The 2014 Public Policy Forum
THE URBAN OCEAN
Port Cities Preparing for Changing Oceans

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Climate change adaptation for ports and port cities: A research agenda

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Consortium for Ocean Leadership Council -- Public Forum on the Urban Ocean
3-12-2014
Overview

1. Ports cities and the climate change challenge

2. Setting the table for adaptation research

3. Research Agenda
   a) Vulnerability assessments
   b) Risk indices
   c) The leadership vacuum
2100
Ports: Critical, complex, constrained

Critical - Economic engines at every scale

Complex – Multiple stakeholders across space and time

Constrained - Dependent on specific and environmentally-sensitive locations

(Asariotis and Benamara 2012; Notteboon and Winkelmans 2003; EPA 2011; AAPA 2013)
Climate change challenges

- Doubling of Cat 4 and 5 tropical storms
- 1-in-100 year storm event of today
- Sea levels to rise 0.7 – 1.9 meters by 2100
- 1-in-3 year storm event of 2100
  - Inland flooding

(Bender et al. 2010; Grinsted et al. 2013; Rahmstorf 2010; Emanuel 2013; IPCC 2012; Tebaldi et al. 2012)
Cascading consequences for port cities

1) Direct damages
   (e.g., structures, equipment, freight, land, etc.)

2) Indirect costs
   (e.g., lost wages, business interruptions, cleanup costs)

3) Intangible consequences
   (e.g., quality of life, environmental damages, loss of essential services)

(IPCC 2012)
Ports concerned, but little action thus far

- Impacts should be addressed by ports: 81%
- Feels informed about climate impacts: 31%
- Has adaptation plan: 4%

(N=93)

(Wecker et al, 2010)
Overview

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ADAPTATION

Process of adjustment to climate and its effects, in order to moderate harm or exploit beneficial opportunities (IPCC 2012).

WHAT CAN WE DO?
Identifier, assess & select strategies

WHAT CAN WE EXPECT?
Identify vulnerabilities

WHAT CAN WE LEARN?
Revise & share lessons learned

Implement strategies

Monitor & evaluate
WHAT CAN WE DO?

- Engineering & design
- Natural & physical sciences
- Social sciences
- Policy
- Stakeholders

WHAT CAN WE EXPECT?

WHAT CAN WE LEARN?
Overview

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3. a) Vulnerability assessments
   b) Risk indices
   c) The leadership vacuum
Setting a research agenda

What can we expect? What can we do?

Case study level vulnerability assessments
Macro-level risk and vulnerability indices
Filling the leadership vacuum
1. Vulnerability assessments

1) GULFPORT, MS
- Container port
- High exposure
- Recent hurricane (Katrina)
- Unique resilience strategy
- 30 stakeholders interviewed

2) PROVIDENCE, RI
- Energy port
- High exposure
- NO recent hurricane
- 27 stakeholders interviewed

Becker, A. et al. (In press).
“Hurricane Ernestine”
99% chance for September 2022

Port of Providence in Cat 3 simulated hurricane
(Surge layer provided by Applied Science Associates)
Stakeholder-based multi-criteria vulnerability assessment

What risk and for whom?
2. Risk/vulnerability indices

- Local sea level rise
- Age of infrastructure
- Local vs. national contribution to GDP
- Sensitivity of ecosystems

Where to spend resilience $???
3. The leadership vacuum

Incentives?

“Leadership???”

Who makes it happen and how?
What can we expect? What can we do?

Engage full stakeholder network in resilience planning

Improve climate projections and risk-assessments

Assess large-scale strategies -- Protect, elevate, or relocate?

Create enabling environment for investment in adaptation

(Becker A, et al 2013)
Construction – 10 years
Permitting & Regulatory Process – 10 years
Engineering & Design – 5 years

Actual working life – >75 years
Project Design Life – 50 years

My career (~35 years)
The rest of my life (~55 years)
My child’s life (~100 years)
My grandchild’s life (~105 years)

Fundamental shift…

I year
5-10 yrs
My career (~35 years)
The rest of my life (~55 years)
My child’s life (~100 years)
My grandchild’s life (~105 years)

1 year
5-10 yrs
My career (~35 years)
The rest of my life (~55 years)
My child’s life (~100 years)
My grandchild’s life (~105 years)

Fundamental shift…

2023
2050
2070
2100
2115
2150

Time

TODAY

Engineering & Design – 5 years
Permitting & Regulatory Process – 10 years
Construction – 10 years

Actual working life – >75 years
Questions?

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Many thanks to the Consortium for Ocean Leadership

Consortium for Ocean Leadership Council -- Public Forum  
on the Urban Ocean  
3-12-2014
Coastal Bases: How the Navy is Preparing for Changing Oceans

Deputy Assistant Secretary of the Navy (Environment)
Donald Schregardus
Overview

- Climate Change Drivers for DoD
  - Executive Orders 13514/13653
  - DoD Climate Change Roadmap

- Key Initiatives
  - Oversight
  - Research
  - Vulnerability Assessments

- Final Message
Executive Orders 13514/13653
(Climate Change-Related Requirements for DoD)

- **EO 13514** - Federal Leadership in Environmental, Energy, and Economic Performance
  - Evaluate agency climate-change risks and vulnerabilities

- **EO 13653** - Preparing the U.S. for the Impacts of Climate Change
  - Remove barriers to increase resilience to climate change
  - Identify opportunities to support climate resilient investments by States, local communities, and tribes
  - Report on progress in Agency Adaptation Plans
  - Inventory/assess required changes to land/water-related policies/programs to make watersheds, natural resources, and ecosystems more resilient
Quadrennial Defense Review (QDR)

- Sets long-term course and re-balances DoD’s strategies, capabilities, and forces to address today’s conflicts and tomorrow’s threats.

- **2010 QDR** – First time DoD formally recognized climate change will impact mission

- **2014 QDR**
  - Employ creative ways to address the impact of climate change
  - Remain ready to operate in a changing environment
  - Complete a comprehensive assessment of all installations
  - Developing new policies, strategies, and plans
DoD’s Climate Change Adaptation Roadmap (CCAR)

- Required by EO 13514 and EO 13653
- 2012/2013 CCARs submitted, 2014 update in progress
- 2014 DRAFT Goals:
  - Identify and assess climate impacts to DoD roles, operations, and mission support capabilities
  - Integrate climate change considerations across the Department and manage risks
  - Collaborate internally and externally on climate change considerations
Key Initiative – Oversight

- **Senior Sustainability Council**
  - Originally established in response to EO 13514
  - Ultimate responsibility for implementing climate change considerations

- **DoD Climate Change Adaptation Workgroup (CCAWG)**
  - All Services plus multiple OSD offices
  - Action Officer level

- **U.S. Navy Task Force Climate Change (TFCC)**
  - Works across program areas – operations, facilities, environmental, etc.
  - Includes Navy representatives to the DoD CCAWG
Key Initiative - Research

- DoD Strategic Environmental Research and Development Program (SERDP)
  - Models and tools for assessing the impacts of sea level rise (SLR) and storm surge on installations
  - Regional studies on understanding impacts in the Southeast, Southwest, Pacific Islands, and Alaska
  - Ecological Forestry and Carbon Management
  - Energy Efficiency and Renewables
  - Participation in the National Climate Assessment

- DoD CCAWG
  - Refining regional scenarios for SLR, in a multi-agency forum, to inform installation vulnerability assessments
Key Initiative – Vulnerability Assessments

- DoD CCAWG
  - Conducting screening-level survey of all coastal/tidal installations to identify current vulnerabilities from six climate change impacts

- U.S. Navy SLR Vulnerability Assessment
  - Uses an approach focusing on infrastructure fragility under a range of SLR scenarios
  - Employs a 3-tiered process based on installation exposure, sensitivity and adaptive capacity to coastal storm surge and SLR
  - Will leverage results from DoD CCAWG survey
Final Message

- Still at beginning stages – “We’ve only just begun”
- Many adaptation measures have been implemented in response to inclement weather
- New policy may be developed, but focus is on integrating climate change considerations into existing policy/programs so they become part of the standard way of doing business
- From an installation perspective, DoD needs a common, government-wide set of criteria/standards to plan towards
- DoD needs to work closely with surrounding communities
Questions?
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While early research efforts have been devoted to the protection (or hardening) of systems against disruptive events, be they malevolent attacks, man-made accidents, or natural disasters, recent attention has been placed on preparedness, response, and recovery \( (PR^2) \) from these events. This is particularly true for the nation's critical infrastructure and key resources (CIKR), as DHS (2009) recently stated that "CIKR resilience may be more important than CIKR hardening."

Resilience research has been an emerging research area for the last decade, though no standard definition or quantitative technique for the paradigm of system resilience has emerged. One approach, illustrated in Fig. 1 as described in Henry and Ramirez-Marquez (2012), describes resilience as the ability to restore a system from disrupted state, \( S_d \), to a stable recovered state, \( S_r \). Resilience is thus defined as the time dependent ratio of recovery over maximum loss in Eq. (1).

\[
a(t) = \frac{\text{Recovery}(t)}{\text{Maximum Loss}(t_d)}
\]  

As a result of disruptive events could occur at locations such as major air transportation facilities such as rail lines and inland ports. Critical infrastructures such as waterways ports and harbors facilitate commodity flows (Khalili, 2009; Simani, 2009). Thus, the same risk of environmental and developed risk of terrorism is present. MacKenzie, Barnes, Conlisk, and West in North America (Rodrique, De Backer, Zeng, 2008). The

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AGENDA

• PROGRESS REVIEW
• WHAT ARE OUR GOALS?
• POTENTIAL PROJECTS
• OUTREACH
• CURRICULUM
• FACULTY & STUDENTS
• FUNDING PLAN
• DISCUSSION & NEXT STEPS
MANAGE
REGIONAL SCALE
NEIGHBORHOOD SCALE
HIGH LINE-RELATED REQUIREMENTS
HIGH LINE ADJACENCY CONTROLS

HIGH LINE FRONTAGE
Open space:
20% of lot area as landscaped open space located up to a height no higher than the HL; one side adjacent to the HL.
ZONING
BUILDING
NEED CONSTRUCTION RENTABLE

WHAT ABOUT MY STREET?
RESILIENCE
The Nature of Urban Design

A New York perspective on resilience

Alexandroos Washburn
2014 Public Policy Forum: The Urban Ocean

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*Questions?*

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