

The U.S. Marine Transportation System

Responses to Climate Change and Variability

presented to

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presented

by Cambridge Systematics, Inc.

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Transportation leadership you can trust.



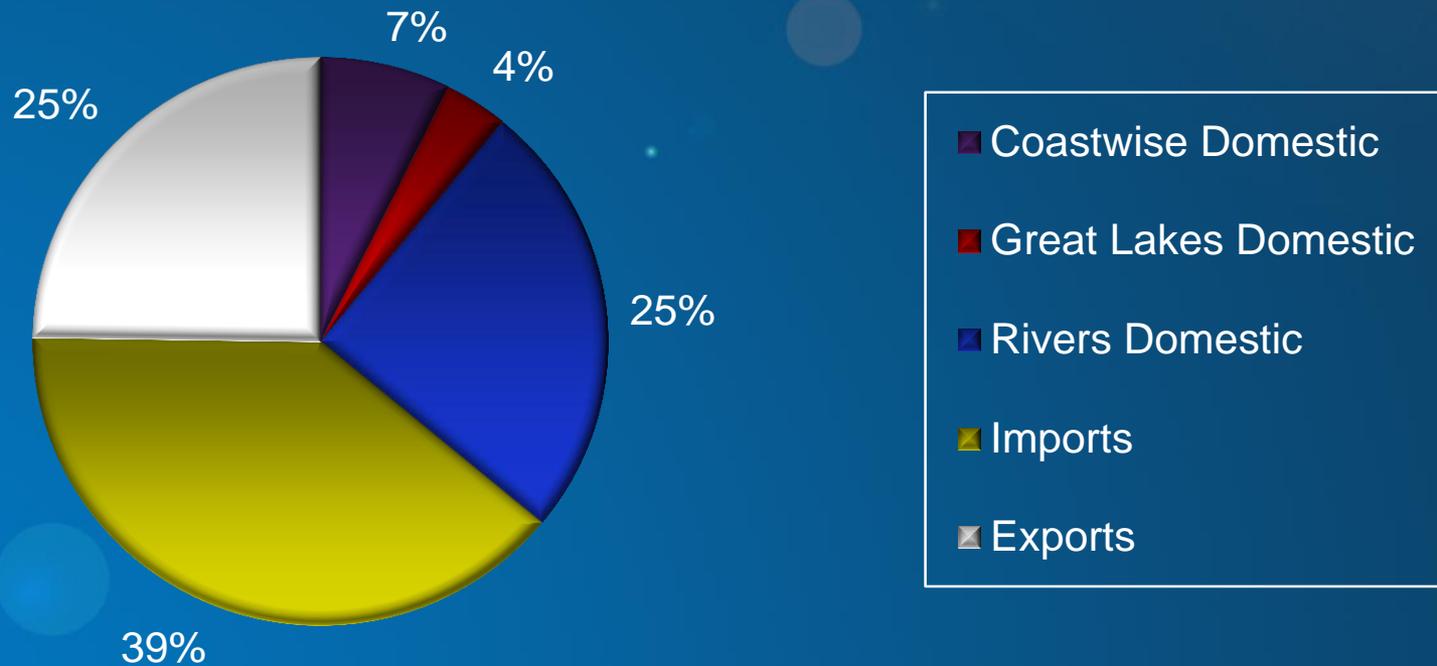
What is the Marine Transportation System?

TRB Special Report 279

- Thousands of miles of navigable channels, hundreds of port complexes, and thousands of terminals located along the nation's lakes, rivers, and coastal waterways
- Tens of thousands of shippers and carriers, who operate a wide range of vessels from this country and abroad, from river barges to the largest oceangoing vessels
- Connections to the nation's other modes of transportation, such as highways, railroads, and pipelines
- A vast freight system that has become integrated with the production process itself

Snapshot of MTS Activity

In 2010, over 2.3 billion short tons of freight moved along U.S. rivers, lakes, and three coasts (Pacific, Atlantic, Gulf) — more than 1.4 trillion dollars of international trade -- equivalent to 130 million loaded trucks in a 1.7 million-mile queue

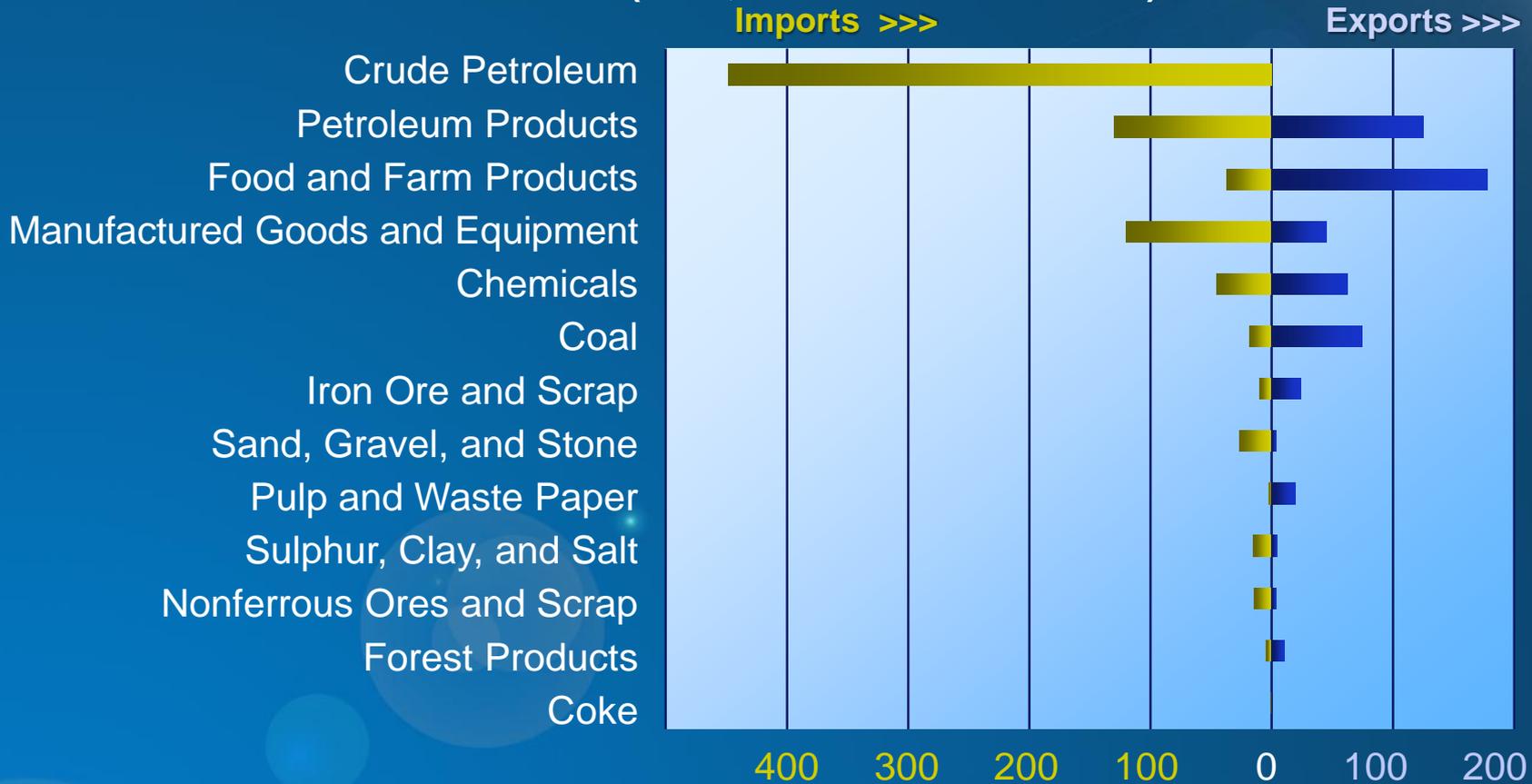


Sources: U.S. Army Corps of Engineers and American Association of Port Authorities.

MTS Trade is Central to the U.S. Economy

Energy, Food, Industrial Production, Consumer Goods, Construction

Balance of Waterborne Trade (2010, millions of short tons)



Source: U.S. Army Corps of Engineers.

MTS Traffic Is Projected to Grow

- Container trades
 - » Containers reduced transportation costs, allowed longer U.S. and global supply chains
 - » Ever-larger vessels provide economies of scale
 - » Panama Canal expansion
 - » “Marine Highway”
- Noncontainer trades
 - » Growing demand for fuels, foods, industrial products, and natural resources



MTS Marine Terminals Are Widely Distributed

- 8,060 cargo-handling docks

- » 1,743 on the Atlantic
- » 2,087 on the Gulf
- » 1,664 on the Pacific
- » 1,919 on the Rivers
- » 647 on the Great Lakes



- Leading Container Ports

- » Los Angeles, Long Beach, New York/New Jersey, Savannah, Oakland, Seattle, Norfolk, Houston, Tacoma, and Charleston

- Leading Tonnage Ports

- » South Louisiana; Houston; New York/New Jersey; Beaumont, Texas; Long Beach; Corpus Christi, Texas; New Orleans; Los Angeles; Huntington, West Virginia; Texas City, Texas

Three Climate Challenges for MTS Planners

How to Adapt When “There is no Normal – Only Different”

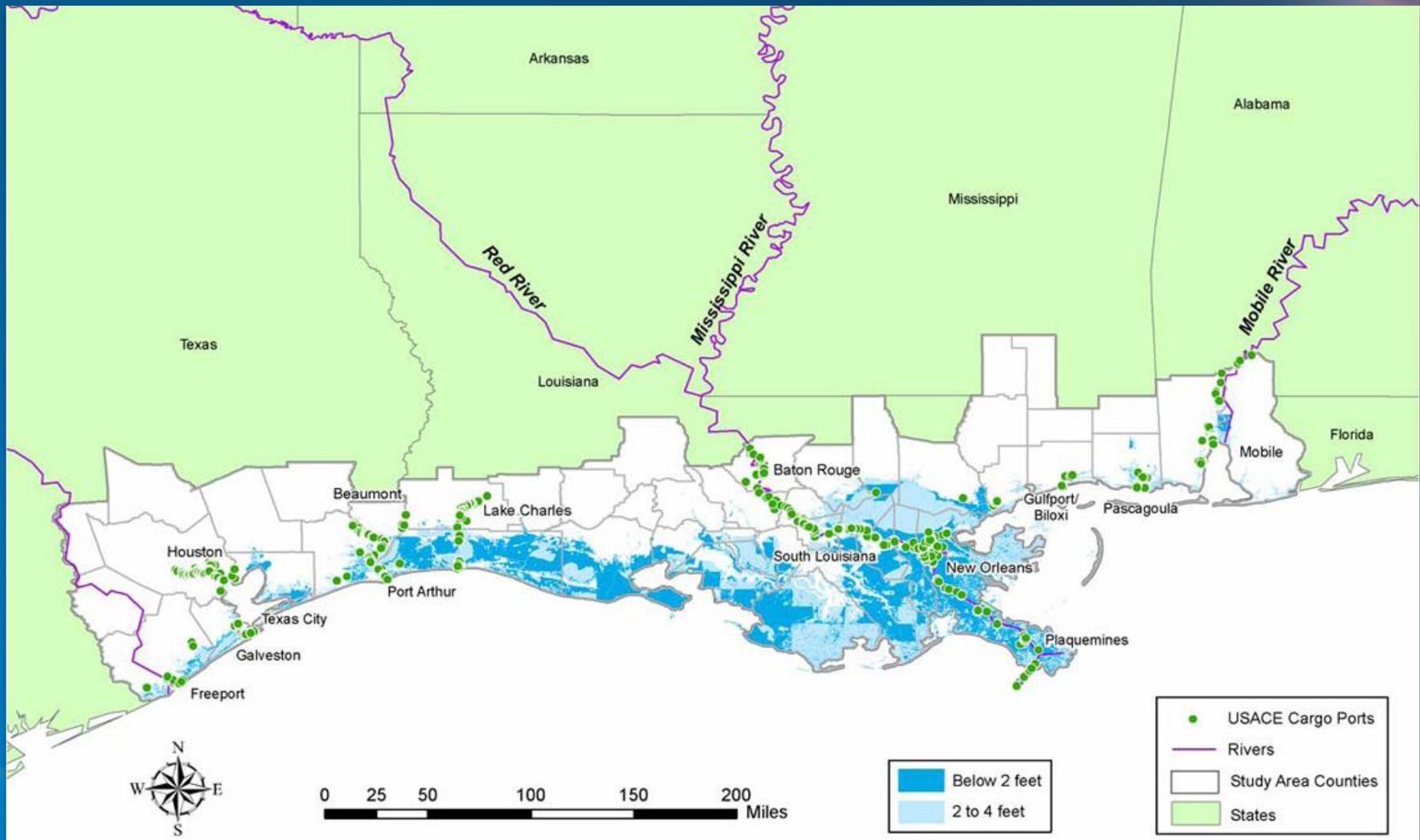
- More variable and extreme climate
 - » Higher temperatures, more intense rainfall events and droughts; increased frequency and severity of storms
 - » Relative sea level rise at coastal facilities
- Risks to the MTS
 - » Temporary shutdowns due to flooding, wind, storm surge
 - » Temporary or permanent shutdowns due to loss of navigation from channel blockage and/or low water
 - » Permanent shutdowns due to relative sea level rise
 - » Major changes in market demand due to shifts in domestic production and consumption (energy, food, industrial products, and natural resources) and global trade patterns

Three Climate Challenges for MTS Planners

MTS Risks Are Systemwide, Not Terminal Specific

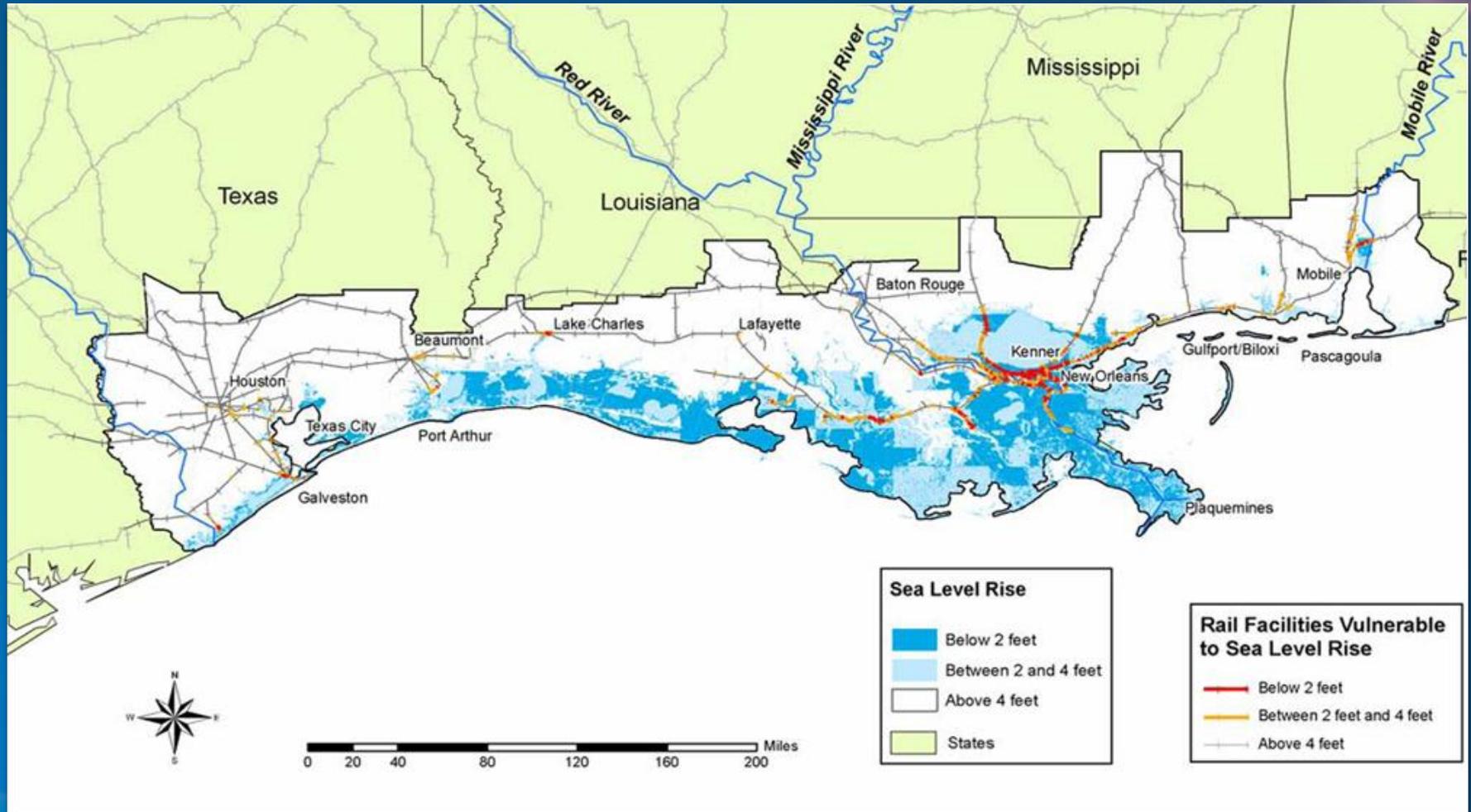
- U.S. DOT Gulf Coast study, Freeport to Mobile
 - » Around 1,000 marine freight terminals representing 40% of all MTS tonnage (petroleum, chemicals, food products, et al.), plus highway and rail connectors
 - » Facilities at very low elevations (0-4 feet above sea level) at potential risk from relative sea level rise to year 2100
 - » Facilities at low elevations (0-23 feet above sea level) at potential risk from increased storm surge to year 2100
- Major findings
 - » Being at low elevations, most marine terminals are at risk
 - » So are the highway and rail links that allow them to operate
 - » Effective adaptation has to address all three modes

72% of Marine Freight Terminals Potentially Vulnerable to Relative Sea Level Rise



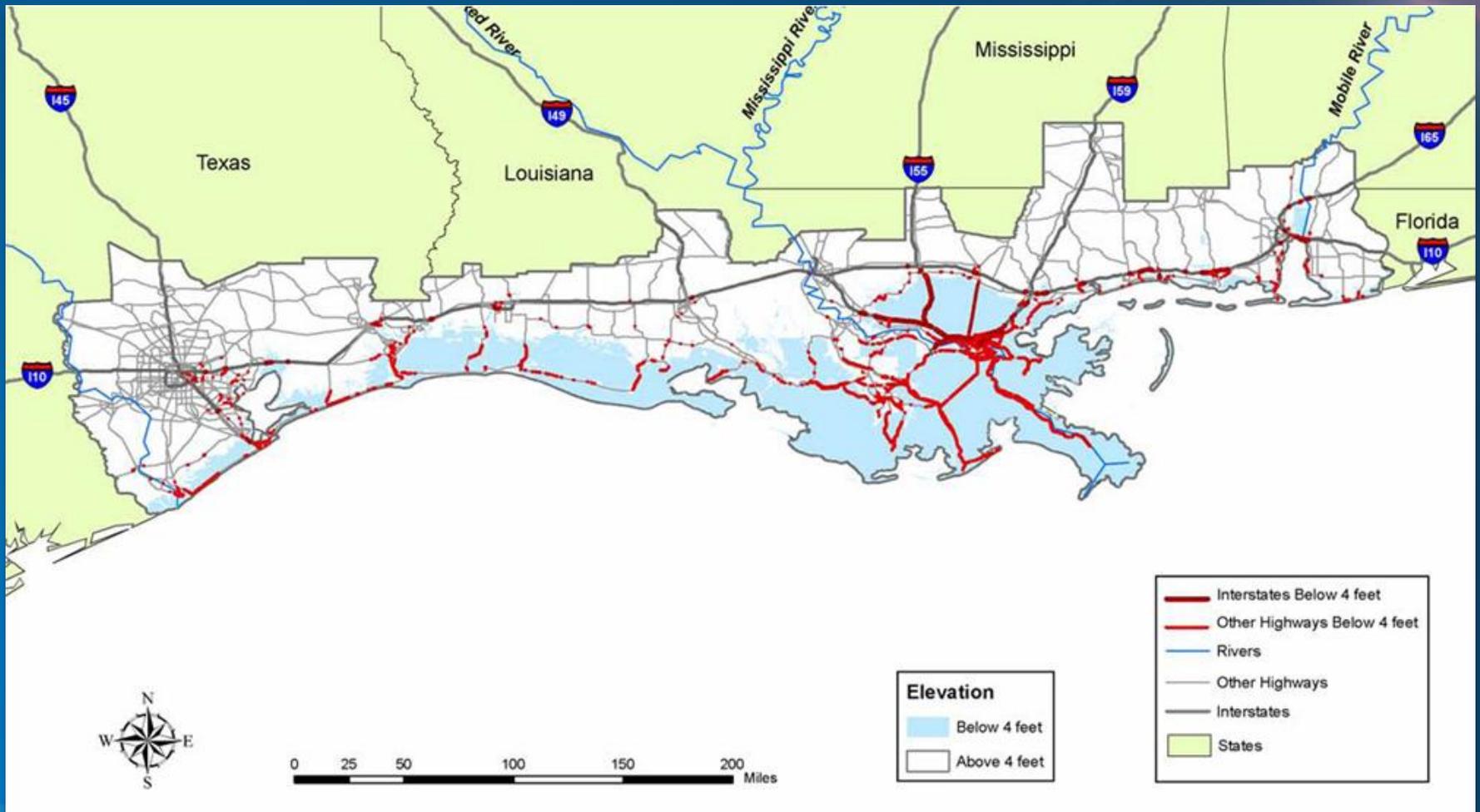
Source: Cambridge Systematics, Inc. analysis of climate projections and U.S. Army Corps of Engineers data, Gulf Coast Study Phase I.

20% of Rail Terminals and 9% of Rail Mileage Potentially Vulnerable to Relative Sea Level Rise



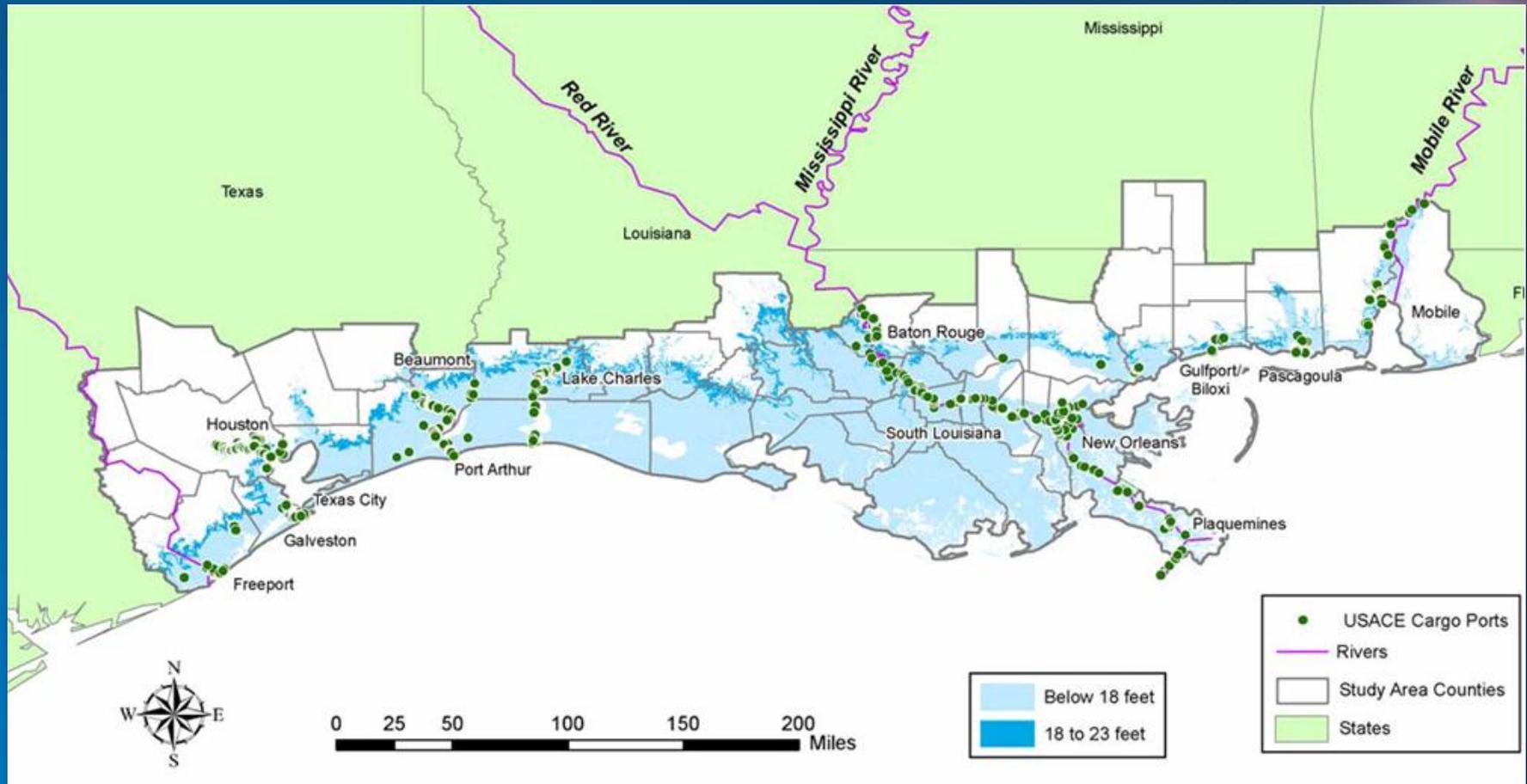
Source: Cambridge Systematics, Inc. analysis of climate projections and Federal Railroad Administration data, Gulf Coast Study Phase I.

24% of Interstate Highway Mileage Potentially Vulnerable to Relative Sea Level Rise



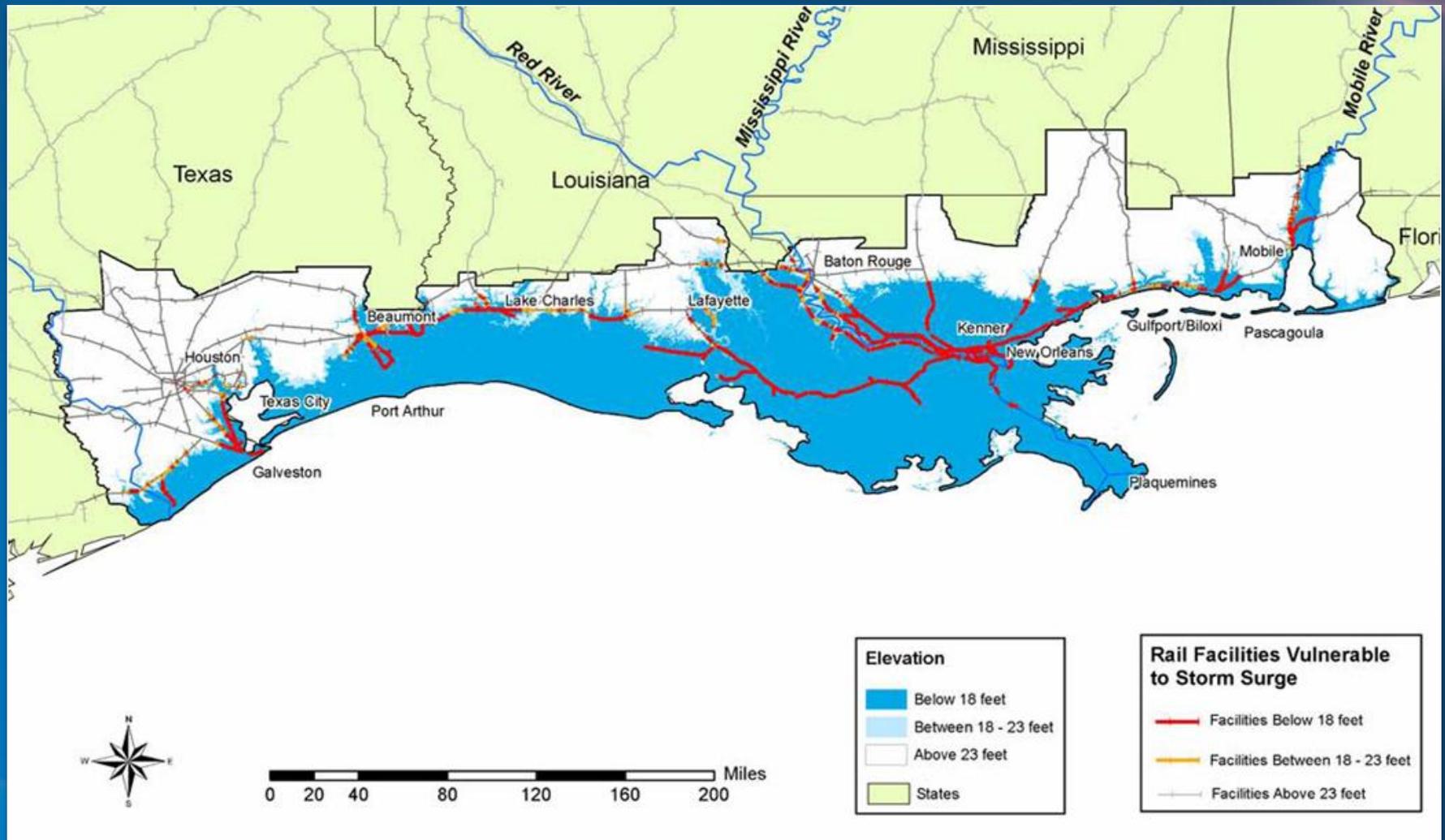
Source: Cambridge Systematics, Inc. analysis of climate projections and Federal Highway Administration data, Gulf Coast Study Phase I.

99% of Marine Freight Terminals Potentially Vulnerable to Increased Storm Surge



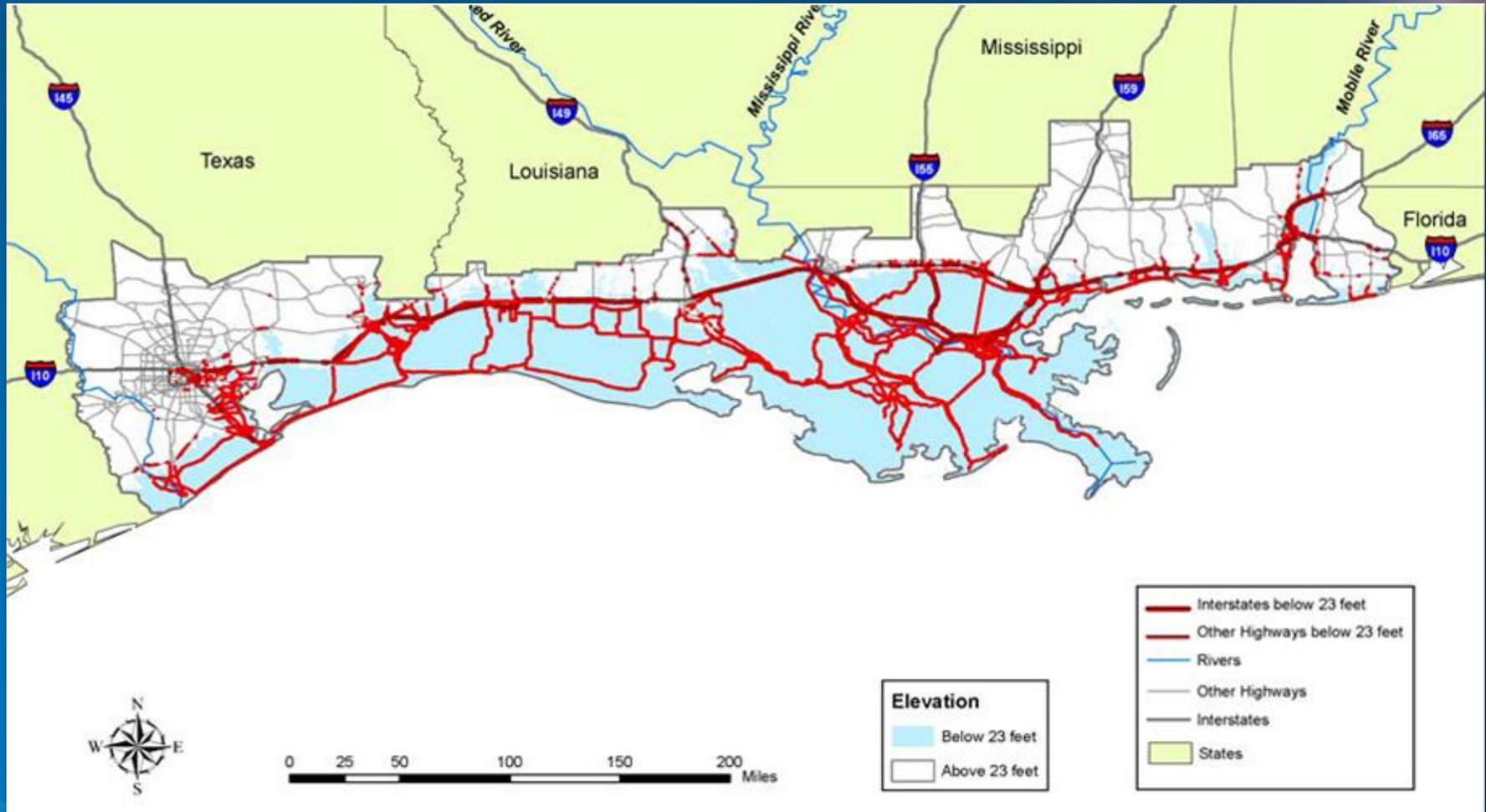
Source: Cambridge Systematics, Inc. analysis of climate projections and U.S. Army Corps of Engineers data, Gulf Coast Study Phase I.

54% of Rail Terminals and 41% of Rail Mileage Potentially Vulnerable to Increased Storm Surge



Source: Cambridge Systematics, Inc. analysis of climate projections and Federal Railroad Administration data, Gulf Coast Study Phase I.

64% of Interstate Highway Mileage Potentially Vulnerable to Increased Storm Surge



Source: Cambridge Systematics, Inc. analysis of climate projections and Federal Highway Administration data, Gulf Coast Study Phase I.

Three Climate Challenges for MTS Planners

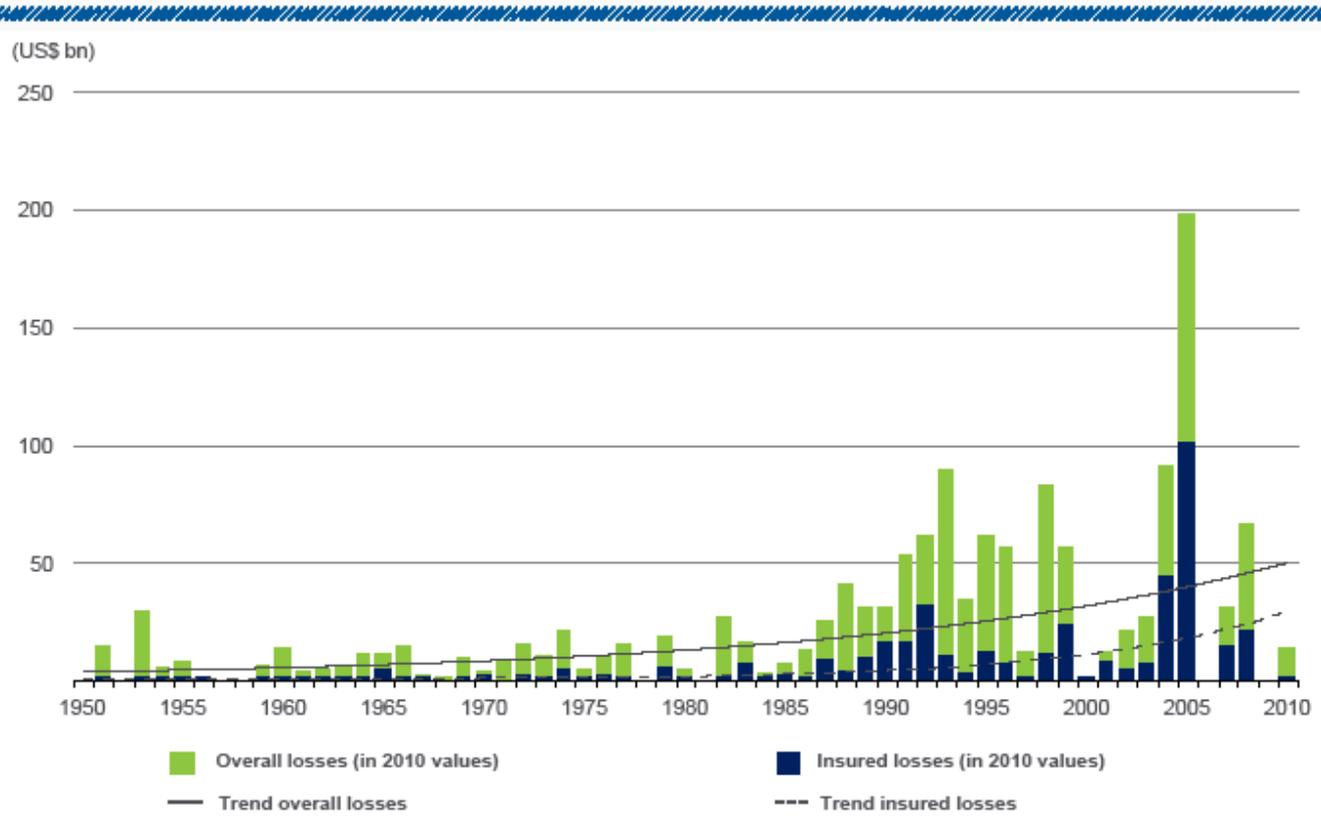
“Don’t Wait for 2050, the Risk is Now”

NatCatSERVICE

Great weather catastrophes worldwide 1950 – 2010



Overall and insured losses with trend



© 2011 Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatSERVICE – As at January 2011

Source: <http://www.munichre.com/en/reinsurance/business/non-life/georisks/natcatservice/default.aspx>.

How do MTS Planners Meet the Challenges?

- MTS planning is not coordinated
 - » The MTS is a collection of interdependent – but independent – seaports, railroads, logistics, and service providers
 - » Hundreds of local, regional, and state governments are business partners in the MTS and in competition with each other
 - » Regulatory and funding authority is spread over dozens of Federal agencies and hundreds of state agencies
 - » No master plan, no empowered master planner
- Individual ports and their host regions are taking independent steps to address climate change and variability, based on their own perceptions of risk

MTS Response Strategies

	Existing Terminals	New Terminals
Protection	<p>Wetlands restoration</p> <p>Shoreline enhancement and land preservation</p> <p>Dike and seawall construction/upgrades</p>	
Resistance and Resiliency	<p>Marine Terminal life-cycle upgrades (higher elevations, stronger buildings, protected storage, increased stormwater capacity, stronger pavement, flood tolerant, easily repaired)</p> <p>Maintenance dredging</p> <p>Highway/rail network life-cycle upgrades (higher elevations, resistant designs)</p>	<p>Locate in lower-risk areas, to the extent practical</p> <p>Build to higher standards</p>

MTS Response Strategies (continued)

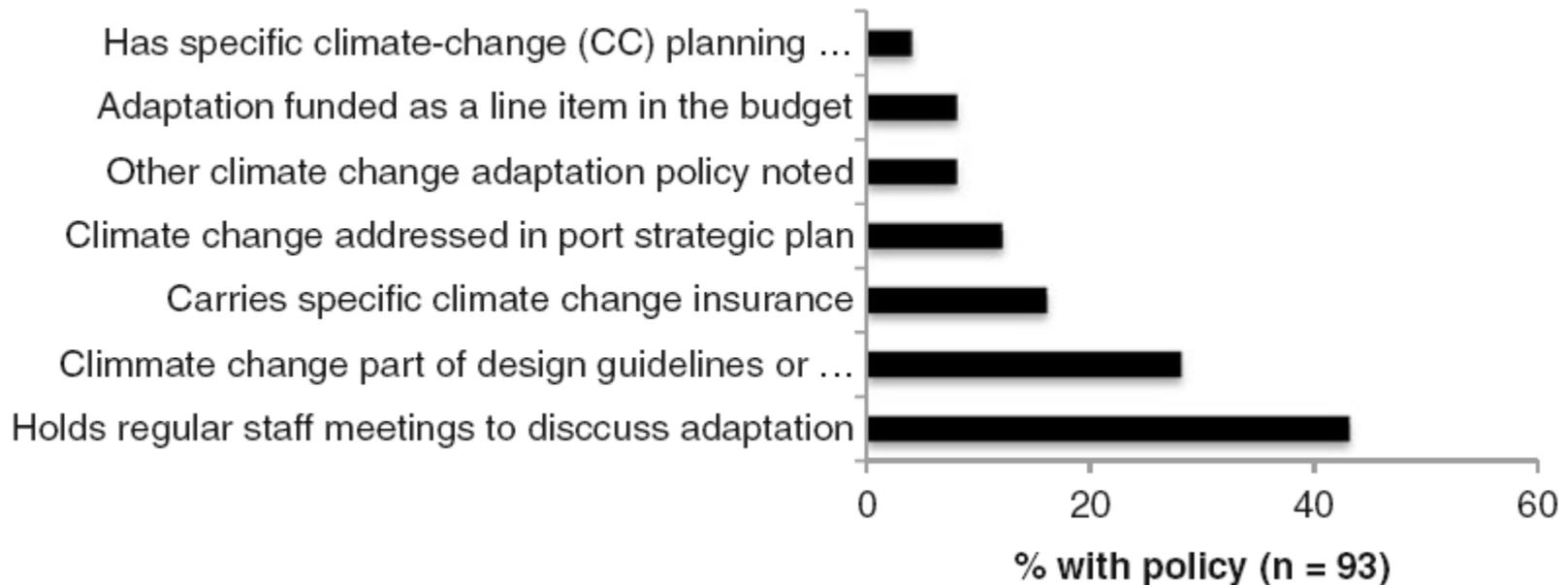
	Existing Terminals	New Terminals
System Management	<p>Where practical, relocate functions that are not water-dependent to lower-risk areas (empty containers and chassis, value-added processing, long-term storage, maintenance, and repair)</p> <p>For ports and states with multiple facilities today, or the possibility of multiple facilities tomorrow, focus investments on lower-risk assets and shift operations away from higher-risk assets</p> <p>Increased coordination and partnership between MTS stakeholders</p>	
Impact Management	<p>“Green Port” strategies to manage emissions and other impacts</p>	
Information and Coordination	<p>Develop information to support consistent risk assessment, best practice responses, and necessary partnerships between ports, their host regions, DOTs, railroads, and other stakeholders</p>	

What Are Ports Doing Today? (continued)

Survey of 93 Ports by Stanford University, AAPA, and IAPH

Not Many Respondents Have Established Strong Adaptation Policies

Climate adaptation policies in place



Source: Austin Becker, Satoshi Inoue, Martin Fischer, Ben Schwegler. *Climate Change Impacts on International Seaports: Knowledge, Perceptions, and Planning Efforts Among Port Administrators*. Springer Science and Business Media, January 31, 2011.

Conclusions

- How the MTS responds to climate challenges will impact the U.S. and global economies and the lives of millions
- Ports, regions, and researchers must demonstrate leadership in education and best practices
- Timely to consider whether current MTS planning practices are adequate for the challenge at hand, or whether new planning approaches are called for

Thank You!

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