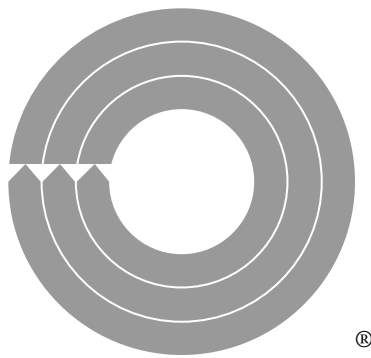


RENEWABLE RESOURCES JOURNAL



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Congress on Coastal Resilience and Risk

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About RNRF

Purposes

The Renewable Natural Resources Foundation (RNRF) is an I.R.C. §501(c) (3) nonprofit, operating foundation, founded in 1972. It is a consortium of scientific, professional, educational, design and engineering organizations whose primary purpose is to advance science, the application of science, and public education in managing and conserving renewable natural resources. RNRF's member organizations recognize that sustaining the Earth's renewable resource base will require a collaborative approach to problem solving by their disciplines and other disciplines representing the biological, physical and social sciences. The foundation fosters interdisciplinary assessments of our renewable resources requirements and advances public policies informed by science.

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RNRF's members are membership-based nonprofit organizations with member-elected leaders. The foundation

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American Geophysical Union

American Meteorological Society

American Society of Civil Engineers

American Society of Landscape Architects

American Water Resources Association

Geological Society of America

Society of Environmental Toxicology and Chemistry

Society of Wood Science and Technology

Universities Council on Water Resources

is governed by a board of directors comprised of a representative from each of its member organizations. Directors also may elect "public interest members" of the board. Individuals may become Associates.

Programs

RNRF conducts national conferences, congressional forums, public-policy briefings and round tables, international outreach activities, and a national awards program.

Renewable Resources Journal

The quarterly journal, first published in 1982, features articles on public policy related to renewable natural resources. It also includes news from member organizations, general announcements, meeting notices, and international conservation news. The journal is provided as a program service to the governing bodies of RNRF member organizations, members of the U.S. Congress and staff of its natural resources- and science-oriented committees.

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Congress on Coastal Resilience and Risk

Presented by

Renewable Natural Resources Foundation

at

National Oceanic and Atmospheric Administration
Center for Weather and Climate Prediction
College Park, Maryland
December 11-12, 2013

Congress Program Committee

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Table of Contents

About RNRF	2
RNRF Member Organizations	2
RNRF Board of Directors	2
Congress Program Committee.....	3
Acknowledgements	5
Introduction	6
Summary of Presentations	8
Coastal Vulnerability and the Need to Act	8
Building Resilience	9
A Systems Approach	11
The Federal Response to Hurricane Sandy.	12
National and Local Policy Imperatives	13
The Netherlands: A Model of Resilience	15
Risk Bias and Insurance	16
The Climate-Resilience Gap	19
Funding Resilience	20
The Role of the Nongovernmental Organization.....	22
Conclusion	24
Appendix A: The Hurricane Sandy Rebuilding Task Force	26
Appendix B: Congress Registrants	29
Appendix C: Congress Program.....	33

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NCEP operations officer, for her help and guidance.

Chair **Tom Chase** and members of the Congress Program Committee provided essential leadership and guidance. Committee members and friends of RNRF who contributed to the meeting's success are listed on page 3.

RNRF Program Director **Melissa Goodwin** performed admirably in working with our committee, speakers, and delegates, and guiding the earnest efforts

of our interns. She managed meeting logistics and contributed to this report as a writer and editor.

Finally, sincere appreciation goes to our highly knowledgeable speakers and delegates who made such an excellent meeting possible. Speakers and delegates are listed in the appendices.

Robert D. Day
Executive Director

Global climate is changing, and this is apparent across the U.S. in a wide range of observations. The climate change of the past 50 years is due primarily to human activities.... Some extreme weather and climate events have increased in recent decades, and there is new and stronger evidence that many of these increases are related to human activities.

Draft National Climate Assessment (2013)

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Editorial Staff: Robert D. Day, editor; Melissa M. Goodwin, assistant editor.

Introduction

Generations of human activity have significantly altered our planet and its atmosphere. Climate change has affected global weather patterns and exacerbated the frequency and intensity of storms. Coastal communities are becoming increasingly vulnerable to these extreme weather events due to rising sea levels, disappearing wetlands, and increasing development.

As the international community works to limit the impending impacts of climate change, more must be done to implement adaptation and mitigation measures needed to protect our coastal communities and economic assets. The coasts of the United States are home to over half of the nation's population and generate nearly half of the nation's domestic product. It is essential that the United States accelerate the national dialogue on the future of our coasts. This dialogue must necessarily occur parallel to debate on federal spending and a re-evaluation of the role of the federal government.

Recognizing an opportunity to contribute to this discussion, directors of the Renewable Natural Resources Foundation (RNRF) called a national *Congress on Coastal Resilience and Risk*.ⁱ The congress brought together a select group of professionals from RNRF member organizations and leaders from government, industry, academia, and nonprofit

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organizations (see Appendix B). Over 160 delegates from 22 states and four countries met December 11-12, 2013, at the National Oceanic and Atmospheric Administration (NOAA) Center for Weather and Climate Prediction in College Park, Maryland. (see Appendix C for a copy of the congress program).

The primary goals of the meeting were to identify critical infrastructure and policies to foster coastal resilience, and to promote an understanding of the new economic and physical environment

Federal funding is minimal and coastal communities lack the resources to effectively mitigate their risks.

in which we live. Delegates had the opportunity to discuss the future of coastal management with leaders in scientific, environmental management, economic and risk assessment fields.

Delegates discussed climate change-driven impacts on the coasts and how to improve the resiliency of coastal communities—both constructed and natural. The meeting featured national and local policy imperatives, means to enhance structural and economic resilience, and the application of smart use and development to achieve a resilient

coast. International experiences and approaches were also examined.

While some progress on resilience had been made since the destructive hurricanes of the 1990s and 2000s, the dialogue on resilience was revitalized by Hurricane Sandy in 2012. The storm made landfall in New Jersey on October 29, 2012. It was the deadliest hurricane to hit the northeastern U.S. coast in 40 years and caused over \$68 billion in damage, making it the third most expensive storm in our nation's history after Hurricanes Katrina (2005) and Andrew (1992). Over 650,000 homes were damaged or destroyed by the storm. Storm surge reached as high as 12.5 feet at Kings Point on the western edge of Long Island Sound in New York. The storm signals the urgency of preparing for climate-driven changes to the coastal environment.

In his introductory remarks, congress program committee chair **Tom Chase** observed that despite increased frequency and extent of damage from natural disasters, there is no common vision of how the nation should organize and coordinate efforts to reduce its coastal risks, including flood risk. He also observed that we lack a sound analysis of the potential risk to the nation from flooding. In 2007, congress called for the president to conduct a national flood vulnerability assessment, however, no funds have been provided by congress to carry out that assessment. Flood risk mapping programs remain underfunded and unable to effectively or accurately

i. PDFs of speaker PowerPoint presentations and materials for further reading are available at www.rnrf.org/2013cong.

communicate to public officials and the public at large the risks that we face.

Our flood infrastructure, primarily dams, levees, coastal dune systems and other coastal defenses, remain in near-failing condition. There is no realistic plan in place to deal with or improve these conditions. Federal funding is minimal and coastal communities lack the resources to effectively mitigate their risks. Efforts to develop innovative funding mechanisms often fall prey to political obstacles.

Climate change and population growth will further exacerbate this already difficult situation. In 2013, the Federal Emergency Management Agency (FEMA) reported that by the end of the 21st century, the 100-year floodplain in the contiguous United States could expand by 45%. Continued development affecting flood prone areas compounds this problem. If something is not done to reduce associated risks, we will pass on a potentially insurmountable challenge to succeeding generations.

Since Hurricane Katrina, the nation has begun to transition away from policies aimed at controlling floods, recognizing that absolute protection against these natural hazards is not possible. Instead, efforts must be focused

The rate of sea level rise in Maryland is twice the national average and three-to-four times faster than the global average.

on identifying risks and developing and implementing a portfolio of approaches to confront these risks when such action is justified and reasonable, i.e., a portfolio of flood risk management strategies.

Despite continuing tension between development and flood risk manage-

ment, limited progress has been made in some communities across the country to reduce flood risk. Awareness by the public has also increased in the aftermath of recent catastrophic flooding events.

Now is the time to accelerate progress and move aggressively to pursue these challenges in flood risk management. We have a choice between proactively minimizing the impacts of potentially life-changing events or reactively recovering from catastrophic events, failing to heed the lessons learned.

Reducing and adapting to climate change impacts are two sides of the same coin; they are linked and equally necessary for smart planning on the coasts and elsewhere. This report primarily addresses adaptation to climate change. Its contents include a synthesis of information and commentary presented by speakers over the course of the two-day meeting. Their presentations are supplemented by insights offered during each subsequent question-and-answer session.

Summary of Presentations

Coastal Vulnerability and the Need to Act

It is essential to examine underlying threats to the nation's coastal communities before exploring the political, economic and technical landscape of coastal resilience. Varying geography, socioeconomics, and infrastructure prevent the presentation of a universal assessment of risk in the United States. Coastal risks and resilience measures are best examined and implemented in a regional context. **Zoe Johnson**, program manager for climate policy and planning in the Maryland Department of Natural Resources Office for a Sustainable Future, provided an overview of threats to the state's coasts and options for pursuing adaptation.

Coastal change planning and mitigation is not a new concept in Maryland. The state has long been conscious of its coastal vulnerabilities and now faces loss of wetlands and agricultural land, extreme erosion, and inundation of coastal areas. The rate of sea level rise in Maryland is twice the national average and three-to-four times faster than the global average.

The two main factors contributing to observed global sea level rise are the warming and subsequent expansion of ocean water (thermal expansion) and the increase of ocean volume due to melting of glacial ice. Regional variations in the rate of sea level rise are affected by factors such as changing ocean currents and subsidence.

The shores of Virginia, Maryland and much of the Mid-Atlantic are experiencing subsidence. This region is just south

of the location of the glacier that was present on the North American continent during the last global ice age. The weight of the glacier caused outlying coastal land to elevate. The retreat and disappearance of the glacier has caused elevated areas to sink to pre-glacial levels. Thus, marshes, agricultural land, and communities are threatened.

Maryland is losing approximately 580 acres each year to shore erosion. Thirteen Chesapeake Bay islands once mapped on nautical charts have disappeared.

Coastal communities are at risk due to rising sea levels, and their differing capacities to improve their resilience is a major challenge.

By 2100, Maryland anticipates between 2 to 6 feet of sea level rise, putting at risk over 400,000 acres of the Eastern Shore. Average temperature will increase by 2 to greater than 8 degrees Celsius. Change in annual precipitation rates will range from a decrease of 10 percent to an increase as high as 20 percent. Spring runoff will be higher and summer runoff will be lower. More extreme weather events pose increased risk and impacts to coastal areas. Storm surge risk is exacerbated by higher sea levels, particularly in the enclosed area of the Chesapeake Bay, which directs

water to Annapolis, Baltimore, and Washington, D.C.

Coastal communities are at risk due to rising sea levels, and their differing capacities to improve their resilience is a major challenge. The ability of coastal communities to adapt and recover is affected by population size, tax revenue, and commercial development. It is essential to confront the challenges of climate change in the context of historic and cultural values and the need for community revitalization. The investment of public dollars in such communities today must take into account the likely impacts of sea level rise in years ahead.

Community assessment tools (scorecards) are valuable tools for local communities to assess their relative risks and disaster preparedness. Many localities do not dedicate sufficient resources to future planning. Decision biases (discussed in Howard Kunreuther's presentation—see page 16) lead to unfortunate outcomes.

Education is needed to promote effective local and national action. The people of the United States must understand the risks faced by coastal communities, and the potential for devastating impacts to the nation's security and economy. Thus, public education is a national responsibility. The behavior of local communities also will benefit from an understanding of inherent regional risks. To this end, Maryland has dedicated significant resources to community education.

Resiliency will be achieved over time using a multifaceted and integrated approach to reducing vulnerability. Es-

sentinal elements of this approach will include land use planning for transportation, shoreline and buffer management, building codes, infrastructure, natural resource management, and emergency and disaster preparedness and response. Such an approach is necessary to maximize the efficacy and efficiency of response and mitigation efforts.

Future investments must be financially wise and structurally sound, incorporating the above-listed elements of resiliency. Maryland's vision for the future strives to protect the state's people, property, natural resources, and public investments in the pursuit of resiliency. It includes:

- Promotion of programs and policies aimed at the avoidance and/or reduction of impact to the existing built environment, as well as to future growth and development in vulnerable coastal areas.
- Shifting to sustainable economies and investments, and avoiding assumption of the financial risk of development and redevelopment in hazardous coastal areas.
- Enhancing preparedness and planning efforts to protect human health, safety and welfare.
- Protecting and restoring Maryland's natural shoreline and its resources, including its tidal wetlands and marshes, vegetated buffers, and Bay Islands that inherently shield Maryland's shoreline and interior.

However, the state faces widespread budget constraints. Maryland has been especially innovative in securing non-state funding to promote coastal resilience. Grants from the National Science Foundation, NOAA, U.S. Environmental Protection Agency (EPA), Town Creek Foundation, and others have been instrumental in the success of coastal resilience investment and education initiatives in the state.

Building Resilience

Policies and practices that promote resilience are essential for the long-term viability of coastal communities. Indirectly, the resilience of coastal communities is also a national and international concern—impacts to coastal infrastructure and economies will have implications worldwide. Further, there is

The problems that we face are known, but we are confronted by a history of ignored recommendations.

great potential for displacement of large coastal populations. U.S. Navy Admiral Samuel J. Locklear III has stated that upheaval related to climate change “is probably the most likely thing that is going to happen... that will cripple the security environment.... You have the real potential here in the not-too-distant future of nations displaced by rising sea level.”¹

Gerald Galloway, the Glenn L. Martin Institute professor of engineering at the University of Maryland College

Park, explored the tools and strategies available to deal with coastal hazards and challenges. The ability to act and react quickly in a community context is essential for the long-term viability of coastal communities.

Galloway asserted that we must act upon recommendations that have already been made. The problems that we face are known, but we are confronted by a history of ignored recommendations. Recommendations in published reports have not been implemented and funding for such implementation has not been forthcoming. Examples of such reports include:

- *Greenhouse Effect and Sea Level Rise: A Challenge for this Generation* (EPA, 1984)
- *Strategies for Adaption to Sea Level Rise* (IPCC, 1990)
- *Sea-Level Rise & Global Climate Change: A Review of Impacts to U.S. Coasts* (Pew Center on Global Climate Change, 2000)
- *Working Group II Report: Impacts, Adaptation and Vulnerability* (IPCC, 2007)
- *Disaster Resilience: A National Imperative* (The National Academies, 2012)

Dr. Gilbert F. White (1911-2006) was a pioneer in the field of flood risk management. He argued that flood protection through storage reservoirs, levees, and channel improvements alone was too narrow a focus for a federal policy. He called for a broader “geographic” approach relying on a mix of “human adjustments” that included but were not limited to engineering works. Among the other adjustments he advocated were land practices and associated watershed measures that could abate flood hazards (what today we would call “natural infrastructure”), restrictions on certain land uses, floodproofing and other structural changes to buildings, warning and evacuation systems, as well as “bearing the loss” in order to realize the benefits of floodplain use. He argued that a mix of human adjustments was needed, noting that “to rely upon engineering works alone is to invite encroachment. To depend upon land use restrictions is to ignore opportunities for optimal use.” This necessarily integrative approach that Dr. White so clearly described can serve us well, in flood risk management and beyond.

- *Holistic Coasts: Adaptive Management of Changing Hazards, Risks, and Ecosystems* (ASFPM Foundation, 2013)

Beyond the unquantifiable costs of injury and the loss of life from disasters, economic damages from natural disasters in the United States continue to grow.ⁱⁱ No person or place is immune to disasters or disaster-related losses. The National Academies have stated that these losses can be reduced through increased attention to resilience. A proactive approach that builds resilience will be more effective at reducing the losses of life, property, and economic productivity than the current approach.

Risk reduction requires commitment to the process of identifying risk, developing and implementing a strategy to deal with that risk, and keeping that strategy up-to-date. Management of risk requires a range of interacting parties including federal, state and local governments; home and business owners; emergency managers; the construction industry; insurers; and markets in general.

The following types of tools are available for these parties to manage and reduce risk.

- *Structural (construction-related)*: Includes levees, dams, adjustable storm surge barriers, floodways, disaster-resistant construction, “smart” building, and well-enforced building codes.
- *Nonstructural (non-construction-related)*: Includes natural defenses, risk mapping, zoning ordinances, economic incentives, hazard forecasting/warning, insurance, and catastrophe bonds.

- *Social and Organizational*: Includes community health systems, public-private partnerships, etc.

Structural solutions (levees, dikes, floodwalls, large-scale hurricane protection systems) are the most common primary response to coastal areas at risk. When these solutions fail or fail to alleviate risk sufficiently, less structural, nature-based, and non-structural solutions are then applied. Galloway stressed that future resiliency efforts should be implemented in the reverse order—exploring buyouts and floodplain restoration and the use of natural protections such as wetlands and dunes, prior to the pursuit of wholly concrete solutions.

“A necessary first step to strengthen the nation’s resilience and provide the leadership to establish a national ‘culture of resilience’ is a full and clear commitment to disaster resilience by the federal government.”

A holistic coasts framework requires use of the above tools and the informed cooperation and involvement of government, private interests, households, and nongovernmental organizations (NGOs). A unified national commitment is needed to address the full range of coastal challenges and incorporate the

players and actions needed to realize that framework.

“A necessary first step to strengthen the nation’s resilience and provide the leadership to establish a national ‘culture of resilience’ is a full and clear commitment to disaster resilience by the federal government.”² Communities and governance structures are complex, dynamic systems. Resilience to disasters requires that these systems be robust and collaborative; every government must have the capacity and wherewithal to recover from disaster. Experience in the disaster management community suggests that linked bottom-up-top-down networks are important for managing risk and increasing resilience. Developing and maintaining community resilience requires identification of specific roles and responsibilities for government at all levels, the private sector, and local stakeholders. People must know the challenges that they are facing.

In this new era of disaster resilience, we must rebuild to new standards, taking into account not only the risks of the past but those of the next century as well. Our current response infrastructure is characterized by a disaster relief cycle. The United States must acclimate to a resiliency state of action. Contingency planning and smart landscape-oriented design of regions, communities, and homes will promote disaster preparedness and resilience.

Better land use planning will drive equitable distribution of disaster relief and resilience funds. While social inequities are unavoidable, social equity and justice should be pursued.

The capacity for resilience begins at the community level and requires community support. Land grant universities including Virginia Tech, University of

ii. Since 1980, the U.S. has experienced 151 weather disasters with damages exceeding \$1 billion each. According to GAO testimony, FEMA has had difficulty implementing plans to assess national preparedness capabilities. The agency’s indicator for determining whether a jurisdiction should receive disaster assistance currently fails to accurately reflect the ability of state and local governments to respond to disasters. Had FEMA adjusted its indicator to reflect inflation and changes in personal income, 25 percent and 44 percent fewer disaster declarations, respectively, would have qualified for public assistance during fiscal years 2004 through 2011.³

Delaware, and University of Maryland are reaching out to communities to help them plan for resilience while developing staff capacity and expertise.

A Systems Approach

The U.S. Army Corps of Engineers (USACE), NOAA, FEMA, The Nature Conservancy, The Conservation Fund, Virginia Institute for Marine Sciences, University of New Orleans, and University of Rhode Island and their partners are developing innovative approaches to coastal landscape transformation. The Systems Approach to Geomorphic Engineering (SAGE)ⁱⁱⁱ advances a comprehensive view of shoreline change, and integrates methodologies that utilize hybrid approaches of green and gray engineering solutions. The SAGE approach looks at the entire coastal system, not just one component, and works to implement hybrid engineering solutions that anticipate changes to the natural environment and provide protection for the coastline.

USACE has adopted a systems approach to reduce coastal risk and improve coastal resilience, encompassing both natural defenses and resilient structures. This dynamic approach to response and mitigation is essential for the changing landscape of coastal risks. **Kathleen White**, senior lead for Global and Climate Change at the USACE Institute for Water Resources, addressed the importance of this approach to risk management.

Climate change will increase pressures on coastal communities in the years ahead, particularly as development continues in increasingly vulnerable areas. We must look at future challenges with a different perspective to find opportunities for creative problem solving. Patterns and solutions of the past are inadequate to predict or address future challenges. Understanding and adapting to projected changes in climate

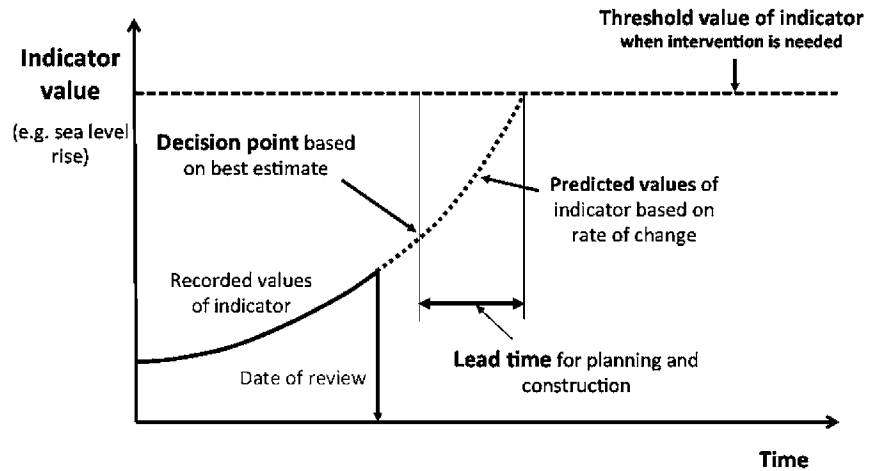


FIGURE 1

requires the assessment of impacts and vulnerabilities, and the development of innovative adaptation measures.

We need to be prepared to provide engineering solutions—in the next 10-20 years and beyond—to enhance human and ecosystem health and resilience to climate and other changes. Natural and

In this new era of disaster resilience, we must rebuild to new standards, taking into account not only the risks of the past but those of the next century as well.

nature-based measures can improve the quality and resilience of economic, ecological, and social systems. Creative and comprehensive approaches incorporate multiple lines of defense, with individual components addressing varying threats. A full portfolio of measures must be incorporated over a range of potential conditions.

The pace and degree of sea level change is a high uncertainty problem with variable risk depending upon location. Modeling multiple scenarios enables development of phased responses that lessen the risk of loss. The use of thresholds in the decision making process allows for consideration of uncertainty and time. (See Figure 1.)

Responding to sea level rise ultimately requires a determination of the value of natural or developed infrastructure and analysis of the comparative benefit of protecting that infrastructure or retreating. Habitat, population density, existing infrastructure (sunk costs), and required proximity to water (e.g., navigation, ports) are all considerations.

Nonstructural and floodproofing measures, including coastal zone management, can have a high return on investment (cost and resiliency) and are a valuable part of a systems approach.⁴

Alternative Financing

Innovative funding strategies and engineering solutions will be needed to confront these problems given inherent uncertainties and economic constraints. Innovative financing of projects can improve the speed and effectiveness of resiliency measures. USACE strives to work within existing authorities to

iii. For more information, visit ccrm.vims.edu/sage.

expand available financing options for infrastructure projects and to learn from the experience of other agencies and the private sector. Additional alternative enabling authorities may provide the best financing solutions for both capitaliza-

tion and recapitalization of critical water resources infrastructure.

Existing authorities to finance infrastructure projects include contributed funds, hydropower marketing agreements and customer direct funding, and permitting the use of government prop-

erty by private interests. New authorities may be needed, including public-private partnerships.

Public-private partnerships require new financing authority. In particular they have been successful in large cities. This financing paradigm alters the traditional distribution of project responsibilities and enables the leveraging of scarce federal resources. General indicators to determine project suitability for public-private partnership financing might include financial feasibility, ability to clearly delineate risks, rights and responsibilities, etc.

The Federal Response to Hurricane Sandy

The federal response to Hurricane Sandy was motivated by an urgent need to better prepare coastal areas to meet future risks including rising sea level, continued development in vulnerable areas, and changes in storm conditions.

Hurricane Sandy and its impact on the eastern coast of the United States, particularly in New York and New Jersey, revitalized the dialogue on coastal resilience. President Barack Obama signed an executive order creating the Hurricane Sandy Rebuilding Task Force

The Hurricane Sandy Rebuilding Task Force developed a set of clear and consistent standards to guide resilient building.

on December 7, 2012. Designed to be in place for less than one year, its purpose was to “ensure that the federal government continues to provide appropriate resources to support affected state, local, and tribal communities to improve the

Natural and Nature-Based Infrastructure (Benefits & Processes)

General coastal risk reduction performance factors: storm intensity, track, and forward speed; surrounding local bathymetry and topography

- Dunes and Beaches—breaking of offshore waves; attenuation of wave energy; slow inland water transfer
- Vegetated Features—breaking of offshore waves; attenuation of wave energy; slow inland water transfer; increased infiltration
- Oyster and Coral Reefs—breaking of offshore waves; attenuation of wave energy; slow inland water transfer
- Barrier Islands—wave attenuation and/or dissipation; sediment stabilization
- Maritime Forests/Shrub Communities—wave attenuation and/or dissipation; shoreline erosion stabilization; soil retention

Nonstructural and Floodproofing Measures (Benefits & Processes)

General coastal risk reduction performance factors: collaboration and shared responsibility framework, wave height, water level, storm duration

- Floodplain Policy and Management—improved and controlled floodplain development; reduced opportunity for damages; improved natural coast environment
- Floodproofing and Impact Reduction—reduced opportunity for damages; increased community resiliency; does not increase flood potential elsewhere
- Relocation—reduced opportunity for damages, does not increase flood potential elsewhere, improved natural coast environment

Structural Measures (Benefits and Processes)

General coastal risk reduction performance factors: storm surge and wave height/period, water level

- Levees—surge and wave attenuation and/or dissipation; reduce flooding; risk reduction for vulnerable areas
- Storm Surge Barriers—surge and wave attenuation; reduced salinity intrusion
- Seawalls and Revetments—reduce flooding; reduce wave overtopping; shoreline stabilization behind structure
- Groins—shoreline stabilization
- Detached Breakwaters – shoreline stabilization behind structure; wave attenuation

From: U.S. Army Corps of Engineers. Coastal Risk Reduction and Resilience: Using the Full Array of Measures. CWTS 2013-3. Washington, D.C.: Directorate of Civil Works, U.S. Army Corps of Engineers. 2013.

region's resilience, health, and prosperity by building for the future."⁵

The Task Force, chaired by Department of Housing and Urban Development (HUD) Secretary Shaun Donovan, coordinated the federal investment of \$60 billion appropriated via the Disaster Relief Appropriations Act of 2013. **Marion McFadden**, senior attorney for disaster recovery at HUD and former acting executive director of the Hurricane Sandy Rebuilding Task Force, presented the task force's Hurricane Sandy Rebuilding Strategy.^{iv}

Hurricane Sandy highlighted the need for regional coordination in infrastructure investment decisions due to the regional impact of natural disasters and the interdependency of local economies.

The mandate of the Hurricane Sandy Rebuilding Task Force was to deliver long-term rebuilding recommendations, signature policy initiatives, a plan for monitoring and providing transparency on how funds are spent, and recommendations on a federal framework for disaster recovery.

Recommendations produced by the task force focused on guiding the Mid-Atlantic region's long-term recovery, with an emphasis on federal actions enabling affected communities to rebuild resiliently and mitigate impacts from future disasters. The main goals included:

- Ensure a regionally coordinated resilient approach to infrastructure investment
- Promote resilient rebuilding based on current and future risk through innovative ideas
- Provide families safe, affordable housing options and protect homeowners
- Support small businesses and revitalize local economies
- Address insurance challenges, understanding, and accessibility
- Build local governments' capacity to plan for long-term rebuilding and prepare for future disasters

In order "to remove obstacles to resilient rebuilding in a manner that addresses existing and future risks and vulnerabilities and promotes the long-term sustainability of communities and ecosystems,"⁶ the Hurricane Sandy Rebuilding Task Force developed a set of clear and consistent standards to guide resilient building. These infrastructure resilience guidelines will promote decisions that better protect communities and ensure wise investment of scarce public resources by setting criteria for investment.⁷ The guidelines include:

1. Comprehensive Analysis (forward-looking and science-based)
2. Transparent and Inclusive Decision Process
3. Regional Resilience
4. Long-Term Efficacy and Fiscal Sustainability
5. Innovative and Environmentally Sustainable Solutions
6. Targeted Financial Incentives
7. Development and Attainment of Resilience Performance Standards

These guidelines are being applied to Hurricane Sandy rebuilding projects and, where feasible, to all infrastructure construction funded with federal dollars.⁸ The task force has initiated a process to ensure that these guidelines will ultimately be integrated into all

relevant agency regulations and program guidance.

Hurricane Sandy highlighted the need for regional coordination in infrastructure investment decisions due to the regional impact of natural disasters and the interdependency of local economies.⁹ The overall goal of adopting a regional approach is to promote better decision-making, create more efficient and effective projects, and to avoid unintended impacts. Adopting a regional approach can eliminate gaps or redundancies in resilience and investment.

Current policies in general do not provide any incentive for coastal or any kind of resilience.

As of the one-year anniversary of Hurricane Sandy on October 29, 2013, the federal government had served nearly 255,000 people and thousands of businesses. Of the Sandy Supplemental Funds, \$12.1 billion had been obligated and \$6 billion outlaid.

National and Local Policy Imperatives

Mary Munson, executive director of the Coastal States Organization, recommended the use of the Coastal Zone Management Act (CZMA) as a major tool to build resilience.

The CZMA was passed by congress in 1972 to promote the "effective management, beneficial use, protection, and development of the coastal zone."¹⁰ It creates an incentivized partnership between the federal government and local communities on coastal planning issues. It establishes a federal role in coastal

iv. See Appendix A for a complete discussion of the Hurricane Sandy Rebuilding Task Force and its recommendations.

management while acknowledging the sovereignty of states in coastal land use planning. If a state develops a coastal management plan that meets federal criteria, that state becomes eligible for an allowance of CZMA funds earmarked for uses in line with stated national priorities.

The CZMA includes language addressing a need for coastal management while fostering economic development. **Margaret Davidson**, acting director of NOAA's Office of Ocean and Coastal Resource Management, indicated that this is a difficult task.^v

The CZMA has been reauthorized or amended eight times since its initial enactment, the most recent of which expired in 1999. Reauthorization has been difficult, in part because stakeholders (namely, participants, use and development interests, and environmental interests) have divergent views concerning possible changes to the current approach to coastal management and which elements of this approach should be emphasized or eliminated.¹¹ Given gridlock on Capitol Hill in recent years, most national policy is politically temporary—administered via executive order.

In the traditional legislative sense, no federal policies for resilience carry the weight or magnitude of the Clean Water Act. Current policies in general do not provide any incentive for coastal or any kind of resilience. The National Flood Insurance Program (NFIP), for example, has not reduced the cost of flooding in the United States; it has actually encouraged people to live in flood-prone areas and to rebuild on the same site.

There are some national programs that encourage coastal resilience. The Silver Jackets Initiative, for example, was USACE's first foray into state and local partnerships. It leveraged joint capabilities and specific geographies to manage risk and enhance response and recovery efforts. FEMA has such groups

as the Mitigation Framework Leadership Group and the Recovery Support Leadership Group.

Davidson proposed that a Natural Disaster Safety Board should be established to investigate our response to natural disasters and use those findings to make our communities and infrastructure more resilient. Similar to the role that the National Transportation Safety Board (NTSB) plays, a national disaster analog would assess what failed in our communities in the wake of a natural disaster. The NTSB provides a tremendous educational value. Establishing a board composed of subject matter experts for natural disasters could help us think about how to make our critical lifelines—infrastructure—more resilient.

*Every \$1 spent on
resilience saves society
an average of \$4.*

Davidson stated that the establishment of a national infrastructure bank would be critical for the nation's continued economic prosperity. Such an infrastructure financing authority would complement existing funding mechanisms and expand overall infrastructure investment, encouraging high-impact growth at a low cost to the government. This discussion has been largely driven by private sector contracting companies. Indeed, given the bipartisan nature of the issue, optimism exists for its establishment. The issue has most recently been adopted in the Senate by a bipartisan coalition supporting the Building and Renewing Infrastructure for Development and Growth in Employment (BRIDGE) Act. The establishment of such a funding mechanism is important for our nation's economic resilience, which in turn is important for our social and community resilience.

Coastal communities contribute nearly 60% of the United States GDP. While resilience is a national issue, most of the country's economic and infrastructure planning takes place at the regional level. Building codes are adopted at a state level but enforced locally. Making communities resilient is challenging because it entails not only building resilient structures, but also forming resilient social networks. Economic resiliency and diversity is important for community resilience. Different regions face different risks and perceive those risks differently. The geomorphology and cultural and political context of individual regions must be understood to take advantage of opportunities for resilience and address regional biases toward risk.

Local capacity building is extremely important because the local level is where return on investment is best appreciated. In 2005, the National Institute of Building Sciences released a study documenting that every \$1 spent on resilience saves society an average of \$4.¹² This economic case for preparedness is well documented. Preparedness is more cost-effective than response and recovery. For example, the New York City Wastewater Resiliency Plan, which evaluated the city's wastewater infrastructure in the context of climate change, found that "investing \$315 million in strategic fortification can safeguard \$1.1 billion of vital infrastructure and save the city \$2.5 billion in emergency response costs over the next 50 years."¹³

In response to rising water levels, the United States needs to start thinking about relocating people, something for which it has very little experience. The future of coastal cities, particularly those that are not politically or economically well situated, is in danger. Should sea level on the outer coasts rise by 3-5 feet in the next 30 years, as is predicted by some models, the relocation of 60 mil-

v. An edited transcript of Margaret Davidson's remarks is available online at www.nnrf.org/2013cong.

lion people will become a very real challenge. Through utilization of emergency supplemental funds or otherwise, cities such as New York, Baltimore, Washington, and perhaps Miami and Hampton Roads, will be saved. Other cities that are less economically or politically significant, or those that will simply cost too much money to save, will be lost to rising water.

A buy-out fund and tax credits should be in place for people who are prepared to leave hazard-prone areas. Encouraging the abandonment of residences in these areas not only reduces the amount and therefore economic value of at-risk property in a given area, but also enables the remediation and restoration of natural defenses.

The Netherlands: A Model of Resilience

The Netherlands is praised as a model nation for coastal resilience. The Dutch have been at the forefront of water-related engineering technology for centuries. To protect their nation from rising sea levels, they dedicated billions of dollars to elevating land and building levees and weirs. In recent decades, the Dutch have embraced the mixing and utilization of both green and grey infrastructure. Current resilience methods embrace elevation and hardening and construction of levees, as well as the remediation and restoration of coastal forest and wetlands. Plans are in place to move people out of at-risk or strategic low-lying areas. Factors in favor of these efforts include a cultural history of adaptation, a homogenous society, and a history of massive public works.

Dale Morris, senior economist at the Royal Netherlands Embassy presented strategies for coastal protection and resilience applied in the Netherlands. Coastal resilience is a foregone conclusion there. Sixty percent of land is at or below sea level. With 70% of the nation's gross domestic product produced at or below sea level, water management

is a matter of national survival. Sea level is expected to increase by 85cm (2.8ft) over the next 100 years in the Netherlands. The international insurance market views the nation's flood risk as uninsurable. Resilience measures to

In response to rising water levels, the United States needs to start thinking about relocating people, something for which it has very little experience. The future of coastal cities, particularly those that are not politically or economically well situated, is in danger.

combat the effects of sea level rise not only guarantee the future of the Netherlands as a sovereign nation, but also

represent an opportunity to continually improve the Dutch people's relationship with their landscape.

Historically, mitigation efforts in the Netherlands focused primarily on reducing flood risk. The Dutch used a combination of hard and soft infrastructure solutions to shorten the coastline, thus concentrating their assets. In 1932, construction of a 32km dam diminished the exposed shoreline of the inland sea Zuiderzee from 300 to 45 kilometers, thus forming the freshwater lake IJsselmeer. Years later in 1953, 750 kilometers of southwestern delta coastline was reduced to 50 kilometers with the construction of strategically placed enclosure dikes. While a technical success, these engineering projects ravaged coastal ecosystems.

Today the Dutch benefit from a strong national commitment to flood protection and accommodation and readily available funds to support such projects. The Dutch government has committed \$1 billion annually to build and maintain water infrastructure.

The Dutch experience a major flooding event every 100 years on average. Risk is calculated as a function of consequences and probability. Cost-benefit analyses are performed for all major infrastructure projects. Unlike in the United States, areas with the most risk

Room for the River

In both 1993 and 1995, the Dutch experienced 300-year floods. Continuing to restrict the river flood plain and continuing to invest in areas immediately behind dikes is unwise. Flood plains in the Netherlands have been severely restricted by development and flow control. Further, continual heightening and reinforcing of dikes is costly and unsustainable and increases overall risk. Dike heightening should be used only as a last resort. The Dutch are transitioning to a model of flood accommodation.

The Room for the River project is a government design plan active from 2006-2015 to address equal goals of flood protection and special quality enhancements around the Rhine, Meuse, Waal, and IJssel rivers. The project will increase the design discharge of the rivers by increasing flow or storing water. Three billion dollars have been dedicated to fund 35 projects dedicated to urban, agricultural/rural, and wetland restoration. The projects are driven by local stakeholders and modeling tools.

are given the highest levels of protection. The safety standard adopted ranges from a 1,250-year storm to a 10,000-year storm.^{vi} In contrast, USACE applies a 100-year storm standard to projects.

Subsidence makes it difficult to manage the water system in the Netherlands in the context of both flood protection and water supply. Historical water management engineering has resulted in an intricate water supply and drainage system throughout the landscape.

Rising sea level will result in increased flood risk in the Netherlands. Increasing population and economic value in coastal zones worldwide cause increased pressures in coastal areas. This challenge and others (more/extreme storms, increased erosion, salt intrusion, more/intense rainfall, spatial developments, subsidence, variable river discharge) are not unique.

The United States also faces these threats, putting significant capital and development at risk. Fifty-five percent of the U.S. population lives within 50 miles of the coastline and coastal counties are home to 39% of the U.S. population. In the 1990s, the United States government spent \$85 billion on hurricane relief.^{14,15} In the 2000s, the nation spent \$288 billion.

A number of coastal resilience projects implemented in the Netherlands are relevant to U.S. coastal needs and challenges. These include Building with Nature (eco-engineering, for example, use of a sand engine for beach nourishment), coastal retrofits (e.g. IJsselmeer dike), river flooding retrofits, and urban retrofits.

Dutch urban flood accommodation techniques are being applied in New Orleans. Restoration of natural land and development of multiple purpose water storage infrastructure (e.g. water gardens) reduce the impact of heavy rain or flooding events while providing urban amenity for the local population.

In planning coastal mitigation projects, over- or under-investment will be very costly. Investments must be planned and managed very carefully and operational and maintenance costs must be taken into account. Short-term decisions in the physical dimension should be looked at in terms of long-term water challenges and infrastructure needs. Spatial reservations in a national land use plan are needed to house and facilitate resilience projects (e.g. future dike enforcements, water storage).

Developed coastal areas can be protected without disrupting commerce or

Understanding how people think is critical to understanding how they make decisions about low probability, high-cost events.

use while improving urban amenity. Landscape architects are valuable resources for combining function with aesthetics in all environments. Simple tools for flood protection can have multiple benefits for multiple stakeholders. Public-private partnerships can help fund and build support for smart land-use initiatives. Communication of risk is critical for community response.

Risk Bias and Insurance

In reducing flood losses from natural disasters, an insurance market can be a highly efficient and effective device for mitigating the consequences of large losses. It can encourage risk mitigation through premium reductions. However, consumers are reluctant to purchase insurance and invest in loss reduction measures from flood-related events.

Developing long-term strategies for encouraging adoption of mitigation measures while providing short-term incentives for undertaking these measures is a challenge. Further complicating the matter is the difficulty in recognizing the biases and simplified decision rules used by consumers in making choices with respect to extreme events. To shed light on this issue, RNRF invited **Howard Kunreuther**, co-director of the Risk Management and Decision Processes Center at the Wharton School of the University of Pennsylvania. He spoke about the present role of affordability and bias in reducing losses from flood-related disasters.

Kunreuther began by emphasizing that we live in a new era of catastrophe. Recent years have seen a radical change in the scale and rhythm of fatalities and destruction from natural disasters. Many victims of natural disasters like hurricanes and earthquakes are uninsured and routinely receive substantially less than the actual cost to repair and rebuild their damaged structures. To reduce the burden on public sector relief, it is critical that those in harm's way take protective measures in advance of disaster.

Following are several of the costliest natural disasters of the past decade:

- Sichuan Earthquake—China, May 2008
 - 70,000 fatalities and 5 million residents homeless
- Honshu Earthquake—Japan, March 2011
 - Over 10,000 fatalities, 17,000 missing
 - Estimated damage \$138 billion (3% Japanese GDP)
- Hurricane Ivan—Grenada, September 2004
 - \$889 million in damage (365% of GNP)
- Hurricane Katrina—U.S., September 2005
 - 1,836 fatalities
 - \$81 billion in damage
- Hurricane Sandy—U.S., October 2012
 - 285 fatalities
 - \$68 billion in damage

vi. A 1 in 10,000-year weather event in the Netherlands is similar in impact to a 1 in 500-year event in the U.S. Gulf Coast.

Of the 25 most costly insured catastrophes worldwide since 1970, fifteen have occurred in the United States. Eighteen have occurred since 2001. Increased costs are associated with a higher degree of urbanization in at-risk areas, huge increases in the value of property at risk, changes in climate conditions, and sea level rise.

Daniel Kahneman's book, *Thinking Fast and Slow*, links intuitive and deliberative thinking for dealing with extreme weather events. Understanding how people think is critical to understanding how they make decisions about low probability, high-cost events. System 1 (intuitive thinking) operates automatically and quickly with little or no effort. Simple associations including emotional reactions and recent past experience are highlighted. System 2 (deliberative thinking) allocates attention to effortful and intentional mental activities. Individuals undertake trade-offs implicit in cost-benefit analysis and recognize relevant interconnectedness and the need for coordination. This type of thinking promotes focus on long-term strategies for coping with extreme events.

System 1 thinking is very poor for dealing with extreme weather events with which we do not necessarily have prior experience. Intuitive thinking triggers potentially disastrous behavior in this context, namely:

- *Availability bias* – estimating likelihood of a disaster by its salience
- *Threshold models* – failure to take protective measures if the perceived likelihood of disaster is below threshold level of concern
- *Imperfect Information* – misperceives the likelihood of an event occurring and its consequences
- *Myopia* – focus on short-term horizons in comparing upfront costs of protection with expected benefits from loss reduction

Myopia in particular must be overcome, the desire for quick returns on investments. For flood insurance, all of the above-listed biases come into play. Individuals do not generally buy flood insurance before floods. Many homeowners will purchase a flood insurance policy after a flood event and cancel the policy if they do not experience a flood in the following years. In these instances, flood insurance is not perceived as a good investment. Many people do not follow through with coverage even in

Require flood insurance coupled with loans and well-enforced standards to encourage investment in cost-effective loss reduction measures.

areas where flood insurance is required.

To overcome barriers to flood risk mitigation, Kunreuther proposed encouraging long-term thinking with short-term incentives. Require flood insurance coupled with loans and well-enforced standards to encourage investment in cost-effective loss reduction measures. Transparency in terms of both insurance premiums and inherent risk is required to address misperceptions of risk broadly and on an individualized basis. Further, financial incentives are needed to address myopia. Kunreuther advocates the adoption of means-tested vouchers to address affordability issues for those requiring special treatment.

There are several guiding principals for insurance. First, insurance premiums must reflect risk. A nonsubsidized premium signals to individuals the hazards they face and encourages investment

in cost-effective adaptation measures. Second, equity and affordability issues must be addressed. Options include providing vouchers to individuals requiring special treatment and the use of HUD Section 8 Housing Vouchers. Finally, multi-year insurance contracts are needed to address myopia and encourage investment in loss-reduction measures through loans.

In a risk-based insurance market, Kunreuther recommends providing vouchers to homeowners only if they take measures to reduce the risk of future flood losses to their property. These improvements can be financed by low-interest loans offered by the government. Following completion of the work, the property owner's risk, and therefore insurance rates, would decrease significantly.^{vii}

Flood insurance should be tied to individual properties and required in every flood prone area. Better flood maps are important for identifying such properties.

One criticism of the voucher program raised by a subsequent speaker, Lindene Patton of Zurich Insurance Group, is that it does not adequately take into account the increase of exposure over time, including frequency and severity of loss. When tying an insurance policy to a property, you must be able to guarantee that the value of the insurance pool will increase as the value of the asset increases. Inflationary increases must be addressed as well.

Legislation to introduce risk-based insurance premiums has been signed into law. The Biggert-Waters Reform Act of 2012 (Biggert-Waters) calls on FEMA and other agencies to make changes to the NFIP. Key provisions of the legislation will make the program more financially stable and change how Flood Insurance Rate Map updates impact policyholders.¹⁶ This includes a directive to FEMA to redraw outdated

vii. For more information, see Kousky, Carolyn and Howard Kunreuther. "Addressing Affordability in the National Flood Insurance Program." Working Paper #2013-12. December 2013.

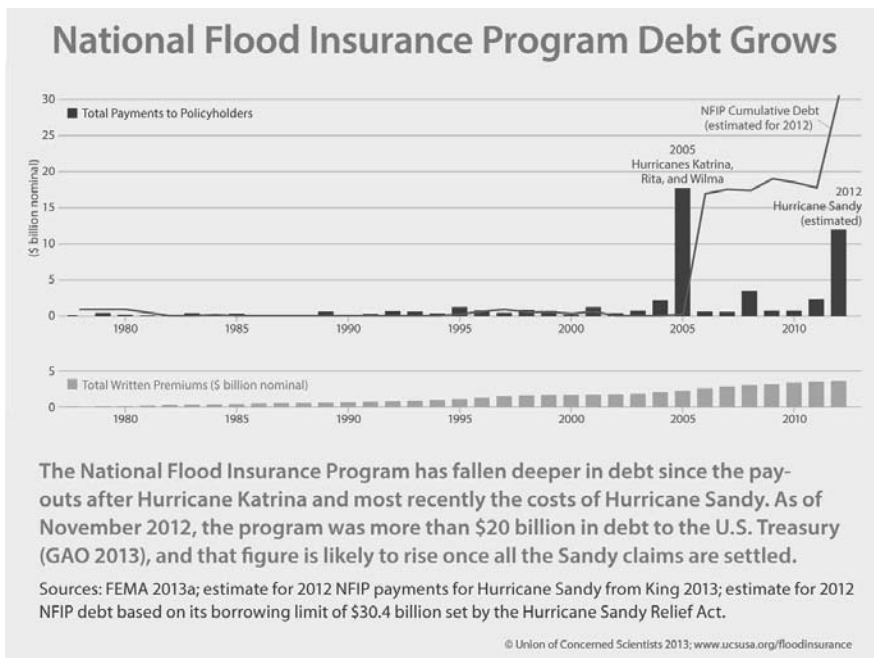


FIGURE 2

floodplain maps. Most importantly, Biggert-Waters requires the NFIP to raise rates to reflect true flood risk for second homes and those that experience repetitive flooding.

When it was initially enacted, Biggert-Waters had bipartisan support. The law curbed a source of rapidly rising government spending and would serve as a reflection of the true cost of climate change. However, following the issu-

ance of insurance bills reflecting new unsubsidized rates, supporters of the law backpedaled. Under the policies of the NFIP, insurance rates in at-risk regions had been suppressed significantly. Absent this control, many citizens residing in floodplains cannot afford to insure their property. The degree of risk assumed has so rapidly outpaced insurance premiums that without government intervention, it is currently impossible

The optimal expenditure on insurance against the risk of natural catastrophe in a given year is the expected loss resulting from natural catastrophes in that year. Subtracting the expected loss as a proportion of GDP for each country from its insurance penetration figures provides an estimate of insurance penetration, after accounting for the optimal insurance against the risks associated with natural catastrophes. This can be represented as:

$$\text{Insurance Penetration (Proportion of GDP)} - \text{Expected Loss (Proportion of GDP)} = \text{Expected Loss Adjusted Insurance Premium}$$

viii. A report by the Government Accountability Office (GAO) addressing flood insurance and private sector involvement was released on January 22, 2014 (GAO-14-127). The report states that “insurers need to be able to charge premium rates that reflect the full estimated risk of potential flood losses...” Delaying implementation of the rate increases required by Biggert-Waters could address affordability concerns, but would also delay addressing the NFIP’s burden on taxpayers. GAO makes no new recommendations in the report, but references a June 2011 report (GAO-11-297) recommending that congress consider eliminating subsidized rates and charge full-risk rates to all policy holders.

for the average person to afford coastal property. As of January 2014, FEMA and the National Academy of Sciences are funding a study to examine these affordability issues.

The 2014 omnibus appropriations bill enacted on January 17 included a one-year delay in rate increases for some newer homes, blocking FEMA’s ability to implement scheduled premium increases.

Legislation to counteract the effects Biggert-Waters has been proposed. The Homeowner Flood Insurance Affordability Act of 2014 was passed in the Senate on January 30, 2014 to delay the increases in flood insurance rates for four years. During this time, FEMA would be directed to make a plan to make premiums cheaper and reassess its flood maps. This bill would effectively gut Biggert-Waters and return the NFIP to a state of insolvency. As of publication of this report, no action has yet been taken on the bill in the House of Representatives.

This congressional action represents an abandonment of risk-based premiums and an elimination of incentives to improve resiliency of coastal properties. It is a regressive move back to a status quo of subsidized development in high-risk areas backed by taxpayers. Regardless of the mechanism, it is critical that we transition to fully risk-based insurance premiums in these regions.^{viii} The voucher system advocated by Kunreuther can be a valuable tool to ease this transition under Biggert-Waters as signed into law.

The NFIP is currently \$24 billion¹⁷ in debt with further deficits projected over time. Over \$527 billion worth of insured assets are located in coastal floodplains.¹⁸

The Climate-Resilience Gap

Lindene Patton, chief climate product officer at Zurich Insurance Group, presented a global insurer's perspective on the challenge of a climate-resilience gap. She described this as a "people problem" rather than a scientific one. Economic and social models are required to reduce the volatility and economic impacts of extreme weather events.

The current state of resilience is unsustainable. We face an increasing series of losses from extreme weather events. These losses are augmented by migration of people to higher hazard areas, increasing asset values, and increasing physical exposure. Currently there are no signs of significant abatement of these variables. Comparative analysis of exposure to natural disaster expenses by the U.S. federal government to expense exposures of social concern reveals that the risk accrued relative to natural disaster impacts is approaching the level of unfunded Social Security System obligations.^{ix} To mitigate damage and costs, we must invest in resilient infrastructure and implement adaptation measures.

There is widespread belief that resilience is primarily an issue in developing markets, thus providing the impression that the climate problem has been "solved" in developed markets. However, failure to update and enforce building codes, failure to manage land use in a way reflective of exposure, and under-appreciated cross-border impacts (among other factors) result in significant resilience issues in developed markets.

The insurance industry has mechanisms to measure the adequacy of insurance. They are used to determine which countries are at greatest risk for economic volatility as a result of extreme weather events. Annual rankings are produced to compare the adequacy

of insurance penetration in every nation. When addressing economic resilience, it is important to determine whether these measurements are comparable in the long run given differences in landmass and population size, particularly in the context of extreme weather events that only impact a localized region.

At a local scale, damage can reach a percentage of GDP, thus affecting the

"A nonsubsidized premium signals to individuals the hazards they face and encourages investment in cost-effective adaptation measures.... [However,] the degree of risk assumed has so rapidly outpaced insurance premiums that without government intervention, it is currently impossible for the average person to afford coastal property."

ability of a local economy to recover and restore in the absence of insurance. When considered on a national basis, impact on GDP from the same event can be negligible. If a national mechanism is in place to divert adequate financial assistance to an affected region in a way that can overcome that percentage im-

pact, then all is well. The reality is that this is not always the case. Insurance is one of the better solutions available to manage this shortfall, but it is not being leveraged enough.

Recent research suggests that it is only the uninsured portion of a disaster loss that tends to lead to permanent macroeconomic losses.¹⁹ There are limits to a government's ability to collect enough taxes after a loss to fund something that happened before. Those limitations become serious following a natural catastrophe. They become very serious if more than one occurs. Figure 3 demonstrates the effect of insured and uninsured losses on GDP in both a single event and in a multi-event scenario.

Politicization of welfare grants results in the creation of moral hazards via government transfer as well as significant costs associated with delayed delivery and expensive distribution. When the purchase of insurance is required, the resulting risk transfer systematically reduces the need for post-event government aid. As a second-best outcome, the requirement for individuals to purchase such insurance could be welfare enhancing.²⁰

If more insurance is not deployed, we are likely to see more litigation. Following extreme weather events, inadequate insurance requirements can result in losses that private property owners are unwilling to accept. This is particularly true in instances where all required protections were in place. Already, mass tort litigation is coming out of severe weather events both in the United States and internationally. Zurich is currently tracking developments in 126 out of 160 jurisdictions in which it operates. These include tort liability and civil action cases.^x

Insurance is the most economically efficient and effective way to provide resilience to society. Climate risk science is not enough to incentivize changes in

ix. See Cummins, J. David, Michael Suher, and George Zanjani. "Federal Financial Exposure to Natural Catastrophe Risk." 2010.

The role of risk transfer

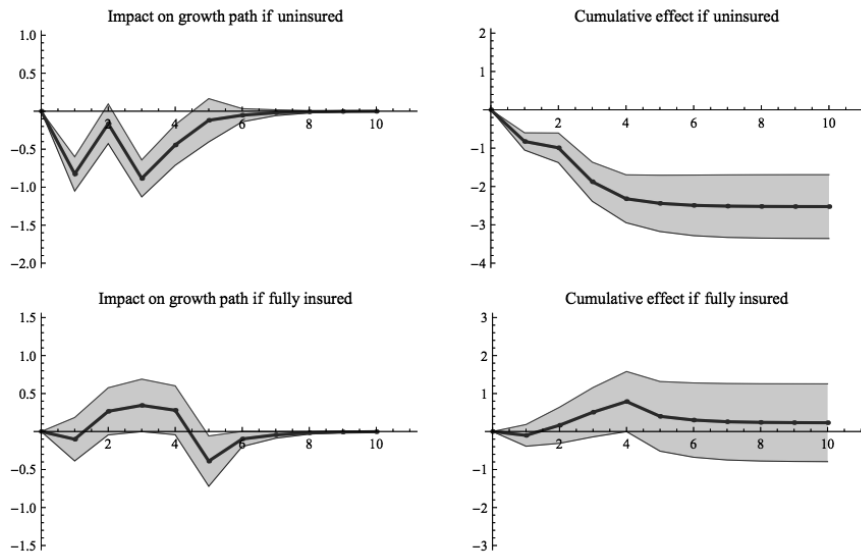


FIGURE 3: *The impulse response function traces out the path of GDP growth over time. The upper panels simulate the growth response to a completely uninsured event of severity equal to the mean size of uninsured losses in the sample. The lower panels simulate a hypothetical fully (100%) insured event of severity equal to the mean size of insured losses. (von Peter. 2012.)*

behavior and public policy. Fear has limitations as a driver of change, particularly if more immediate risks are competing for attention and are easily understood. In the years ahead, insurance will drive the change that we lack the political will to accomplish.

The insurance industry has identified many risks but has only one unified recommendation: risk based pricing. A nonsubsidized premium reveals the degree of risk a customer faces and encourages investment in cost-effective adaptation measures. However, resiliency and exposures are so far out of economic balance that risk based pricing is often unaffordable. Many other solutions identified by the insurance industry are not in its control, including updated building codes and land use policy. More public-private partnerships are needed to facilitate the sharing of such

information and implement these solutions. The sharing of expertise reduces economic risk.

The insurance industry has identified many risks but has only one unified recommendation: risk based pricing.

Calling for risk-based premiums is not enough. Unless affordability (an economic science issue) is addressed, no solution to the climate resilience gap will be reached. The development of economic models to assess economic

resilience and resilience investment strategies represents a tremendous research opportunity.

The Department of Homeland Security is currently working on implementation of a new program, Resilience Star. Resilience Star would operate similar to Energy Star for the differentiation of assets in terms of their resilience quality, ultimately enabling differentiation of mortgages. In terms of asset value and economic derivative value, this would likely have a greater long-term value than reduction of insurance premiums.

Increasing concentrations of exposure in coastal areas must be considered more closely. Insurance can be used as a tool to insert resilience through “betterment endorsements,” balancing demand with resilience. Disaster planning for on-the-ground response to flood events must be proactively addressed by government and disaster relief agencies.

While the frequency and severity of climate-driven natural disasters is increasing, the percentage of insured damage is decreasing. These uninsured losses drive subsequent macroeconomic cost, while sufficiently insured events are inconsequential in terms of foregone output. At the same time, high potential risks are becoming wholly uninsurable. This current state of resilience is not sustainable. Investment in resilient infrastructure and implementation of adaptation measures are required to mitigate damage and costs.

Funding Resilience

Howard Marlowe, chairman of Alden Street Consulting, LLC spoke about how resiliency projects will be funded. His talk included discussion of federal financing trends, the effects of sequestration and congressional gridlock, and the opportunities presented by those challenges.

x. For more information on issues surrounding current and emerging legal aspects, see Carroll, Christina M. et al. “Climate Change and Insurance” published by the American Bar Association in November 2012.

USACE's budget has been decreasing in real dollars since as early as 2003. The current level of federal investment in infrastructure is insufficient to sustain operability. In 2013, USACE's budget was less than \$5 billion, an inadequate amount to maintain and invest in infrastructure in a nation of our size. At a minimum, USACE faces a \$1 billion annual shortfall to maintain infrastructure at a minimally acceptable level. At least an additional \$1 billion shortfall precludes additional planning and construction. USACE's national database of authorized studies and projects along the coast predicts an average annual cost of \$1.8 billion for fiscal years 2013-2017.

It is critical that the nation make use of the scarce money available for water infrastructure projects. Two immediate policy alternatives are 1) reducing USACE operating costs by embracing a systems approach and extending the value of a dollar or 2) increasing funds for water resources via alternative financing.

Best practices cannot possibly be maximized by the project-by-project approach currently being applied. A strength and an opportunity available in regional resilience planning is approaching related projects as a system rather than individual tasks. Project scopes often cross political lines and can have impacts on one another. Ecological, social and economic initiatives are transboundary and must be treated as such. Regional sediment management is one area where much stands to be gained from a systems approach.

Such projects require interagency cooperation and the consolidation of regulatory requirements including environmental stipulations and permitting. Streamlining this process without endangering the environment can be done. Federal and state agencies must be able to share information with one another. The incorporation of stakeholders is critical.

The policies and practices of the Office of Management and Budget (OMB)

discourage regional approaches to project implementation. OMB collects data for projects authorized by congress, assesses the availability of resources and what resources are endangered, and prioritizes them accordingly. As such, OMB maintains control of USACE projects and recommendations. This prevents USACE from freely adopting a regional approach to project financing and implementation.

Funds can be leveraged from alternate sources to federal appropriations. Financing policy alternatives include

*At a minimum, USACE
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at a minimally
acceptable level.*

value capture and public private partnerships. Value capture can be used to help finance projects by leveraging savings from reduced insurance premiums and capturing the subsequent rise in real estate tax revenue from increased property values. In other words, positive externalities of public investment in resilient infrastructure are internalized via tax revenue.

The success of public-private partnerships is dependent upon the interest of private investors in investing in the coast. Private sector involvement in public projects can provide needed capital, management expertise, and flexibility.

The benefits of private investment in the coast are readily apparent. Privatization of port management and operations, for example, can allow private entities to cut operating costs and save money while freeing up the USACE budget for application elsewhere. Careful due diligence is required, however, as

privatization can erode accountability and transparency. Another tool is asset allocation. As a proviso for receiving a community's approval for a seemingly unrelated project, a private entity is required to execute or fund a coastal resiliency project.

There are impediments to such policy change. The organizational culture of governance is problematic; districts and divisions are reluctant to relinquish power. Further, congressional mandates are not forthcoming.

New partnerships are essential. A regional alliance of coastal states dedicated to best practices for that area is required. While individual states may manage their coasts differently, they must understand and act on the fact that they have common interests. Actions within one state have transboundary consequences, both beneficial and otherwise. Involvement in a regional alliance is essential to increase the effectiveness of programs and save money while doing so. Local governments, USACE, federal and state resource agencies, private for-profit interests, and the NGO community all must be involved.

The establishment of a regional alliance will promote smart use and development to achieve a resilient coast through the implementation of regional-ity and alternative financing. Regional alliances facilitate the exchange of information. They require a center of regional expertise (physical or virtual) to serve as a clearinghouse for information. The alliance must be able to influence the budgeting process. Adequate long-term funding and participation by governing bodies and private interests within the region will be critical for its long-term success.^{xi}

Developing the details of a regional systems approach would be the responsibility of an alliance for that particular region. Another responsibility is the advocacy of water resources policies at the federal and state levels. Alternative financing will be the cornerstone of such an alliance's operation. The

establishment of regional alliances will enable parties to manage the coasts in a more responsible way than the historical norm.

The adoption of a regional alliance model for coastal management is the closest we will be able to come to the Dutch model of resilience in the United States given our existing political infrastructure. On a regional scale, needs and risks are homogenous to the point where the political will to enact large-scale coastal management decisions is readily available.

If we don't act, the vulnerability of our coastal communities and risk to people, property, and environmental resources will only increase. The deliberate and informed use of funds is essential for sustained coastal resilience.

The Role of the Nongovernmental Organization

Action by the federal government to promote coastal resilience is necessary for long-term success. Meanwhile, independent groups including academic institutions, the private sector, and NGOs can work together to improve the resilience of target areas through a variety of means. **Jim Blackburn**, professor of civil engineering at Rice University and co-director of the University's Severe Storm Prediction, Education, and Evacuation from Disasters (SSPEED) Center presented the role NGOs can play in coastal risk mitigation.

A basic model embraced by the SSPEED Center is a landscape-scale non-structural concept. The Center is working to utilize natural land formations to protect the Houston ship channel, which houses the largest

concentration of refining and chemical plants in the United States. SSPEED is developing partnerships to promote the establishment of a non-structural buffer zone along the Texas Gulf coast.

Green space solutions offer tremendous opportunity for coastal infrastructure. Natural land formations are very important for the protection of inland

A strength and an opportunity available in regional resilience planning is approaching related projects as a system rather than individual tasks.... While individual states may manage their coasts differently, they must realize, understand, and act on the fact that they have common interests.

resources from storm surge; wetlands and prairies have excellent flood storage potential.

Constraints inherent in this region and others throughout the country include the absence of federal regulations to promote resiliency, prevalence of private property, and a lack of federal funds. In

response, Blackburn and partners postulated the establishment of a resilient economy based upon use, appreciation, and protection of natural systems as an alternative to development in low-lying land of Galveston Bay. In other words, leveraging the economy as a non-structural alternative to protect of resources.

Two solutions emerged: 1) the proposed Lone Star Coastal National Recreation Area (LSCNRA) and 2) a Natural Resource Value Trading Concept. LSCNRA is a proposal to create a unit of the National Park System by partnership agreement involving low-lying land along the Texas Gulf coast. This region has tremendous unrealized economic potential in its capacity for outdoor recreational pursuits including fishing, hiking, bird watching, coastal kayaking, etc. To capitalize on this potential, a national park concept has emerged, wherein a national park unit is created out of an amalgam of properties, few, if any, of which are owned by the National Park Service at the time of the creation of the national park.

The proposed administration of the LSCNRA will be the National Park Service in cooperation with all of the participating landowners. LSCNRA will be reliant on a network partnership governance concept governed by a partnership agreement established between federal, state, and local governments, NGOs, and private landowners. It is an agreement to operate a park system together. NGOs have taken a leadership role in pursuing this proposal.

NGOs have long been proponents and advocates of various projects and initiatives seeking to conserve natural resources. They are transitioning into a new role where they formulate and act

xi. A regional alliance is not a new concept. The Delaware River Basin Commission (DRBC) was established in 1961 to regulate the interstate river system and function as regional governing body. Each signatory of the DRBC (Delaware, New Jersey, Pennsylvania, New York, and the federal government) is responsible for a fair-share portion of the commission's operating budget. Contributions by the federal government to the DRBC's operating budget ceased in 1996. The cumulative federal shortfall from October 1996 to June 30, 2012 totaled \$9,994,250. The four states continue to support the DRBC, but contributions have dwindled due to budget pressures. A regional alliance for coastal resilience must have safeguards to prevent the funding difficulties that plague this existing commission.²¹

on alternate ways of addressing issues of concern. Approximately 25% of the property of interest for the proposed LSCNRA is already owned by individual, unaffiliated NGOs.

The second economic development concept developed by the SSPEED Center is a natural resource value trading

[NGOs] are transitioning into a new role where they formulate and act on alternate ways of addressing issues of concern.

system. Its basic principle is the marketability of the value of natural resources as a commodity in the private market. Such a system would function as a second economic engine to the proposed LSCNRA, complementing outdoor and historic recreational tourism.

The valuation of ecosystem services in coastal regions can be a useful tool in the prevention of development in ecologically sensitive areas, the restoration and preservation of natural defenses, and the establishment of a nature-based economy.

Changing corporate attitudes can be leveraged. Companies value a “zero footprint” label in marketing materials, a claim that requires offsets. Increased ecological services created by landowners in the coastal buffer zone can be sold to such companies needing to offset water use, ecological impact, carbon footprint, etc. There is also a philanthropic and gift market for ecological services. This type of innovation can be developed for the benefit of this and other coastal regions.

To take advantage of these opportunities, a trading platform, the Lone Star Coastal Exchange (LSCE) is being developed. The exchange will offer the opportunity to purchase offsets within identified areas with sellers offering various service units verified and guaranteed on a contractual basis. Marketable services include:

- Flood storage,
- Conservation of existing habitat,
- Neo-tropical migrant habitat creation,
- Coastal wetland creation/migration,
- Migratory waterfowl habitat creation,
- Prairie habitat creation,
- Carbon sequestration, and
- Endangered species habitat.

NGOs have a unique ability to establish and facilitate an ecological services trading system. Such organizations are essential to the implementation of

creative and sustainable resilient land use initiatives, including non-structural surge damage reduction concepts such as the LSCNRA. As an alternative to government intervention and with the

“The valuation of ecosystem services in coastal regions can be a useful tool in the prevention of development in ecologically sensitive areas, the restoration and preservation of natural defenses, and the establishment of a nature-based economy.”

absence of public funds, NGOs have the expertise and ability needed to leverage market trends to accomplish the goals of ecological restoration and the safeguarding of important natural resources.

Conclusion

The changing economic and physical environments of our nation's coastal regions necessitate a comprehensive reevaluation of our approach to coastal management. The magnitude of accrued risk of coastal structures and resources to natural disaster impacts is massive. It is essential that we formulate and implement resiliency policies and practices as soon as possible.

The information in this report is not new but the message has never been more urgent. Coastal resiliency has been studied extensively over the years and several reports have been prepared that contain excellent recommendations regarding coastal infrastructure and policies. However, these recommendations have not been implemented. It remains to be seen whether or not the most recent calls for action by initiatives like Hurricane Sandy Rebuilding Task Force will have an impact.

Achieving coastal resilience is a technical business. Federal and state legislative representatives who are determined to provide leadership will need to become students of the options and tradeoffs. Advocates of state resiliency programs should be prepared to seek funding from federal, state and private entities.

Resiliency is best approached on a regional scale but an unequivocal commitment by the federal government is an absolute requirement. Federal agencies including USACE, NOAA, and USGS will have a significant role to play in this undertaking. Establishing political momentum and leveraging scarce resources

will be a challenge. Local communities that will be most affected must step up and demand attention by political figures. Our elected officials will not lead us toward resiliency if we do not push them.

The insurance industry has identified many risks but has only one unified recommendation: risk-based pricing for hazard insurance. However, the cost of resiliency measures and the value of coastal resources at risk are sufficiently large that the cost of risk-based insurance will be unaffordable for many property owners.

Updated building codes and reality-based land use policies are necessary early actions. More public-private partnerships are needed to facilitate the sharing of such information and to implement these solutions. The sharing of knowledge and expertise can reduce economic risk.

The United States cannot immediately transition to an action plan based upon risk-based insurance. Too many people would be financially devastated because historically subsidized insurance rates have enabled them to live in at-risk areas. On the other hand, the nation must come to terms with the unsustainable accrual of liability through federal guarantees, perpetuated by unwise coastal development policies. There must be a period of transition to accommodate a necessary change of policy. Thought leaders are proposing excellent ideas, including a transition supported by limited-term insurance vouchers (variably subsidized) tied to

variously supported requirements of resiliency improvements for structures.

Current legislation in congress embodies a full retreat from adopting a risk-based insurance model for the NFIP. Rather than postponing action, congress should adopt a plan for beginning the transitioning of the NFIP to a sustainable model. Meanwhile, there is much that individuals, communities, and states can do to lessen their coastal risks. Action by NGOs and the leveraging of public-private partnerships will be critical in accomplishing this goal.

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Appendix A: The Hurricane Sandy Rebuilding Task Force

Hurricane Sandy and its impact on the eastern coast of the United States, particularly in New York and New Jersey, revitalized the dialogue on coastal resilience. President Barack Obama signed an executive order creating the Hurricane Sandy Rebuilding Task Force on December 7, 2012. Designed to be in place for less than one year, its purpose was to “ensure that the federal government continues to provide appropriate resources to support affected state, local, and tribal communities to improve the region’s resilience, health, and prosperity by building for the future.”¹

The task force, chaired by Department of Housing and Urban Development (HUD) Secretary Shaun Donovan, coordinated the federal investment of \$60 billion passed by congress primarily for the region impacted by Hurricane Sandy. The Disaster Relief Appropriations Act of 2013 (also known as the Sandy Supplemental Bill) directed funds to 19 federal agencies, the majority of recovery funds directed to HUD, Department of Transportation, Department of Homeland Security/FEMA, and USACE.

The mandate of the task force was to deliver long-term rebuilding recommendations, signature policy initiatives, a plan for monitoring and providing transparency on how funds are spent, and recommendations on a federal framework for disaster recovery. In assembling the recommendations, the task force received input from various agencies, and state, tribal and locally elected officials from the affected areas.

Before the release of the final strategy document, the task force also briefed more than 500 external stakeholders interested and invested in the rebuilding strategy, which resulted in 48 statements of support.

The Strategy

The recommendations produced by the task force focused on guiding the region’s long-term recovery, with an emphasis on federal actions enabling the affected regions to rebuild resiliently and mitigate impacts from future disasters. The task force set forth recommendations that fall into three categories: (1) recommendations related to the Sandy supplemental appropriation and its role in the recovery effort in the region; (2) recommendations related to the recovery effort in the region that is not tied to the supplemental appropriation but will have an impact on the recovery moving forward; and (3) recommendations related to the region’s recovery efforts from future storms that have national policy implications.

The task force presented a total of 69 recommendations.² An overview of the task force’s main goals and recommendations to achieve those goals are as follows:

Ensure a regionally coordinated resilient approach to infrastructure investment by:

- Providing a forum to coordinate and discuss large-scale, regional infrastructure projects and map the connections and interdependencies between them, saving money and getting better results for all levels of government.
- Establishing guidelines to ensure those projects are situated and built to withstand the impacts of existing risks and future climate change, in the region, and across the country.
- Making the electrical grid smarter and more flexible, and protecting the liquid fuel supply chain to better prepare for future storms and other threats.
- Helping to develop a resilient power strategy for telephone and internet communication systems and equipment, so that our ability to communicate when it’s most necessary is less vulnerable to disaster.
- Assessing the performance and full value of green infrastructure and using natural approaches to addressing the impacts of climate change in our coastal communities.

Promote resilient rebuilding based on current and future risk through innovative ideas by:

- Giving governments and residents the best available data and information on current and future risks to facilitate good decision making for recovery and planning—for example by creating and making widely available a Sea Level Rise planning tool.

- Leveraging the Rebuild By Design competition to deliver innovative, resilient rebuilding ideas to the Sandy-impacted region.
- Prioritizing the engagement of vulnerable populations on issues of risk and resilience.

Provide families safe, affordable housing options and protect homeowners by:

- Helping affected families to stay in their homes by allowing homeowners to make emergency repairs quickly.
- Foreclosure moratoria: Preventing responsible homeowners from being forced out of their homes due to short-term financial hardship while recovering from disaster by creating nationally-consistent mortgage policies.
- Making housing units—both individual and multi-family—more sustainable and resilient through smart recovery steps including elevating above flood risk and increased energy efficiency.
- Communicating to state, tribal and local governments, residents, and workers consistent guidance on how to remediate indoor environmental pollutants such as mold.

Support small businesses and revitalize local economies by:

- Making it easier for small businesses to access federal contracts for Hurricane Sandy rebuilding.
- Creating specialized skills training programs in the areas needed most for Sandy rebuilding including opportunities for low-income individuals and other vulnerable populations.
- Developing a one-stop shop online for everything related to small businesses and recovery
- Improving the process for accessing critical disaster recovery loans and other resources and increasing SBA's unsecured disaster loan limits and expediting the disbursement of small dollar loans.

Address insurance challenges, understanding, and accessibility by:

- Encouraging homeowners and other policy-holders to take steps to mitigate future risks, such as elevating their homes and businesses above flood levels, which will not only protect against the next storm but also make their flood insurance premiums more affordable.
- Streamlining payouts to homeowners and other policy holders in the wake of a disaster.
- Examining ways to address affordability challenges posed by congressionally mandated reforms to the National Flood Insurance Program (aka the Biggert-Waters reform).
Build local governments' capacity to plan for long-term rebuilding and prepare for future disasters by:
 - Supporting regional planning efforts underway in New York and New Jersey to create and implement locally created and federally funded strategies for rebuilding and strengthening their communities against future extreme weather.
 - Funding Local Disaster Recovery Manager positions in communities in the Sandy-impacted region and taking additional steps to prepare for future disasters.

Infrastructure Resilience Guidelines

In order "to remove obstacles to resilient rebuilding in a manner that addresses existing and future risks and vulnerabilities and promotes the long-term sustainability of communities and ecosystems,"³ the Hurricane Sandy Rebuilding Task Force developed a set of clear and consistent standards to guide resilient building. These infrastructure resilience guidelines, developed by an interagency working group, will bring about decisions that better protect communities and ensure wise investment of scarce public resources by setting

criteria for investment.⁴ The guidelines are as follows:

1. Comprehensive Analysis (forward-looking and science-based)
2. Transparent and Inclusive Decision Process
3. Regional Resilience
4. Long-Term Efficacy and Fiscal Sustainability
5. Innovative and Environmentally Sustainable Solutions
6. Targeted Financial Incentives
7. Development and Attainment of Resilience Performance Standards

The guidelines are being applied to Sandy rebuilding projects and, where feasible, to all infrastructure construction utilizing federal funding.⁵ The task force has initiated a process to ensure that they will ultimately be integrated into all relevant agency regulations and program guidance.

Regional Coordination of Infrastructure Projects

Hurricane Sandy highlighted the need for regional coordination in infrastructure investment decisions due to the regional impact of natural disasters and the interdependency of local economies.⁶ The overall goal of adopting a regional approach is to promote better decision-making, create more efficient and effective projects, and to avoid unintended impacts. Adopting a regional approach can eliminate gaps or redundancies in resilience and investment.

Expedited Federal Review and Permitting

An estimated \$20-30 billion of the Sandy Supplemental Funds will be allocated to infrastructure projects, all of which are likely to require some form of permitting or federal review. The review process can take anywhere from two weeks to four years, substantially increasing cost. In order to accelerate the review process for Sandy rebuild-

ing projects, a Steering Committee, established by Executive Order 13604, is guiding the effort to establish an expedited and unified interagency review process for disasters, as of July 29, 2014.⁷

Building off of the success of the Steering Committee, the task force also established a Sandy Regional Infrastructure Team, which is responsible for facilitating early and ongoing coordination, prompt identification and resolution of issues, and alignment of Federal and state processes where appropriate.⁸ The efforts of the Steering Committee and the Sandy Regional Infrastructure Team will ensure that the review and permitting process of complex Sandy rebuilding projects are carried out as quickly and efficiently as possible.

Rebuild by Design

As part of its effort to promote resilient rebuilding through innovative ideas, the Hurricane Sandy Rebuilding Task Force launched the Rebuild by Design competition, which invites the world's most talented design professionals to envision solutions that will increase resilience across the Sandy-affected region. The task force has been working closely with state and local jurisdictions and philanthropic organizations to develop this process. Philanthropies,

led by the Rockefeller Foundation and the NJ Community Foundation, have donated more than \$5 million in cash and in-kind services.

The design competition centers on four focus areas:

- Coastal communities
- High-density urban environments
- Ecological and water body networks
- A catchall "other areas" category

Unlike traditional design competitions, in which the participants propose solutions to a problem presented by the competition host, the Rebuild by Design competition is unique in that the host has already identified the desired outcomes, e.g. reduced risk, innovation, etc. The competition received an influx of proposals; 148 teams from 15 countries submitted designs, and ultimately 10 teams were selected to advance in the competition. The winning designs may be implemented with disaster recovery grants or other types of public or private funding. Rebuild by Design is currently in its third of four stages.⁹

The Strategy Roll Out and Progress to Date

The rollout of the Hurricane Sandy Rebuilding Strategy has received bipartisan support and statements of support from public officials, NGOs, think tanks, advocacy groups, academic institutions, and philanthropic organizations.

On September 30th, 2013 the task force was wound down. However a succession plan was established to ensure that the 69 strategy recommendations it set forth will be carried out by the Administration and appropriate agencies.

As of the one-year anniversary of Hurricane Sandy on October 29, 2013, the federal government has served nearly 255,000 people and thousands of businesses. Of the Sandy Supplemental Funds, \$12.1 billion has been obligated and \$6 billion outlaid.

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Appendix B: Congress Registrants

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	Carolyn Tilney Policy Intern Renewable Natural Resources Foundation Bethesda, MD			Robert Zepp Assistant Supervisor, Chesapeake Bay Field Office U.S. Fish & Wildlife Service Annapolis, MD

Appendix C: Congress Program

Wednesday, December 11

8:00 am – 9:00 am Registration and Continental Breakfast

9:00 am – 9:10 am Welcome and Opening Remarks

Howard Rosen

RNRF Chairman

Former President, Society of Wood Science and Technology

Silver Spring, Maryland

9:10 am – 9:30 am Congress Context and Goals

Tom Chase

Chair, RNRF 2013 Congress Program Committee

Director, Coasts, Oceans, Ports & Rivers Institute

American Society of Civil Engineers

Reston, Virginia

What is Coastal Resilience?

Using Coastal Planning and Management to Advance Coastal Resilience.

9:30 am – 10:00 am Threats to our Coasts: Climate Change-Driven Sea Level Rise and Extreme Weather Events: An Illustration of Coastal Vulnerability and Why We Need to Act.

Zoe Johnson

Program Manager for Climate Policy and Planning, Office for a Sustainable Future,

Maryland Department of Natural Resources

Annapolis, Maryland

10:00 am – 10:30 am Discussion / Questions

10:30 am – 11:30 am RNRF Awards Presentation

Howard Rosen

RNRF Chairman

Excellence in Journalism Award

Dirty, Sacred Rivers: Confronting South Asia's Water Crisis by Cheryl Colopy

Outstanding Achievement Award

Chasing Ice, directed by Jeff Orlowski

Sustained Achievement Award

Al Gore

- 11:45 am – 12:15 pm What Resilience Means to Coastal Communities in the Face of Climate Change. Best Management Practices to Manage and Enhance Community, Economic, and Coastal Resilience.
- Gerald Galloway**
Glenn L. Martin Institute Professor of Engineering,
Department of Civil and Environmental Engineering, University of Maryland,
College Park, Maryland
- 12:15 pm – 12:45 pm Discussion / Questions
- 1:30 pm – 2:00pm The Hurricane Sandy Rebuilding Strategy. How the federal government is working to ensure resilience and mitigation in recovery from Hurricane Sandy.
- Marion McFadden**
Senior Attorney for Disaster Recovery,
U.S. Department of Housing and Urban Development and Former Acting Executive Director,
Hurricane Sandy Rebuilding Task Force
Washington, D.C.
- 2:00pm – 2:30 pm Discussion / Questions
- 2:30pm – 3:00 pm A Systems Approach Encompassing Natural Defenses and Resilient Structures: Innovative Funding Strategies
- Kathleen White**
Senior Lead for Global and Climate Change
Institute for Water Resources, U.S. Army Corps of Engineers
Washington, D.C.
- 3:00 pm – 3:30 pm Discussion / Questions
- 3:30 pm – 4:00 pm National and Local Policy Imperatives. What are current national policies? Are these policies wise or effective? What policies should states and local communities implement with regard to the coasts? What is the role of the federal government?
- Margaret Davidson**
Acting Director, Office of Ocean and Coastal Resource Management, NOAA
Silver Spring, Maryland
- 4:00 pm – 4:30 pm Discussion / Questions
- 7:30 pm Film Screening: Shored Up
A documentary about coastal communities and sea level rise Featuring discussion and Q&A with director Ben Kalina, Open to the university community and the public
H.J. Patterson Hall, University of Maryland College Park

Thursday, December 12, 2013

Promoting Resilient Coastal Practices in an Unsettled Environment

- 9:00 am – 9:30 am The Necessity of Risk-Based Management and Incentivized Risk Reduction. Development in disaster-prone coastal areas has not been driven by adequate knowledge of risk. A discussion of the changing landscape of coastal investment and development.
- Howard Kunreuther**
Co-Director, Wharton Risk Management and Decision Processes Center,
University of Pennsylvania,
Philadelphia, Pennsylvania

9:30 am – 10:00 am Discussion / Questions
10:00 am – 10:30 am The Insurance Industry’s Response to Climate Change Impacts and Its Role in the Transition of Coastal Communities and Economies Toward a Resilient State.
Lindene Patton
Chief Climate Product Officer, Zurich Financial Services
Washington, D.C.

10:30 am – 11:00 am Discussion / Questions
11:00 am – 11:30 pm An international perspective on sea level rise and options available for coastal and urban adaptation.

Dale Morris
Senior Economist, Royal Netherlands Embassy
Co-Director, Dutch Dialogues, Washington, D.C.

11:30 pm – 12:00 pm Discussion / Questions

NGOs, States, Local Communities and Response

12:45 pm – 1:15 pm Economic Realities of the New Post-Recession America and the Future of Coastal Management. The need for new partnerships that promote smart use and development to achieve a resilient coast.

Howard Marlowe
President, Marlowe & Company
Washington, D.C.

1:15 pm – 1:45 pm Discussion / Questions

1:45 pm – 2:15 pm The Role of the NGO. How do you build community, exploit connections, and build excitement? What is the future of the NGO community in the debate on the future of our nation’s coasts?

Jim Blackburn
Partner, Blackburn & Carter
Houston, Texas

2:15 pm – 2:45 pm Discussion / Questions

3:00 pm – 3:30 pm Coastal Zone Management and Community Resilience

Mary Munson
Executive Director, Coastal States Organization
Washington, D.C.

3:30 pm – 4:00 pm Discussion / Questions

4:00 pm – 4:30 pm Congress Wrap Up and Discussion

Robert Day
RNRF Executive Director
Bethesda, Maryland

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