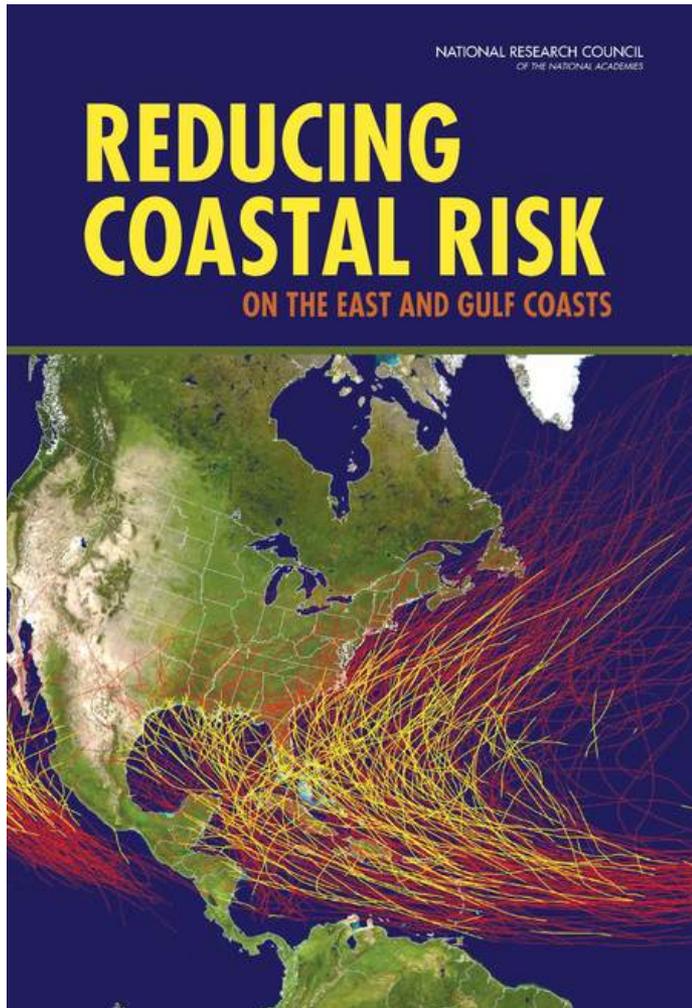


Reducing Coastal Risk

Committee on U.S. Army Corps of Engineers Water Resources Science, Engineering, and Planning:
Coastal Risk Reduction

National Research Council
Rick Luettich, Committee Chair



Committee Membership

- RICHARD LUETTICH, JR.,* Chair, University of North Carolina
- GREGORY BAECHER,* University of Maryland
- SUSAN BELL, University of South Florida
- PHILLIP BERKE,* Texas A&M University
- ROSS COROTIS, University of Colorado
- DANIEL COX, Oregon State University
- ROBERT DALRYMPLE, The Johns Hopkins University
- TONY MACDONALD,* Monmouth University
- KARL NORDSTROM, Rutgers University
- STEPHEN POLASKY, University of Minnesota
- SEAN POWERS, University of South Alabama
- DON RESIO, University of North Florida
- AP VAN DONGEREN, Deltares, The Netherlands

**Participating in webinar*

NRC Staff:

Stephanie Johnson, Deborah Glickson, Anita Hall, Sarah Brennan

Statement of Task

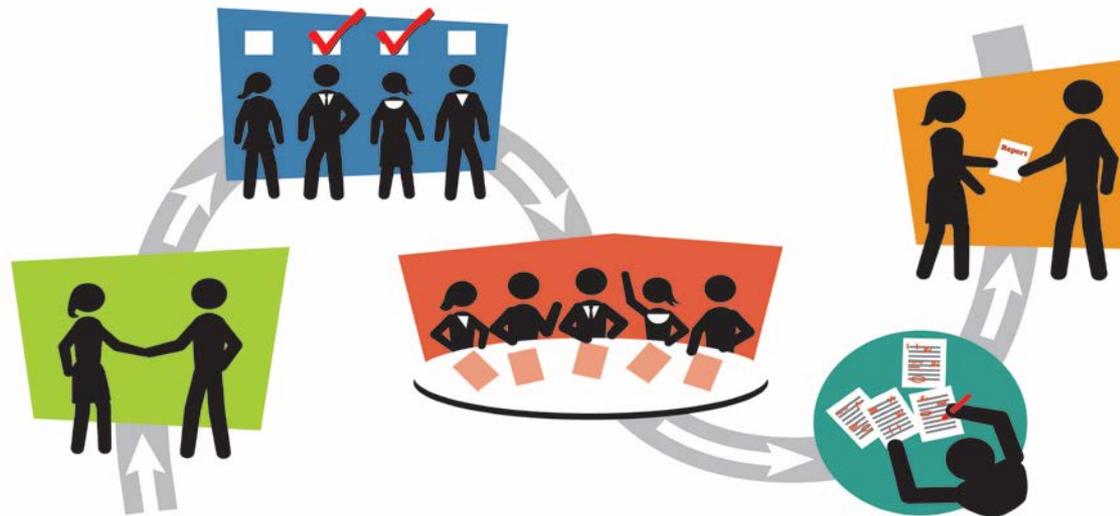
Focus on reducing flood risk from storms along the East and Gulf Coasts:

- To what extent have **coastal risk-reduction** strategies proven **effective** (life safety, economic return)?
- What are the **regional and national implications** of expanded coastal risk reduction?
- How might **risk-related principles** contribute to project design standards and increase community preparedness?
- What **general principles** might be used to guide future U.S. **investments** in coastal risk reduction?

Sponsored by USACE, as the 3rd phase of a 5-year study to provide advice on a range of scientific, engineering, and water resources planning issues

Study Process

- 14 month study
- 5 in-person meetings (DC; Mobile, AL; Newark, NJ)
- Briefings from federal and state agencies, Congressional staff, community managers, private sector, academia
- Peer-reviewed consensus report



Study Context

- 8 U.S. cities in global top 20 of estimated average annual losses from coastal storm flooding
- Hurricanes Sandy and Katrina highlighted the nation's vulnerability

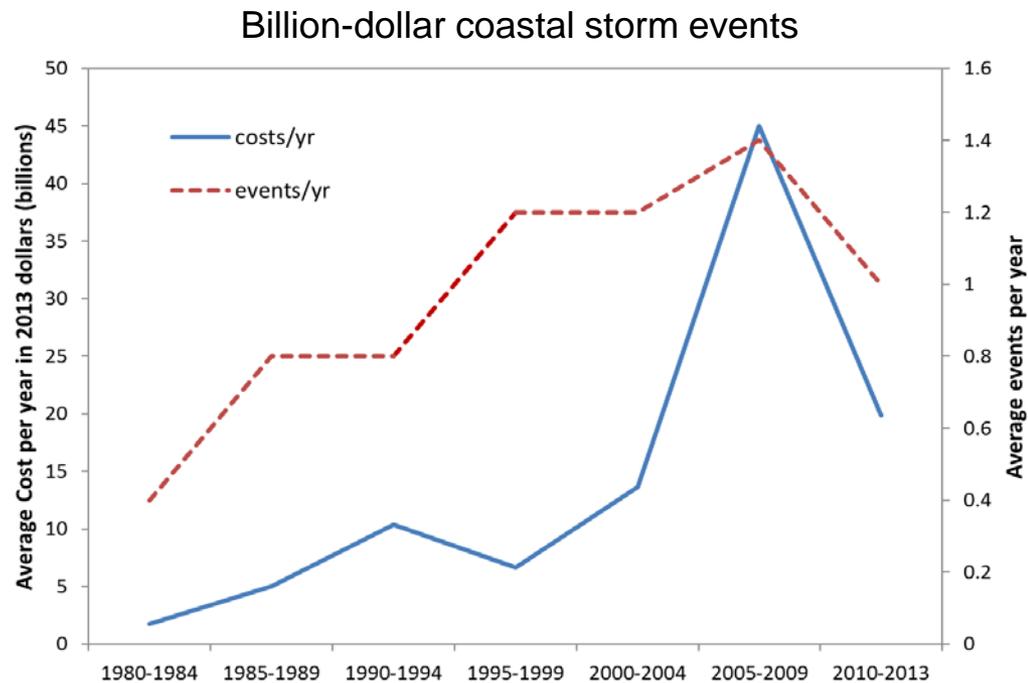


Image source: NASA



Study Context

- Tropical storms and floods comprise ~50% of all natural disaster losses in the U.S.
- Extensive and growing loss from natural disasters
 - increase of people and property in harm's way
 - sea level rise is exacerbating problem
 - additional challenges due to climate change
- Increasing % of damages covered by federal aid



Data source: NOAA

Landscape for Coastal Risk Management

- **No central leadership or unified vision:** Responsibilities spread over multiple levels of government
 - FEMA, USACE, HUD, NOAA, USGS; state, local governments
 - Each driven by different objectives, authorities
 - No coordinating body with singular focus on coastal risk
 - No national priorities



- **Vast majority of funding for coastal risk-related issues is provided only after a disaster occurs**
 - Mostly for response & recovery
 - Small fraction for mitigation

Landscape for Coastal Risk Management

- **Few comprehensive regional evaluations of coastal risk have been performed**
 - Risk reduction efforts tend to be local, not regional
 - USACE is not authorized to address coastal risk at a national scale.
- **Lack of alignment of risk, reward, resources, and responsibility**
 - Resulted in significant **inefficiencies** and **inappropriate incentives** that *increase* the nation's exposure to risk



Image source: NOAA

Risk Reduction Strategies

$$\text{RISK} = \text{HAZARD} \times \text{CONSEQUENCE}$$



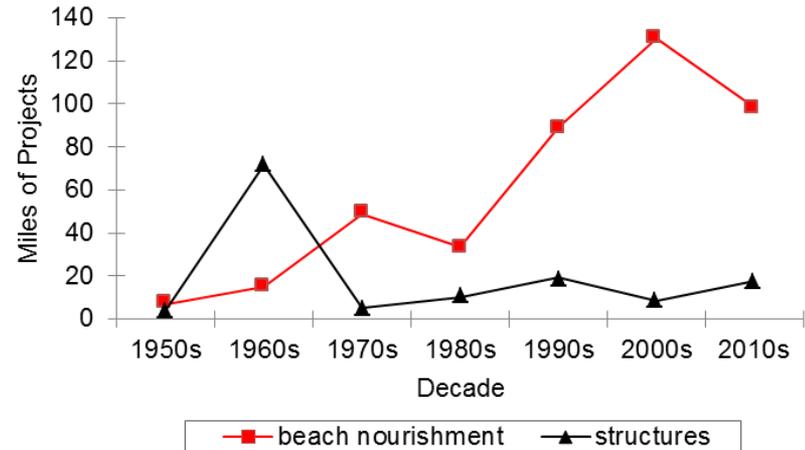
Image sources: N. Aquino, FEMA, committee

- **Reduce the hazard (flooding, wave attack)**
 - Hard structures (seawalls, surge barriers)
 - Nature-based strategies
 - Beach nourishment and dune building
 - Saltmarsh, seagrass, reefs
- **Reduce the consequences**
 - Building elevation and flood proofing
 - Non-structural (e.g., Land-use planning, preparedness, buyouts)

Optimal approaches will be site-specific, may involve multiple strategies

Strategies to Reduce the Hazard: Beach Nourishment and Dune Building

- Short term environmental impacts significant; long-term impacts unknown



Data source: USACE



Image source: NOAA

- Can be designed to reduce short-term impacts and increase ecological value

Strategies to Reduce the Hazard: Other Nature-Based Approaches

Saltmarsh, seagrass, mangroves, coral or oyster reefs, etc.

- **Provides substantial ecological benefits and varying levels of coastal risk reduction**
 - More effective on waves than surge
 - May require large expanses of habitat
 - Continued research needed to quantify effects
- May involve both conservation and restoration activities



Image sources: NOAA

Strategies to Reduce the Hazard: Hard Structures

- **Hard structures are likely to become increasingly important in densely populated urban areas - space is limited for nature-based strategies**
- **Adverse environmental impacts exist, designs can lessen these impacts**

Look for ways to couple hard structures and nature-based strategies

Strategies to Reduce the Consequences

- Includes hazard zoning, building elevation, land purchase, and setbacks
- **High documented benefit-cost ratios (5:1 to 8:1)**
- Given less attention by the federal government
- Other than building elevation, these are viewed as difficult to implement by states

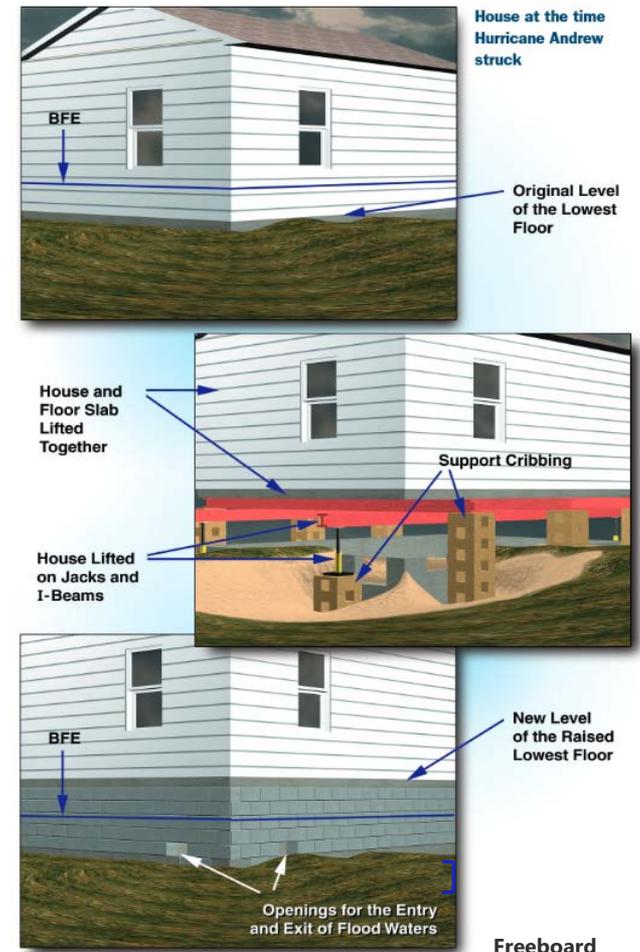


Image source: FEMA

Guiding Investments in Risk Reduction

Two basic approaches for
evaluating investments:

- 1) Risk-standard
- 2) Benefit-cost



- There is **no basis to justify a default 1-percent annual chance (100-year) design level** for coastal risk.
- **Benefit-cost analysis constrained by acceptable risk and social and environmental dimensions** provides a reasonable framework
 - Constraints could include mass casualties or individual risk
 - Costs/benefits that are difficult to measure can also be constraints

Guiding Investments in Risk Reduction

- Capacity to consider life-safety, environmental, social costs and benefits is limited in USACE current decision framework.
 - National Economic Development (NED) given priority
 - Social and environmental benefits rarely influence decision making
 - Life-safety only recently a consideration for dams and levees.
- ***Principles and Requirements for Federal Investments in Water Resources (CEQ, 2013)*** provide an effective framework to account for these other costs and benefits.
 - Improvement upon current planning framework

Guiding Investments in Risk Reduction

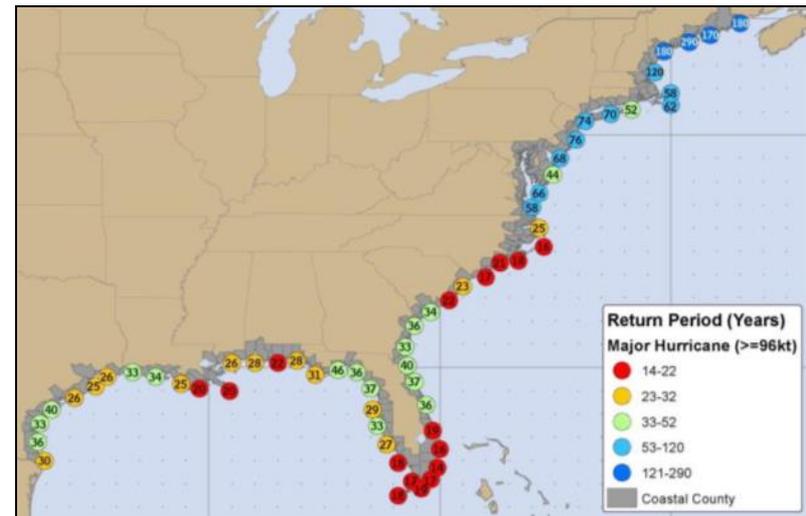
- **CEQ should expedite efforts to complete accompanying guidelines required to implement the *P&R*.**
- **Until then, there are steps USACE could take to improve consideration of multiple benefits and costs.**
 - More quantitative assessment of other costs and benefits, besides NED



Image source: Mass.gov

Vision Toward Coastal Risk Reduction

- **A National Vision for coastal risk management is needed.**
 - Use federal resources to reduce coastal risk vs enabling it to increase
 - Clarify roles and responsibilities of federal, state and local governments for reducing coastal risk
- The federal government should work with states to develop a **national coastal risk assessment**
 - Use this to assess economic, life-safety, social, and environmental costs and benefits under various risk management scenarios



Vision Toward Coastal Risk Reduction

- **Stronger incentives are needed** to improve pre-disaster risk mitigation efforts at the local level
 - Better align risk, rewards, responsibilities
- The USACE should **seize opportunities within its existing authorities** to strengthen coastal risk reduction
 - Evaluate incentives (e.g., cost-share) for sound planning
 - Develop modeling tools
 - Reevaluate 50-yr planning horizon



Image source: Wikipedia

Summary

- ***Coastal risk is increasing***
- Past investments have largely been ***reactive rather than proactive***
- ***Full array of risk reduction strategies*** should be considered
- A ***national vision*** for coastal risk management is needed
- Federal government, states should develop a ***national coastal risk assessment***
- ***Benefit-cost analysis*** (constrained by ***acceptable risk***, social/environmental considerations) is an appropriate decision framework for investments
- ***Stronger incentives*** needed to better align risks, rewards, and responsibilities

More resources:

- Full report at www.nap.edu
- Additional resources under “Related Resources” tab:
 - [4 page report brief](#)
 - Key issues [slide show](#)
 - [Video](#)
- Webinar and slides will be posted at dels.nas.edu

