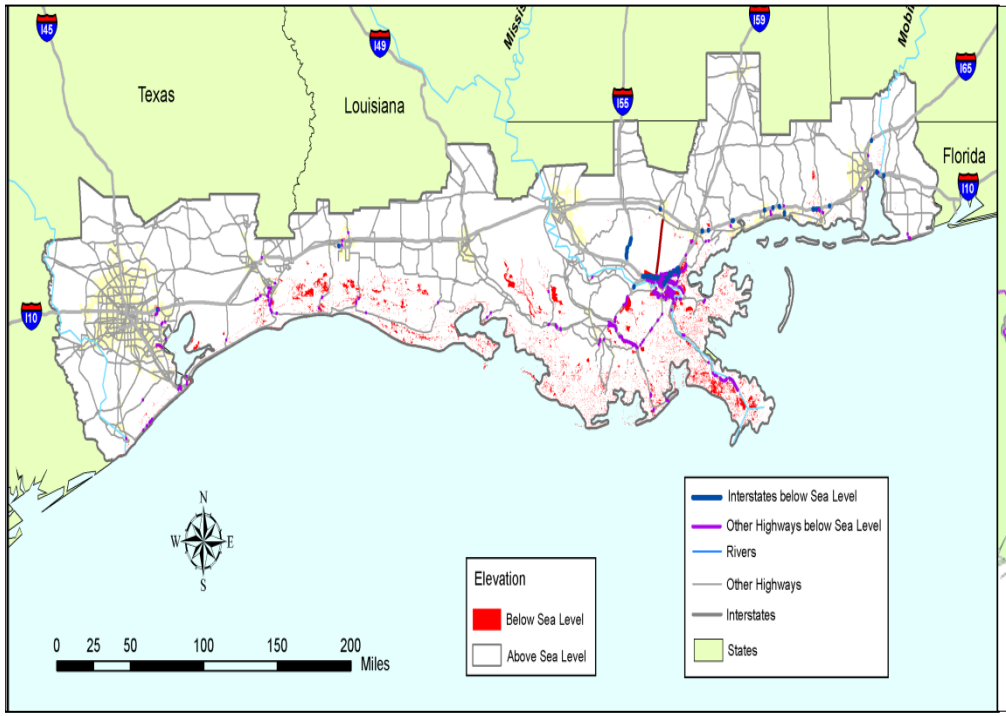
*Source: "*The Gulf Coast Study, Phase 1,*" Climate Change Science Program, 2008

Gulf Coast Study: Impacts of Sea Level Rise

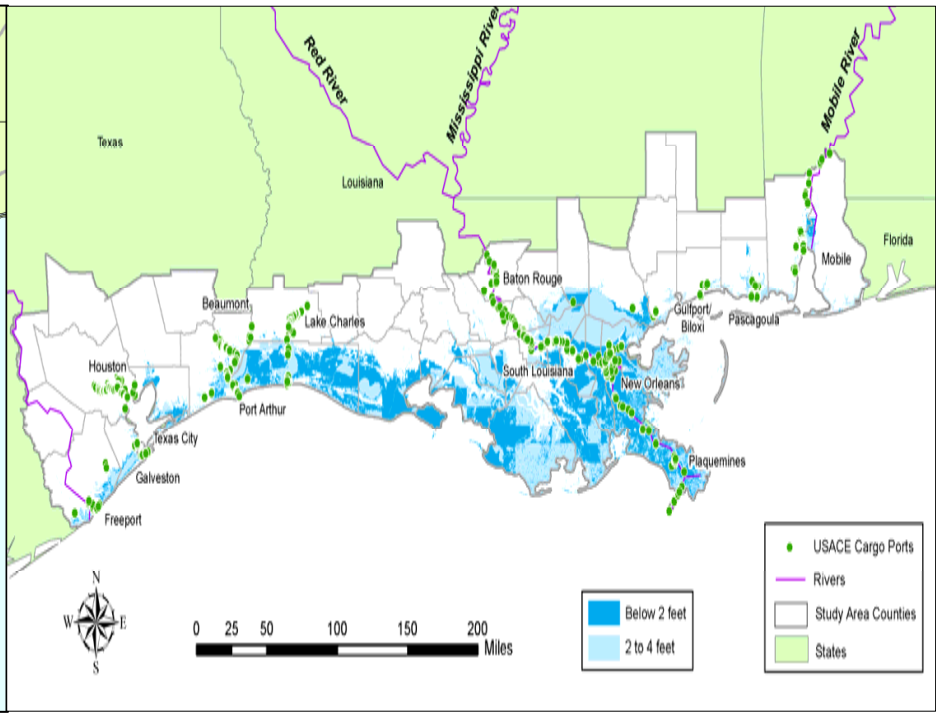
Impact	Assets Affected
Relative Sea Level Rise of 1.2 m (4 feet)	Permanent flooding of: • 24% of interstate miles, 28% of arterial miles • *More than 2,400 miles (~3,862 km) of roadway are at risk of permanent flooding* •72% of freight / 73% of non-freight facilities at ports •9% of the rail miles operated, 20% of the freight facilities •3 airports •Temporary flooding in low-lying areas due to increased heavy downpours will broaden affected areas

Freight Handling Ports Facilities Potentially Vulnerable to Relative Sea Level Rise

Baseline (Present Day)



1.2 m (4 ft) of Sea Level Rise



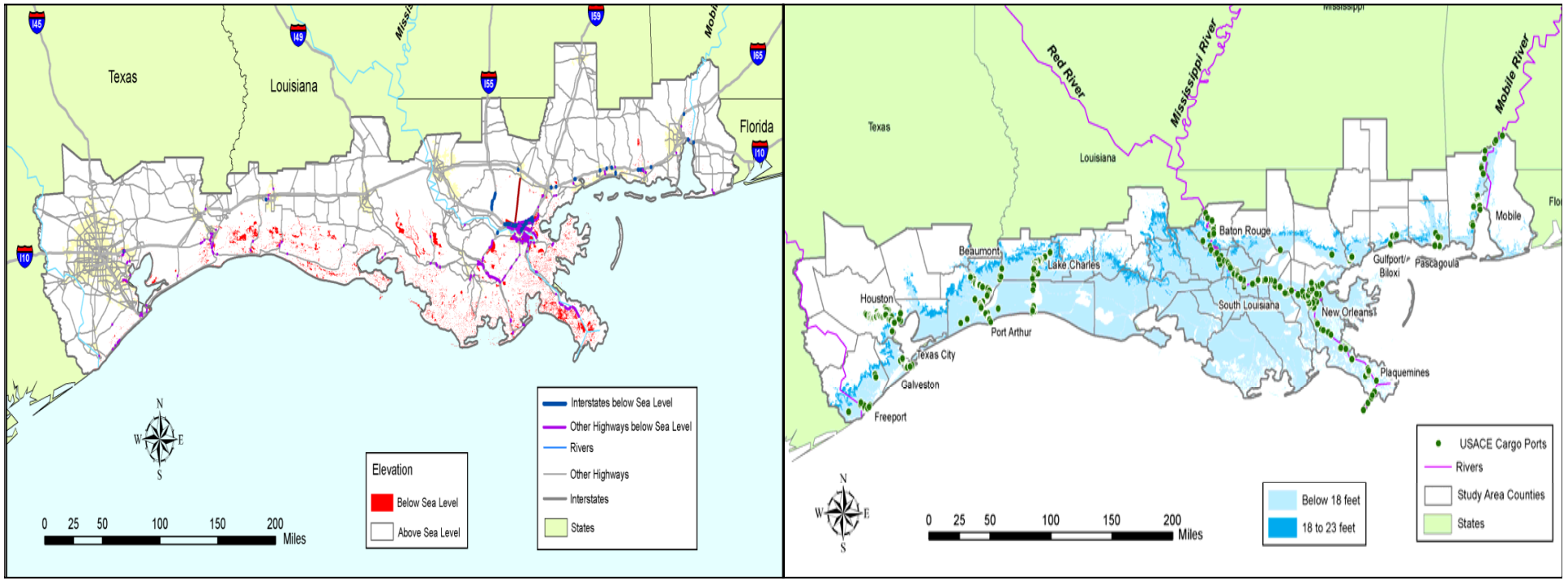
Gulf Coast Study: Impacts of Storm Surge

Impact	Assets Affected
Storm Surge (up to 5.49m or 18 ft of surge)	Vulnerable infrastructure include: •51% of interstate miles, 56% of arterial miles •98% of port facilities vulnerable to surge and 100% to wind •33% of rail miles operated, 43% of freight facilities •22 airports in the study area at or below 18 feet MSL •Potentially significant damage to offshore facilities

Freight Handling Ports Facilities Potentially Vulnerable to Storm Surge

Baseline (Present Day)

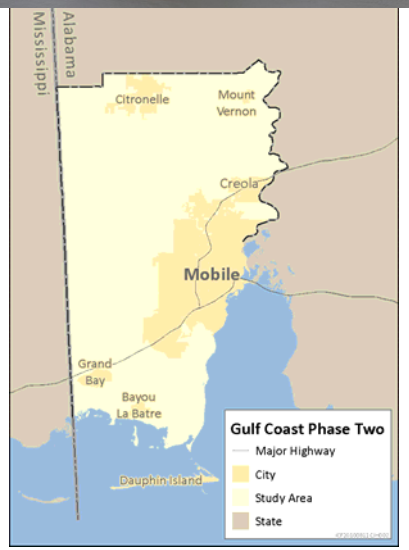
5.49 m (18 ft) of Storm Surge



Gulf Coast Phase 2: U.S. DOT Federal Highway Administration

- This phase is focused on:
  - Identifying vulnerable infrastructure in Mobile, Alabama,
  - Conducting detailed engineering and risk studies to identify options for strengthening critical infrastructure, and
  - Developing tools and methods that can be applied to other locations.

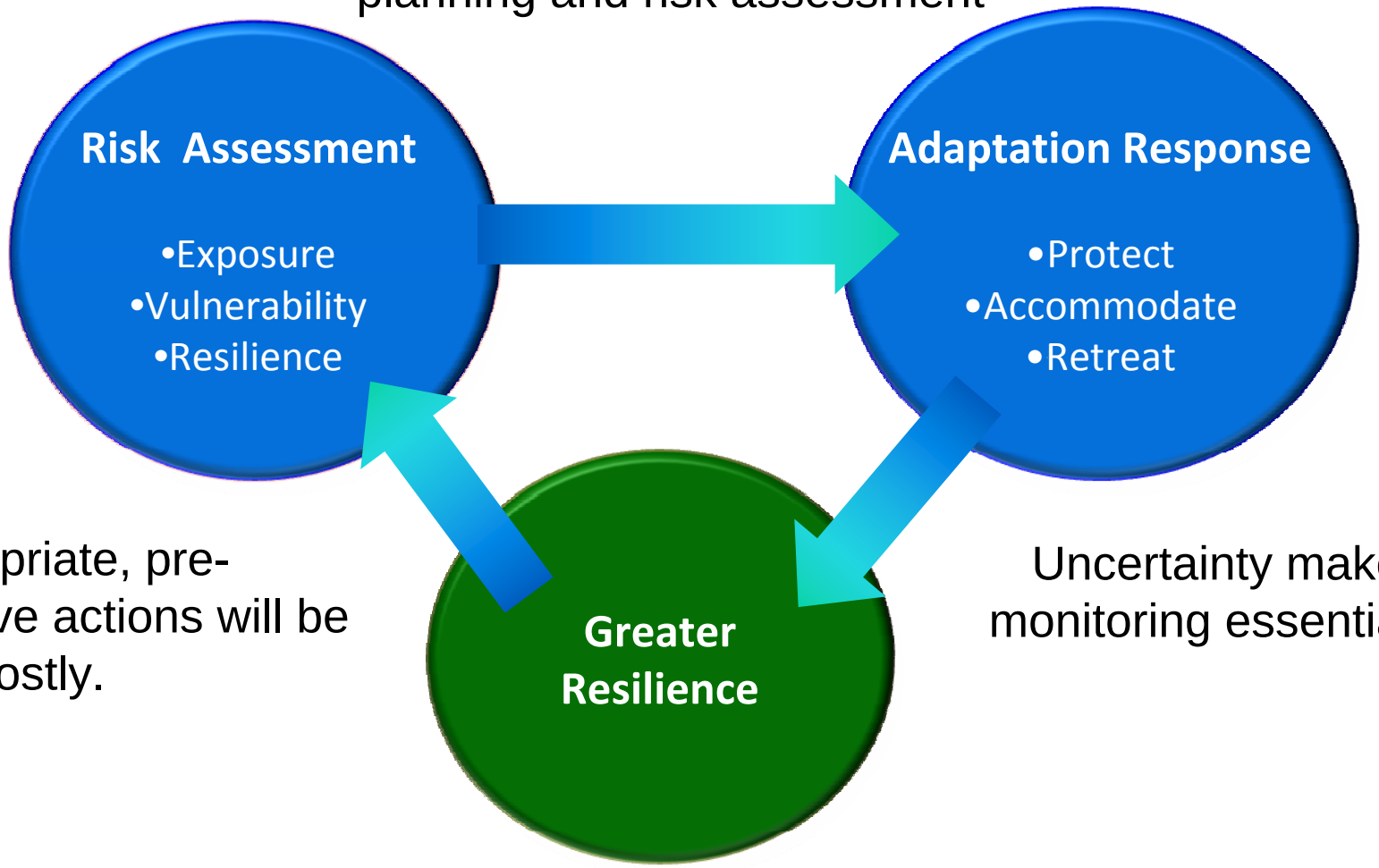
Mobile Container Terminal at Port of Mobile, Alabama



Study area of Gulf Coast Phase 2

Reliability under a range of conditions

New approaches: scenario planning and risk assessment



Appropriate, pre-emptive actions will be less costly.

Uncertainty makes monitoring essential.

Possible Solutions

Approach	Possible Activities
Protect	• Construct storm surge barriers • Strengthen buildings/foundations
Accommodate	• Elevate structures • Improve flood tolerance • Develop floating structures • Use easy to repair materials • Dredge more frequently
Retreat	• Retreat inland • Relocate
Planning Flexibility	• Reduce irreversible investment • Reduce lease lengths

Challenges

Type	Examples
Funding and Budgeting	• Capital Planning • Economic Realities
Politics and Regulatory	• Planning Agencies • Environmental and Community Concerns
Immediate Concerns	• Aging Infrastructure • Congestion and Growth
Geographical and Operational Boundaries	• Infrastructure Location • Transportation system-wide Planning
Technology and Research	• Materials • Design and Engineering

Questions? Comments?

Mike Savonis
msavonis@icfi.com

Thank You!