



Holistic Coasts:

Adaptive Management of Changing Hazards, Risks, and Ecosystems

A Summary Report based on the 4th Assembly of the
Gilbert F. White National Flood Policy Forum
Arlington, Virginia
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Our coasts and coastal watersheds are integrally linked to our economy, our environment, and our way of life. They provide food and habitat for flora, fauna, and people. They support our shipping and resource extraction. They help to clean our runoff and air, and they host our recreational activities. Collectively, all of these facets—and more—are the underpinnings of a large segment of our nation's economy and resource base, thus making our coasts and coastal watersheds essential for our future.

Unfortunately, the health and condition of our coasts and coastal watersheds are in jeopardy. Coastal mega-disasters are becoming more prominent due to our growing population and threats of increasing coastal storm strength and frequency. Once productive fisheries can no longer meet demands, due both to environmental degradation and to continued pressures to over-harvest. Further, the industrial uses and ports, which are essential to our economy, lack sufficient resiliency against current and future storms. At the same time, a significant—and growing—number of people are moving into coastal communities.

Coupling these trends with the current threats of climate change and sea level rise makes it clear we are on a path that will weaken our economy and diminish our quality of life.

The Association of State Floodplain Managers Foundation and its corporate, agency, and individual partners hosted a two-day meeting in February 2013 to evaluate our nation's coasts as part of the Foundation's Gilbert F. White Flood Policy Forum series. In attendance were leading industry, academic, and government experts. Represented disciplines included sciences and engineering, planning, banking, real estate and insurance interests, the legal community, and policy makers. And while the ensuing discussions focused on flooding and disasters along our coasts, the resulting recommendations are all inextricably linked to an understanding that the challenges facing our nation's coasts go well beyond disasters to involve our environment and our economy.

The primary recommendation of the Forum, however, was not linked to disasters, the environment, or the economy, but was focused on the current management system. This system is stove-piped to a fault and will not meet the demands imposed on our nation's coasts with a changing climate.

Holistic Coasts is a bold vision—an integrated management approach and philosophy that breaks stove pipes, promotes individual and collective accountability and responsibility, and balances human use, the environment, and the economy into a resilient and sustainable system. Readers of this report will not find all answers regarding how to achieve Holistic Coasts in the following pages, but this report offers a starting point for a vision and partnership that—if successful—will help secure a sustainable future for our nation.



Doug Plasencia
President
ASFPM Foundation



(Credit: aerial views of the damage caused by Hurricane Sandy in Mantoloking, New Jersey, New Jersey Army National Guard, Oct. 30, 2012.)

Introduction

Recent events show our nation's approach to managing coasts is not sustainable

Large populations are living in coastal areas that are exposed to a range of hazards, including coastal flooding.

A significant component of the nation's population now lives in or near areas subject to coastal hazards, and the numbers and appraised value of buildings, residences, and businesses in coastal areas continue to increase.

Growing public and private payouts for poorly sited assets and disaster assistance are combining to contribute to a cycle of increasing costs—regionally and nationally—that is likely to be economically unsustainable at all levels. When coastal storms manifest into major disasters, communities lose valuable tax base, jobs, and private capital. Federal disaster costs are also reaching unprecedented levels.

Also, property owners often resist development constraints and other measures to mitigate hazards, including land use and building restrictions and appropriate levels of insurance protection.

Climate data trends indicate that climate change is a real and current threat.

With increasing evidence of climate changes and accelerating rise in sea levels, it is critical to recognize that our coasts and coastal watersheds are facing increasing threats and impacts from these and a range of other adverse factors.¹

Over the past century, the world's average sea levels have risen approximately 8 inches.² Since 1993, however, the rate of increase has doubled over the long term average.^{3,4} Climate scientists now predict ocean rises of an additional 1 to 4 feet during the coming century—with some scenarios showing as much as 6.6 feet—and ongoing rises into the future.^{5,6} In some coastal areas, due to subsidence and erosion, "relative" sea level rise is much greater than average.^{7,8,9}

Additionally, scientists are predicting more intense and potentially more frequent extreme weather events.^{10,11} Storms may also expand ranges beyond what was previously considered "normal," due in part to effects of warming sea surface temperatures, although future projections of storm frequency, intensity, and tracks continue to be uncertain.

Predicted sea level rise will cause physical changes to the coast.

The anticipated changes in sea levels will have significant physical and biological impacts on our coasts and coastal resources. These impacts will affect dunes and beaches, bays and estuaries, bluffs, reefs, marshes, and mangroves, as well as coastal ecosystems, many of which support critical jobs, industries, and commerce. Additionally, these impacts will present concerns related to erosion and deposition, land inundation, salinity intrusion into freshwater supplies, and fish and wildlife habitats.

At present, several coastal communities are taking sustainable actions to adjust and adapt to these foreseeable changes. In addition, although likely well intentioned, some short-term adaptive measures (such as groins and extensive bulk-heading of shorelines), can exacerbate long-term erosion and ecosystem losses by reducing habitat and limiting natural shoreline migration.

Lastly, new research warns that failure to manage greenhouse gas emissions in the short term may correlate with long-term, more damaging sea level rise in the future.¹²

\$6.6
trillion

Contribution to GDP from coastal shoreline counties, just under half of U.S. GDP in 2011.

Source: NOAA stics.noaa.gov estimates of BEA GDP, 2012¹³

51
million

Total number of jobs in U.S. coastal shoreline counties in 2011.

Source: BLS, 2012¹⁴

\$2.8
trillion

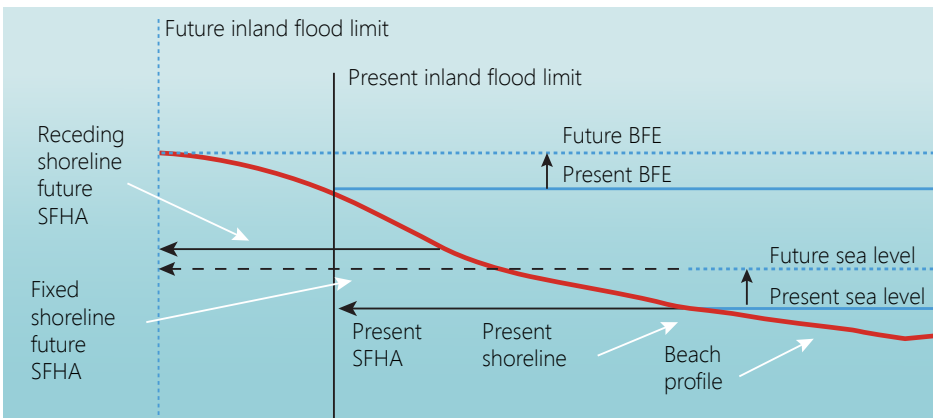
Wages paid out to employees working at establishments in coastal shoreline counties in 2011.

Source: BLS, 2012¹⁵

#3

Global GDP rank in 2011 (behind the U.S. and China) of coastal shoreline counties, if considered an individual country.

Source: BLS, 2012; World Bank, 2012¹⁶



INCREASED FLOOD DEPTH AND ACCELERATED EROSION ARE OUR FUTURE: Sea level rise, eroding and subsiding lands, and more frequent storm events will lead to higher flood depths, more frequent flooding, and accelerated coastal erosion. Unfortunately, current hazard mapping programs and minimum building and zoning standards ignore these risks, thus making future disasters worse. (Credit: adapted from AECOM, et al. 2013.)¹⁷

Current approaches do not sustain coastal ecosystems and dependent human activities.

Many current approaches to managing coasts are failing to sustain coastal ecosystems and the numerous human activities that depend on them. For instance, important fisheries and other industries related to harvesting of shellfish, development of pharmaceuticals, and other extractive activities depend heavily on healthy coastal estuaries.

Over-building, increasing population density, deteriorating water quality, loss of habitat, and overfishing are leading to dangerously low populations of many aquatic species important to these businesses.

Even tourism, the economic lifeblood of many coastal communities, relies on healthy beaches, reef systems, and waters that are suitable for fishing and swimming.

Current approaches are creating tomorrow’s vulnerability for commercial interests.

If we fail today to make necessary adjustments to changing coastal conditions to protect and restore coastal ecosystems and to “make room” for dynamic coastal processes, we create vulnerabilities for our long-term economic and commercial interests.

Businesses disrupted by coastal flood disasters will experience negative impacts related to business facilities, workforces, and customers. Shipping will be disrupted when ports cannot function due to sedimentation, infrastructure breakdown, and disruptions associated with extreme storm events.

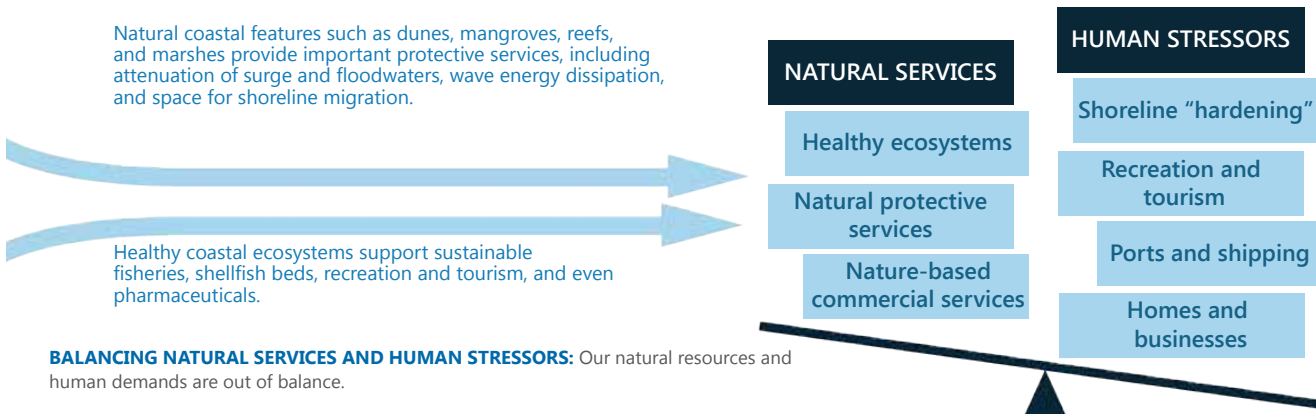
In light of the current and expected coastal changes, there will continue to be a critical need for accurate data and information to help guide wise coastal decisions at all levels, including for governments, businesses and individuals.

SFHAs and BFEs

Two key concepts in the National Flood Insurance Program (NFIP) are Special Flood Hazard Areas (SFHA) and Base Flood Elevations (BFE). SFHAs are high-risk flood areas mapped by FEMA and local communities where flood insurance is mandatory for buildings with federally-backed mortgages. These are areas estimated to have a one percent annual chance of flooding (sometimes called the “100-year flood”), depicted on a Flood Hazard Boundary Map or a Flood Insurance Rate Map.

A BFE is the elevation shown on a Flood Insurance Rate Map that indicates the water surface elevation resulting from a flood with a 1 percent chance of equaling or exceeding that level in any given year. In the NFIP, at a minimum, new buildings in SFHAs must have their first floor elevated at or above the BFE.

With rising sea levels, over time, BFEs also generally rise, and, absent major barriers such as levees or floodwalls, SFHAs will continue to expand landward. Even with flood barriers, a “residual risk” of flooding always exists, in the event a barrier fails to control a flood. Current NFIP flood maps do not yet incorporate future flood risks from climate change, sea level rise or anticipated urbanization.



BALANCING NATURAL SERVICES AND HUMAN STRESSORS: Our natural resources and human demands are out of balance.



Introduction

Resilient and sustainable coasts are achievable

From America’s founding to today, our coasts continue to be among our most critical resources.

Since the nation’s beginnings, our coastal areas have been among the most economically and environmentally productive areas—crucial to our overall success.

The 395 U.S. shoreline counties are home to more than 120 million Americans—more than one-third of the U.S. population (39 percent). These counties support approximately 51 million jobs and more than \$2.8 trillion in annual wages, while producing 45 percent of the nation’s annual gross domestic product.¹⁸

In addition to housing many of the country’s largest urban centers, coastal communities support a wide range of activities, including most of the nation’s fish and shellfish production. They also sustain important agricultural production, serve as major industrial and financial centers and worldwide trade centers for imports and exports, provide critical habitat for wildlife, and offer recreational experiences and beauty that support significant domestic and foreign tourism.

As such, wise management choices are essential to facilitate the ongoing stability, prosperity, and viability of our critically important coastal resources.

A commitment to smart planning and wise land use choices is key.

Despite mounting challenges, our coasts can continue to maintain their high-value productivity if we effectively address vulnerabilities and appropriate land management, while emphasizing long-term sustainability and resiliency. The public’s concern for coastal losses and vulnerability should be channeled toward long-term planning for community resilience and sustainability in today’s changing environments.

Coordinating state, regional, and local actions to better identify and mitigate vulnerabilities will be essential to reduce the costs of current and future natural hazards and flood disasters.

Coastal management challenges require more data and science expertise.

To support effective decision making, state-of-the-art science expertise and data must be acquired and made readily accessible to all levels of government and the private sector. An explosion of new science, technologies, and improved forecasting capabilities is currently being brought to bear to help define risks and to assist governments and individuals in identifying and implementing effective solutions.

With the proper information and support, the public, communities, and businesses have shown their ability to effect the necessary adjustments in spatial planning, resource management, and hazard mitigation.



COASTAL ISSUES IN THE NEWS: Coastal management issues and their urgency are growing concerns for communities, states, and the nation.



SAND DUNES ARE OUR FIRST LINE OF DEFENSE AGAINST COASTAL STORMS AND BEACH EROSION: Unlike most terrestrial systems, coastal dune systems often naturally move over the landscape. Healthy dune and beach systems can provide an important first line of defense against coastal storms and beach erosion, absorbing and reducing energy of storm waves and helping to maintain recreational beach areas.

We must set the course to promote wise coastal management into the future.

The importance of our nation's coasts demands that we address physical and ecological concerns. With thoughtful, science-based planning and improved coordination at all levels, we can make essential adjustments in policies and practices to reduce costs and strengthen the resiliency of our communities and our coastal environments into the 21st century.

Future goals should include resilient and sustainable rebuilding after disasters.

In the wake of past disasters, community reconstruction efforts have too often failed to consider and incorporate adjustments for natural hazards, thus leading to repeat losses in subsequent storms. This has been true for individual and business properties, as well as basic community infrastructure, such as water and energy utilities, schools and public buildings, health care and transportation facilities, and other basic facilities and functions.

Additionally, poorly sited and un-protected critical facilities present follow-on concerns when emergency operations centers, police and fire stations, and evacuation centers become inaccessible or inoperable when they are most needed—during and immediately following a disaster.

Increasingly, however, communities are implementing risk reduction strategies to dramatically reduce their losses in subsequent events. Comprehensive and well-integrated hazard mitigation and recovery plans must be implemented to assure that post-disaster reconstruction efforts make communities more resilient and sustainable for the future.

In the wake of Hurricane Sandy, the Administration, working through the Sandy Rebuilding Task Force, provided resources to rebuild the affected area to be more resilient than before, including support for more climate-resilient roads and infrastructure, and projects that protect drinking water and buffer communities from flooding. Three key outcomes of that effort to date include:

- National Oceanic and Atmospheric Administration (NOAA) and its partners developed the "Sea Level Rise and Coastal Flooding Impact Viewer."
- NOAA and the U.S. Army Corps of Engineers (USACE) developed the Infrastructure Systems Rebuilding Principles to promote a unified strategy for federal activities in restoring the coast; and
- The Sandy Rebuilding Task Force issued the first ever minimum flood risk reduction standard, requiring Sandy supplemental appropriations be invested utilizing best-available-data for elevation plus one foot or more of freeboard.

Additionally, the President's Climate Action Plan directs agencies to expand the application of this flood standard nationwide and update their flood-risk reduction standards for Federally-funded projects to reflect a consistent approach that accounts for sea level rise and other factors affecting flood risk. The Task Force Rebuilding Strategy¹⁹ promulgated 69 broad-ranging recommendations to help guide Sandy recovery efforts toward more resilient and sustainable outcomes, and to apply lessons learned from Sandy to broader application throughout the nation. For example, the Rebuilding Strategy recommends implementation beyond the Sandy-affected region of a minimum flood risk reduction standard for major Federal investment that takes into account data on current and future flood risk.

**8.6
million**

Approximate permanent population residing in currently mapped 1% annual chance coastal flood areas (NFIP Special Flood Hazard Areas). This is 2.8% of the U.S. population.

Source: Crowell, et al, 2013²⁰

95,000

Approximate number of miles of U.S. coastline.

Source: NOAA NGS, 2011²¹

350,000

Approximate number of structures located within 500 feet of the U.S. shoreline.

Source: The Heinz Center, 2000²²

**\$527
billion**

Value of assets insured by the NFIP in the 1% annual chance coastal floodplains in 2011.

Source: NOAA and FEMA, 2012²³

3

Overall ranking from 1 to 5 of the health of U.S. coastal waters. This is considered "fair" overall condition. The coterminous U.S. rating is 2.5.

Source: EPA, 2012²⁴



Introduction

A holistic coastal approach is necessary for success

The complex nature of coasts and their related uplands calls for a broad-based, comprehensive approach to coastal management.

Among our nation’s landscapes, the economic, environmental, land use, and social dynamics of coasts and their related upland resources are unique.

These areas—where the sea meets the land—have long histories of settlement and commerce densities, while offering great variety in natural resources, fish, wildlife, biological diversity and productivity, and natural beauty. But they are also areas of often fractured, multiple-layered management with increasing occurrences of natural hazards and costly disasters, and ongoing issues of degradation of environmental resources.

Add in the new factors of unprecedented population growth and changing climates and rising sea levels, and the need for a broader perspective in planning and managing our critical coastal areas becomes apparent.

Achieving a “holistic” coasts outcome will require development of a management framework.

To build sustainable, resilient coastal communities, while maintaining and restoring vital natural resources and ecosystems, a broad and inclusive framework must be developed to help all levels of government and the private sector manage future risks wisely.

Such a holistic framework would more effectively coordinate risk management and resource protection efforts across all levels to support sustainable, resilient communities, while minimizing disaster costs and losses to individuals and society.

Overall, a holistic coasts strategy would aim to:

- Minimize damage from current and future floods and coastal hazards.
- Apportion the costs of damages and environmental degradation fairly and appropriately.
- Restore and protect coastal natural resources, including biological resources and the natural ability of land and vegetation to reduce inland coastal hazards.
- Support sound economic uses of renewable and nonrenewable resources.



VIEW LOOKING WEST ALONG THE NEW JERSEY SHORE: Storm waves and surge cut across the barrier island at Mantoloking, New Jersey, eroding a wide beach, destroying houses and roads, and depositing sand onto the island and into the back-bay. The arrows in each image point to the same features. (Credit: images courtesy of United States Geological Survey.)²⁵

Holistic Coasts:

At the 2013 Gilbert F. White National Flood Policy Forum “Human Adjustments in Coasts,” the nearly one hundred assembled Forum participants sought to define the holistic coasts framework concept and its key purpose in the face of current and future conditions. Broadly speaking, ‘holistic coasts’ was defined as “**a framework focused on sustainable management of coasts and associated uplands balancing appropriate human occupancy and use, infrastructure, commerce; and functional ecosystems with consideration of current risks and future change.**”

The overall purpose of a holistic coasts framework “**is to ensure the continued social, economic, and environmental viability of our Nation’s precious coastal resources for this and future generations.**”

This report builds on and broadens the dimensions of a holistic coasts framework, considering current science, technology and understanding; key policies and programs at all levels that could contribute to building such a framework; and social, economic, and environmental concerns, and related research needs facing the nation and coastal communities now and into the future.

A national holistic coasts approach and framework will promote focus, coordination, and sustainable use.

Establishing a national holistic coasts approach and framework will help promote shared focus, improved coordination, and more sustainable communities and resources management. A holistic coasts approach would also focus on appropriate and sustainable human uses of coasts, while balancing the economic benefits of coasts with the associated damage and disaster-risk potential.

In addition, a holistic coasts framework would account for current and future risks while providing for long-term, sustainable protection and restoration of coastal resources and related quality ecosystems.

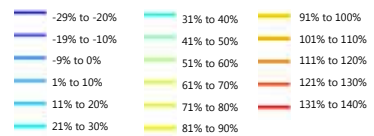
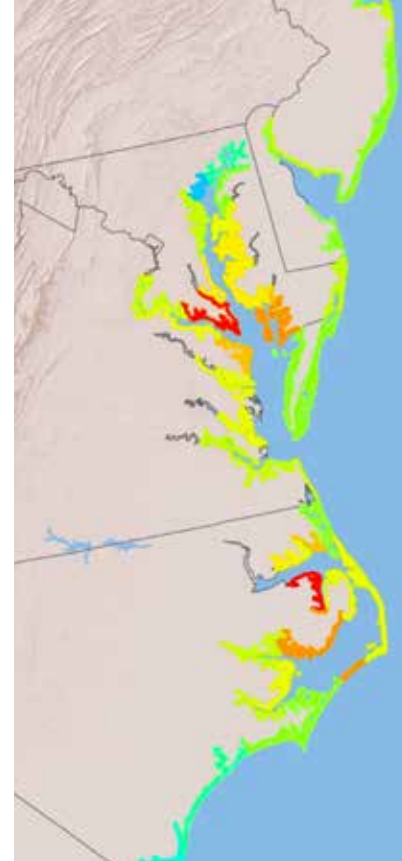
For example, in a holistic coasts framework, communities, individuals, and businesses could be encouraged and incentivized, through help from state and federal programs, to manage and reduce natural hazard and flooding risks. This would include receiving technical assistance and promoting the availability of the best scientific data for planning, land use, and critical community decision making.

A holistic approach would support long-term resiliency and sustainability of coastal communities.

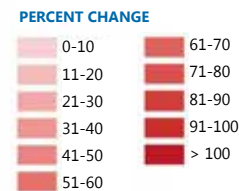
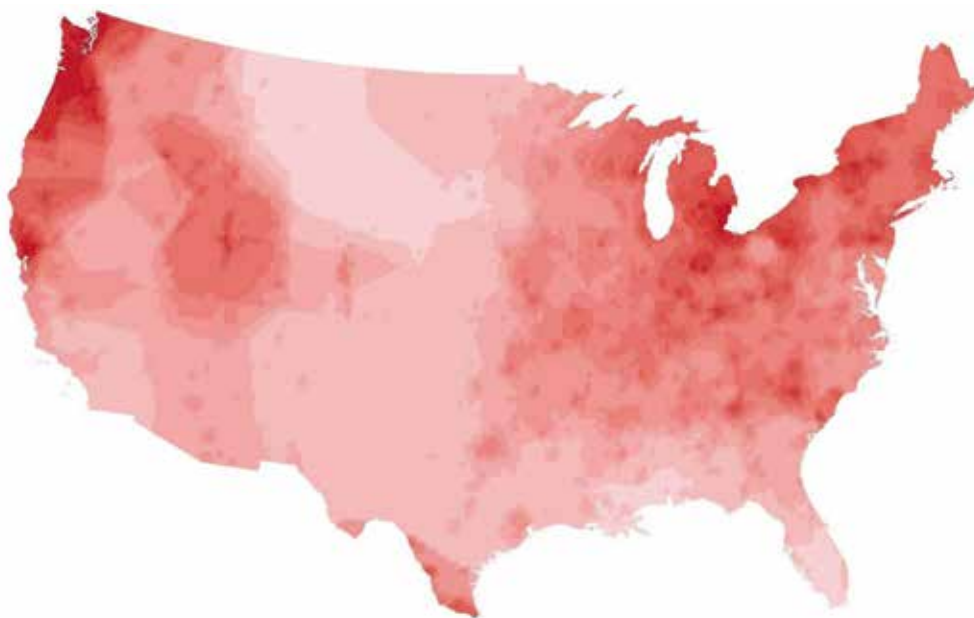
A key goal of a holistic coasts approach would be to increase awareness and improve the management of coastal risks and critical natural resources among those living in, working in, and supporting our nation's coastal regions.

A holistic coasts framework would bring together the science, policy, and collective commitment required to create long-term conditions for sustainable, resilient coastal communities and to respond to current and future challenges, including reducing future costs and suffering.

This approach would meld the critical roles of state and local governments to frame community growth and development through infrastructure, land use, and building standards, with better alignment of federal incentives, grants and aid, and private sector coordination.



MEDIAN CHANGE IN COASTAL FLOODPLAIN AREA BY 2100: Based on current scientific projections, there is now a 50% probability of the above depicted change in the coastal flood hazard area for the Mid-Atlantic Coast by 2100. Changes are with respect to current conditions for fixed shorelines (i.e., shorelines not allowed to migrate inland with rising sea levels, due to human-built seawalls, bulkhead structures, etc.). (Credit: map courtesy of AECOM, et al., 2013.)²⁶



MEDIAN PROJECTED PERCENT CHANGE IN SPECIAL FLOOD HAZARD AREA FOR 2100 OVER CURRENT CONDITIONS: Expansion of floodplains represented on the map reflect the increased likelihood of higher base flood (1% annual chance flood) riverine discharges from climate change and population effects, and storms and storm surges, including effects of sea level rise. (Credit: map courtesy of AECOM, et al., 2013.)²⁷



Recommendation 1

Establish a national holistic coasts framework

Current coastal management is fragmented and risks mounting losses from coastal hazards and degradation of resources.

National policy for coastal management is fragmented among a variety of governmental levels with varying aims, and often driven by short-term economics and politics that fail to account for changing conditions, depletion and degradation of resources, and increasing risks. Federal programs routinely send mixed messages, with some promoting development or redevelopment in hazard-prone areas, while others seek to discourage risky development.

For example, housing, community development, and disaster assistance programs have historically allowed and funded rebuilding in flood-prone areas without mitigation or protection to reduce the future impacts of flooding. Many states and communities have developed flood-prone areas in an effort to foster economic development and generate revenues. This development has often been at the expense of natural buffers and other protective features.

Moreover, federal disaster assistance and recovery funds have served to produce incentives for less responsible nonfederal planning. The current economic and political climate, however, is increasingly unfavorable to the sorts of federally funded, large-scale flood control projects and multibillion dollar disaster bailouts that characterized past federal flood policy.

Additionally, reforms such as the Flood Risk Reduction Standard for Sandy Rebuilding Projects, requiring use of best-available data and at least one foot of freeboard, help to ensure that federally funded disaster recovery efforts result in greater resilience than prior to the disaster.

A national holistic coasts framework would help integrate federal actions and leverage state and local roles.

The purpose of a national holistic coasts framework would be to help ensure continued social, economic, and environmental viability of the nation's precious coastal resources and communities, while minimizing the risks and costs of coastal hazards for present and future generations.

This framework would strive to leverage and support effective state and local roles in land use management and resource protection by improving integration of policies and programs at all levels, providing appropriate financial incentives and disincentives for better risk management, and improving science and the availability of information needed for coastal management decision making.

NATIONAL POLICY: A unified national policy is needed to address the full range of coastal challenges, players, and actions.

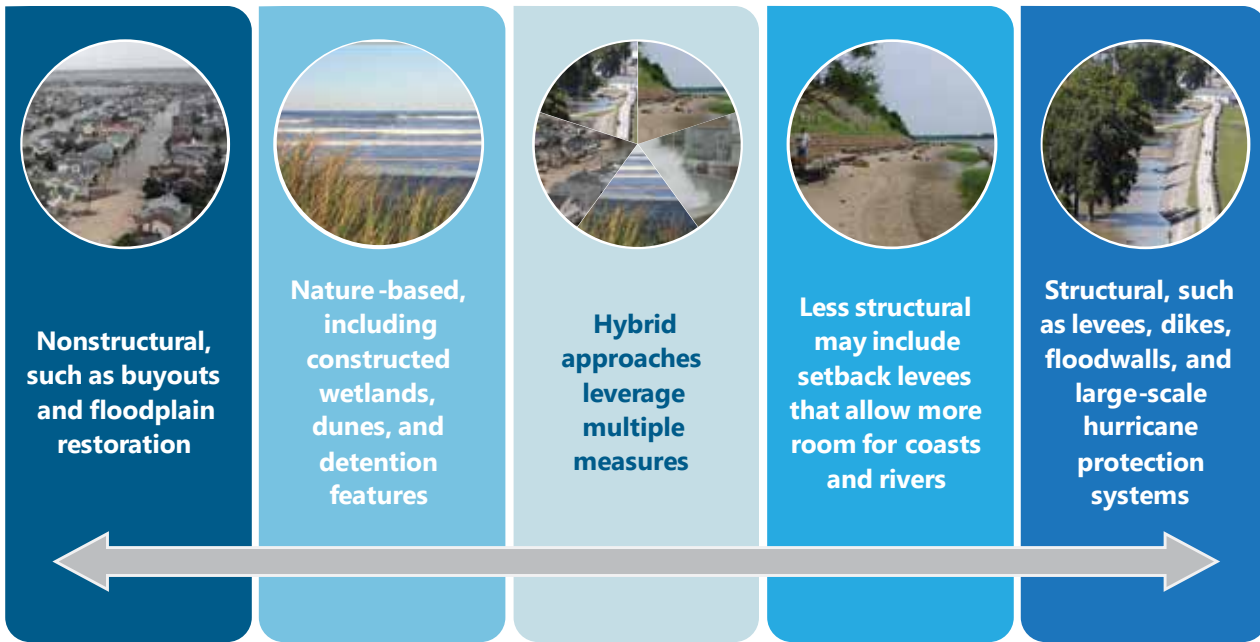
States and communities need to be better prepared to weather future floods with less federal assistance.

We should build on existing programs and consider new approaches.

Federal and state conservation, land use and public lands, infrastructure, disaster assistance, insurance, and other programs already provide legal authorities that can be used to support a holistic coasts framework and strengthen public safety and resource protection.

On the federal level, the Coastal Zone Management Act and Coastal Barrier Resources Act provide the basis for partnering with state and local governments to foster coastal regional planning and management. Federal Executive Orders 11988 (Floodplain Management), 11990 (Wetlands Protection), 13514 (Sustainability), 13653 (Climate Preparedness and Resilience), and others provide specific direction to federal agencies to promote and manage





actions related to floodplains, wetlands, and climate planning, consistent with a long-term holistic coasts view.

Flood insurance and disaster assistance programs could provide additional incentives for resilient and sustainable recovery planning and action in the face of anticipated physical and environmental changes. Expanding the focus of such program investments is a key theme of the Hurricane Sandy Rebuilding Strategy.²⁸ Continued development and implementation is needed to enhance this approach. Numerous other federal and state programs could be better aligned in this regard, either through administrative changes or through legislation.

In a holistic coasts framework, financial incentives should be designed to reward those communities that make the greatest efforts to manage and reduce future hazard-related risks and costs.

The long-term goal: Reduce flood damage, enhance ecosystem health, and reinforce sustainable use through a holistic policy.

To reduce coastal hazards and damage while restoring ecosystem health and productivity, a national holistic coasts framework would set goals and measure progress in each area of concern. It would aim to unify and better integrate policies at all levels to support resilient and sustainable coastal communities and ecosystems into the future, while focusing increased attention on the roles and responsibilities at each level.

The framework must be sufficiently flexible to recognize and adjust approaches for regional differences and varying hazards, where appropriate. The framework should also recognize that an ongoing effort will be needed to improve data and information on coastal resources and hazards and to make such information accessible and usable by all.

RANGE OF RISK MANAGEMENT METHODS: Methods to manage coastal flooding risk can range in a continuum from nonstructural to structural and hybrids. (Credit: adapted from USACE, 2013.)²⁹

U.S. saltwater fisheries generated more than \$199 billion in sales in 2011³⁰

U.S. Ports handled \$1.8 trillion in waterborne cargo exports and imports during 2012.³¹

Tourism is an essential driver of many coastal economies

Coastal states produced 59% of U.S. energy in 2011³²

COASTAL CONTRIBUTIONS: Holistic coasts framework can help plan for a sustainable coastal economy.



Recommendation 2

Realizing holistic coasts: The key is state and local leadership

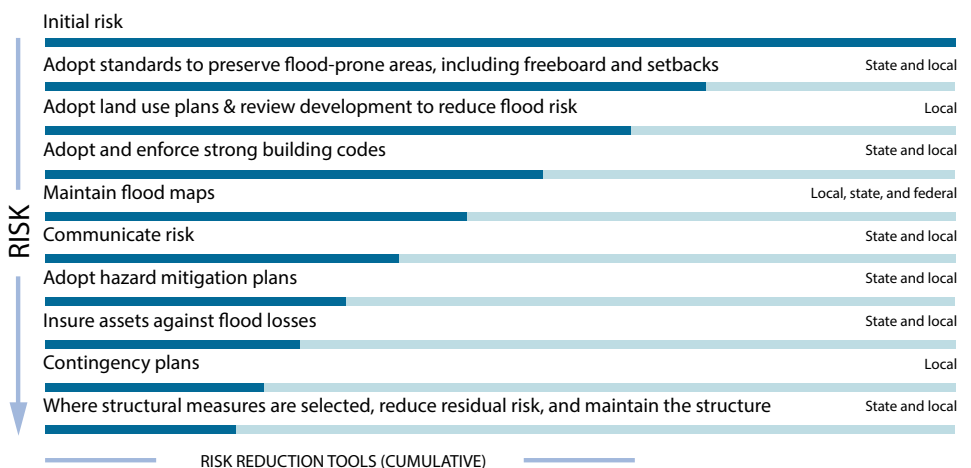
Coastal states, local governments, and private interests have the most to gain and the most to lose.

Overall, the direct effects of wise coastal management will be greatest on the states, communities, and private interests located along the nation's coasts. This is not to suggest this is a regional challenge only—the linkages of our coastal areas to the nation's economic, social, and environmental well-being are well established. However, state and local governments currently command the greatest roles, responsibilities, and authorities to help guide development through appropriate land use, building regulation, and planning for economic development, environmental quality, public safety, and sustainability.

Given the complex and competing interests and priorities facing state and local governments, it can be difficult to coordinate and implement these roles and responsibilities effectively. A major goal of a national holistic coasts framework would be to support state and local implementation of actions that reduce risks, protect resources, and increase community resiliency and sustainability.

Key state and community roles and responsibilities include establishing and enforcing land use, zoning, hazard mitigation, and building code standards appropriate to the landscapes and development within their jurisdictions, such that citizens are safer and face less risk due to flooding and other natural hazards.

Other key state and community roles and responsibilities include guiding



BUYING DOWN RISK: Communities and states have a wide range of tools available to manage and reduce risks associated with coastal hazards.

economic and community investments, including investments in infrastructure, community and human development services, natural resources, and commerce, and providing for and promoting public safety, as well as community resiliency and sustainability.

The President established a nonfederal Task Force on Climate Preparedness and Resilience to advise the Administration on how the Federal Government can respond to the needs of communities nationwide that are dealing with the impacts of climate change.³³

Task Force members include state, local, and tribal leaders from across the nation who will use their first-hand experiences in building climate preparedness and resilience in their communities to inform specific recommendations to the Administration.

We must adjust incentives to support wise coastal management decisions into the future.

State and local governments should actively pursue development adjustments to accommodate changing future coastal conditions, including:

- Landward relocations.
- Voluntary buyouts.
- Robust building code standards and elevation requirements.
- Greater restrictions on fill.
- Protection of natural areas and ecosystem functions that provide natural defenses.

Efforts to adjust incentives must recognize and reinforce appropriate roles and responsibilities for state and local governments, the private sector, voluntary organizations, and individuals.

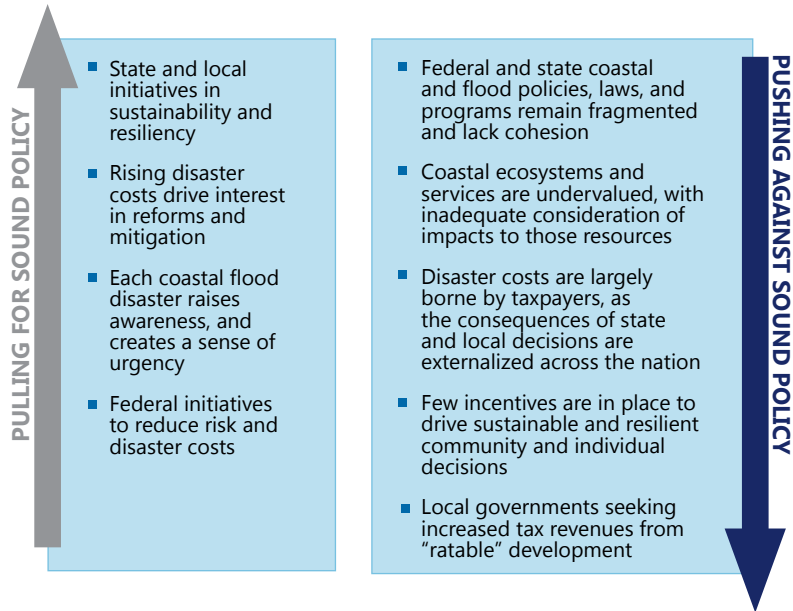
Hazard mitigation plans for coastal communities must be integrated into comprehensive plans that address land use and zoning.

Currently, states and communities are required by the federal Robert T. Stafford Disaster Assistance Act to develop and periodically update hazard mitigation plans for their jurisdictions to identify areas prone to natural hazard impacts and to plan appropriately for hazard mitigation.

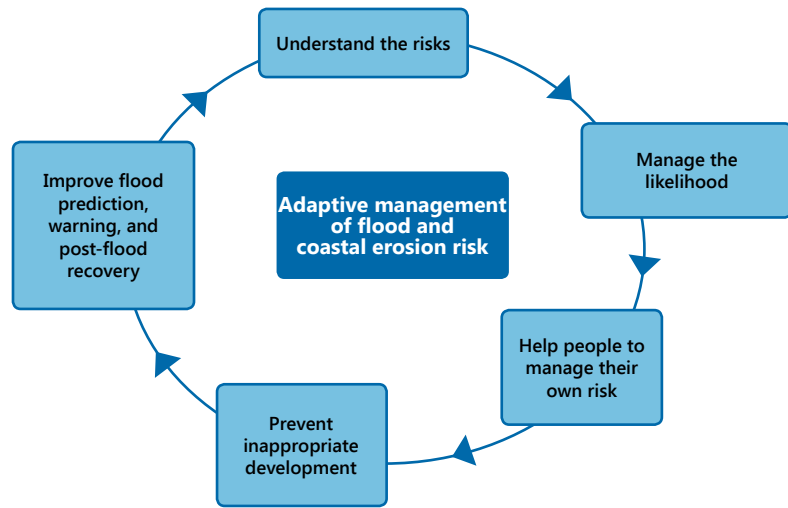
Often, however, these plans are not utilized or incorporated into general community planning and development, except during disaster recovery efforts. Moreover, FEMA does not currently require these plans to address risks associated with flood control structures or to account for the impacts of climate change. A national holistic coasts framework would help assure that hazard mitigation planning is both effective and fully implemented as part of ongoing state and community actions to reduce risk.

States should be encouraged to update regularly their coastal zone management plans and state hazard mitigation plans to support a holistic coasts framework.

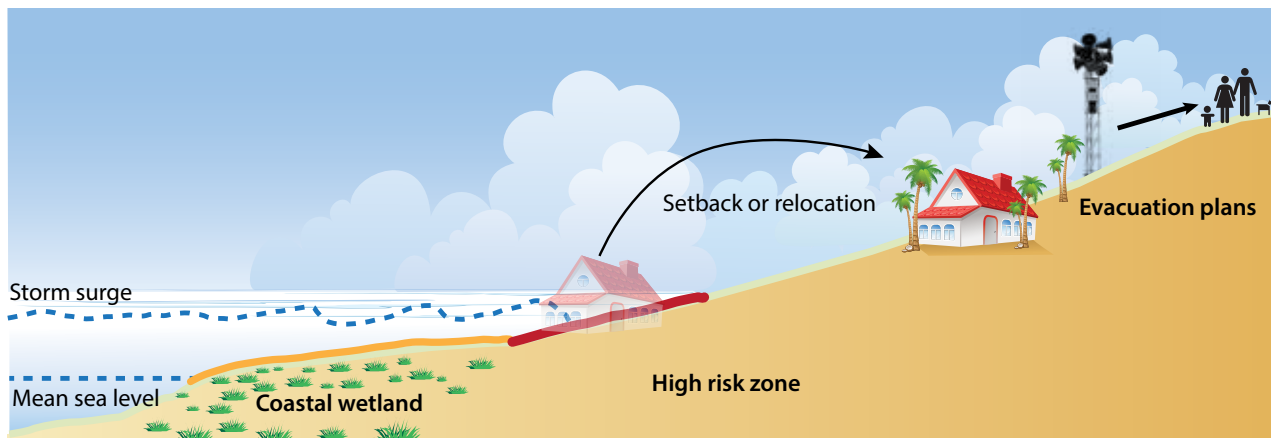
State coastal zone management plans, prepared in accordance with the Coastal Zone Management Act, and state hazard mitigation plans must be strengthened and regularly updated to help guide coastal development, conservation, and resource protection and restoration in coastal areas. A holistic coasts framework would support the strengthening of state and community guidance on land use, building standards, and coastal resources protection.



PUSH/PULL: Communities are responding to conflicting pressures affecting their hazard and risk vulnerabilities.



ADAPTIVE MANAGEMENT OF FLOOD RISK IN A DYNAMIC ENVIRONMENT: While the above steps are not necessarily sequential, climate change and sea level rise, coupled with increased population growth in coastal zones, demands that we have reliable and accurate data and make sound land use decisions for the future. (Credit: adapted from DEFRA, 2011)³⁴



INTEGRATED SYSTEM: An integrated system can be achieved through a combination of natural, nature-based, nonstructural, and structural features. (Credit: adapted from USACE, 2013.)³⁵



Recommendation 3

Align federal policy and programs into a holistic coast framework

Federal policy and programs require review and alignment.

Reports and studies completed by federal agencies, auditors, academics, and others over the past two decades recognize that the nation’s floodplain and coastal management policies and legal frameworks must be strengthened and better aligned to reduce more effectively losses from floods and natural hazards and to protect and restore critical natural resources for the future. This need is especially pressing for appropriate management of our coasts and coastal resources.

Existing Executive Orders and policies, as well as coordinating institutions, provide a foundation for building a national coastal management framework. These include Executive Orders 11988 (Floodplain Management), 11990 (Wetlands), and 13514 (Sustainability); an interagency process to revise and modernize the Federal Principles and Guidelines for water and related land resources

planning; and the National Ocean Council (ocean resource conservation), U.S. Climate Adaptation Task Force, Federal Interagency Floodplain Management Task Force, and Mitigation Framework Leadership Group.

Additionally, the President issued a new Executive Order 13653 on “Preparing the United States for the Impacts of Climate Change,” which directs Federal agencies to take a series of steps to make it easier for American communities to strengthen their resilience to extreme weather and prepare for other impacts of climate change.³⁶

Key federal laws and programs provide basic building blocks that can be enhanced and optimally aligned to develop a national framework. These building blocks include the National Flood Insurance Program, the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Disaster Mitigation Act of 2000, the Clean Water Act, the Coastal Barrier Resources Act, the Coastal Zone Management Act, and

a variety of other conservation and environmental laws and programs related to coastal resources. In addition, coastal programs of the U.S. Army Corps of Engineers, including coastal studies and projects and technical assistance, play a critical role in coastal risk and resources management.

Additionally, federal programs that support states and communities with human settlement and resettlement, such as the Department of Housing and Urban Development Community Development Block Grants (CDBG and CDBG – Disaster Relief), Department of Transportation grants and disaster assistance, U.S. Army Corps of Engineers projects and disaster assistance, Environmental Protection Agency’s State Revolving Funds for water infrastructure, and disaster loans of the Small Business Administration, often play an immediate and significant role in post-disaster recovery and help shape the future direction of communities’ risk management, resiliency, and sustainability.



New direction and alignment of these and other federal programs will help assure that the nation's standards for construction and operation of critical facilities and infrastructure, as well as recovery assistance, appropriately account for current and future coastal zone hazard risks. For example, the Uniform Flood Risk Reduction Standard³⁷ helps support a more resilient recovery from Hurricane Sandy and warrants broader, national implementation.

We must learn lessons from each disaster event.

Each disaster event and the associated recovery processes are complex and encompasses numerous lessons to be learned and incorporated into future actions. A holistic coasts management approach would prioritize considering and making appropriate adjustments for lessons learned from each disaster.

In addition to taking the lead in determining the extent of the nation's vulnerability to coastal hazards and risks, the federal government should require detailed interagency and interdisciplinary investigations for all significant, damaging coastal flood or storm-related events to explore causes and appropriate solutions to enhance future resiliency and sustainability. Investigations similar to those conducted by the National Transportation Safety Board after major transportation-related disasters could serve as models for regularization of such post-disaster studies.

A holistic coastal flood policy requires vertical integration of community, regional, and state and federal policies, laws, programs, and practices.

A holistic coastal flood policy would require consistent application and vertical integration among all levels from the community level to regional and state levels, and among federal agencies, laws, and programs.

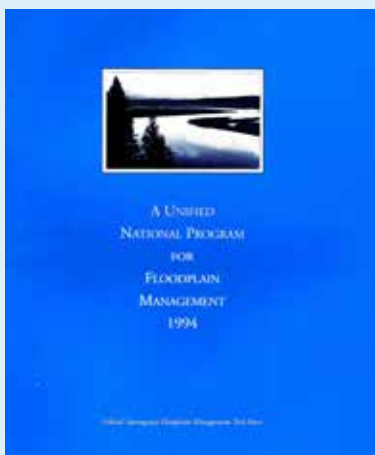
Federal programs should reinforce coastal risk reduction and environmental protection and restoration by states, communities, and the private sector.

As an example, studies have shown that the federal Coastal Barrier Resources Act is effective in discouraging development in high-risk, undeveloped coastal barrier island areas when state and local policies on conservation and removal of development subsidies are aligned.³⁸

Unified National Program for Floodplain Management

The recognized need for a cohesive, coordinated approach to flooding and development in flood-prone areas is rooted in a 1966 federal flood control policy task force report to Congress titled, "A Unified National Program for Managing Flood Losses" (House Document 465).

Creation of this document was followed by enactment of the NFIP (Section 1302[c] of the National Flood Insurance Act of 1968 [P.L. 90-448]), in which Congress declared that the objectives of a flood insurance program should be



integrally related to a unified national program for floodplain management, and the President should transmit to Congress for its consideration any further proposals for such a unified program.

Since 1976, interagency task forces have issued a series of documents seeking to bring federal and other levels of government policy into better alignment to reduce flood risks and protect and restore natural resources and floodplain functions.

In 1977, the President issued a key Executive Order (11988) that called upon federal agencies to take actions to support wise management and avoid unwise use of floodplains.

This interagency/intergovernmental approach was also employed in the wake of the Great Midwest Flood of 1993 (and the landmark 1994 "Sharing the Challenge" report of the Interagency Floodplain Management Review Committee ["Galloway report," July 1994]), and in the recent "Hurricane Sandy Rebuilding Strategy" of the Sandy Rebuilding Task Force (August 2013).

Such interagency efforts have had—and continue to have—profound impacts on the advancement of policies to address natural hazard threats and protect communities and natural resources.

A holistic coasts flood policy should also require horizontal alignment across watersheds, basins, ecosystems, and states to support an integrated approach to coastal resource management.

An integrated approach to coastal resource management requires horizontal alignment across watersheds, basins, ecosystems, and states, especially where there is economic, environmental, or hydrologic connectivity. Such alignment will often be critical to protect and restore effectively the ecological functions that support community resiliency and sustainability and long-term productivity of coastal ecosystems.

Federal programs should reinforce coastal risk reduction and environmental protection and restoration by states, communities, and the private sector.



Recommendation 4

Balance human and environmental long-term needs

Coastal hazards threaten economic health and stability.

Many coastal hazards have the potential to threaten the economic health and stability—and, in some instances, the basic sustainability—of coastal communities. At the same time and by their nature, many economically important activities must be located in coastal areas subject to these hazards.

Key examples are port and transportation facilities, fishing and related industries, certain energy-related facilities, and recreation and tourism support, all of which are intimately tied to their coastal surroundings and resources.

In the past, however, we have often failed to consider coastal hazards in siting and community design to ensure that key economic activities that must be located in coastal areas are as hazard-resistant, resilient, and sustainable as possible over the long term.

This does not mean that all those working on these activities must live in the same high risk areas. Planning for the location of workers and communities supporting coastal economic activities must consider transportation as a basic issue.

We should also give increased consideration to relocation of support for these activities to areas with the least risk, while still enabling the coastal enterprises to adequately function.

This balancing of the risks and benefits associated with coastal development and management is at the heart of a holistic coasts framework.

The health of our nation's coastal economies and ecosystems is critically important in the near and long terms.

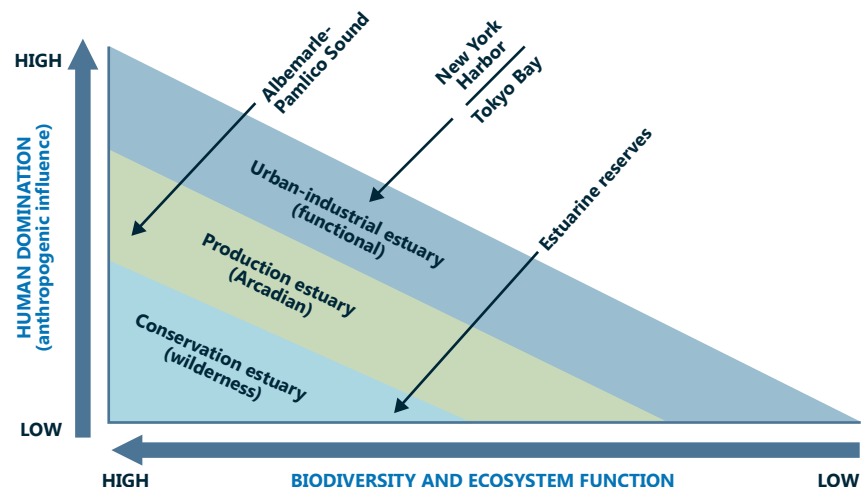
In considering the importance and critical productivity of our nation's coastal areas, we must recognize that the well-being of our coastal economies and the health of our coastal ecosystems are intimately tied. These areas should be primary concerns, both now and into the future.

Currently, many coastal ecosystems are failing, with some in danger of collapse. These include major fisheries, bays and estuaries, coastal and freshwater marshes, mangroves, and natural beach and dune systems. Identified issues include overfishing, pollution, urbanization and coastal development, and effects of climate change that are altering ecosystems, reducing

biodiversity, and increasing stresses on wildlife and natural resources, as well as communities and economies.³⁹ Many coastal ecosystems are already heavily impacted by human activities. For example, 75 percent of U.S. coral reefs located in the Atlantic, Caribbean, and Gulf regions are now rated in "poor" or "fair" condition, and all Florida reefs are now rated as "threatened."⁴⁰

For a robust economy, a safe population, and sustainable quality of life for coastal residents, ecosystem health must be supported and, where necessary, restored. Directing greater care for the identification, differentiation, and planning for activities that must be sited in hazardous coastal areas and those that can be located in less hazardous areas could assist with improving ecosystem health, both within and outside the context of disasters.

A BETTER FUTURE FOR OUR COASTS: HOW TO STRIKE THE RIGHT BALANCE: What do we want our coasts to do for us? How do we make the most difference? (Credit: Weinstein, M. and D.J. Reed, 2005.)⁴¹



The threats of coastal hazards and the importance of healthy ecosystems must be better understood and communicated.

To develop stronger support for resilient and sustainable holistic coasts, a much better understanding is needed at all levels regarding the threats posed by coastal hazards, the values and services provided by healthy coastal ecosystems, and the methods available for hazard mitigation.

We should also recognize that coastal ecosystems often provide critical protective and productive services. Such services include shoreline stabilization, wave and storm surge buffering from severe coastal storms, key food sources and nursery habitat for fish and other species, water filtration and water quality protection, carbon storage, and opportunities for recreation and enjoyment.

Commerce also depends on resilient infrastructure, including utilities, transportation, and in some cases, existing coastal flood defense facilities, such as seawalls, hurricane protection systems, and engineered beaches and dunes. Analysis of coastal hazards and ecosystem values should be integrated into planning at all levels.

Sustainable hazard mitigation can help assure the long-term balance of human and environmental needs.

Many options are available to manage and reduce coastal hazards through best science, wise planning, and strong, shared private and public commitments.

Care should be taken, however, wherever practicable, to design protection systems that harmonize with natural processes and ecologies and that are sustainable in the long term.

When developing strategies to manage and reduce risks and losses, a strong emphasis should be placed on the use of mitigation approaches and strategies that employ and reinforce natural processes.



Benefits/processes:

- Break offshore waves
- Attenuate wave energy
- Slow inland water transfer

Performance factors:

- Berm height and width
- Beach slope
- Sediment grain size and supply
- Dune height, crest, and width
- Presence of vegetation

Benefits/processes:

- Break offshore waves
- Attenuate wave energy
- Slow inland water transfer

Performance factors:

- Reef width, elevation, and roughness

Benefits/processes:

- Break offshore waves
- Attenuate wave energy
- Slow inland water transfer
- Increase infiltration

Performance factors:

- Marsh, wetland, or submerged vegetation elevation and continuity
- Vegetation type and density

Benefits/processes:

- Wave attenuation and dissipation
- Sediment stabilization

Performance factors:

- Island elevation, length, and width
- Land cover
- Breach susceptibility
- Proximity to mainland shore

Benefits/processes:

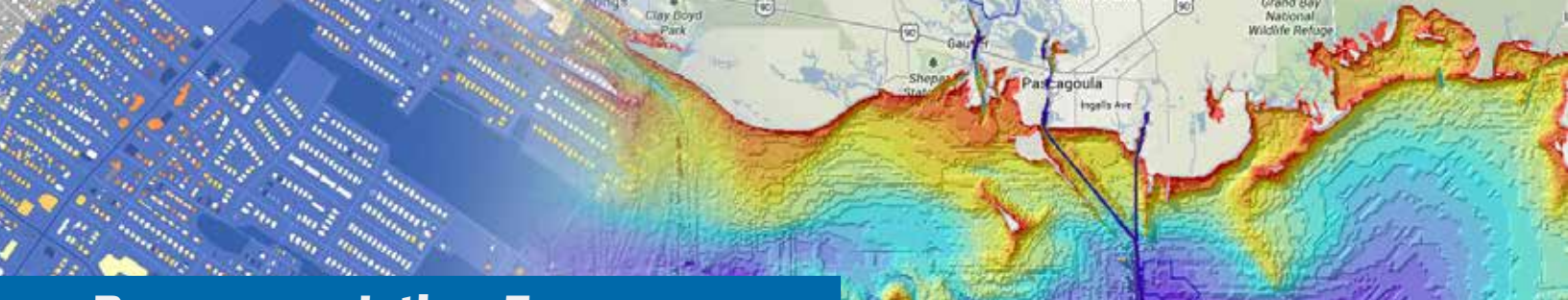
- Wave attenuation and dissipation
- Shoreline erosion stabilization
- Soil retention

Performance factors:

- Vegetation height and density
- Forest dimension
- Sediment composition
- Platform elevation

NATURAL AND NATURE-BASED INFRASTRUCTURE: GREEN

INFRASTRUCTURE: A variety of natural coastal features and ecosystem communities provide valuable and multiple natural “services” when preserved and protected, including storm wave attenuation, fish and wildlife habitat, and filtering and protecting water quality. (Credit: adapted from USACE, 2013.)⁴²



Recommendation 5

Invest in science and data to yield savings

Communities need robust, forward-looking natural hazards-related science and data to support decision making.

A holistic coasts framework must be grounded in quality, forward-looking natural hazards science and data, which are important to support policy making and decision making at all levels of government. Important science and data should be made widely and easily available, including use of the Internet and web-based sources.

Current, accurate flood hazard mapping, based upon best available science and regularly updated data for all coastal-related hazards, including anticipated future conditions, will be essential to support community development and land use decisions. We must also effectively deploy new and emerging technologies to develop improved delivery and dissemination tools and methods, and to properly apply coastal risk and hazard data.

Coastal planning must result in sound, defensible decisions.

Although communities should continually seek improved science, they must move forward with coastal management decisions based on currently available data, while incorporating appropriate safety margins.

A key means of public education would be to expand the use and application of coastal hazard “visualization” tools, made easily and widely accessible for public information, planning, and decision making.

For example, NOAA collaborated with government, private sector, academic, and non-governmental organization partners to develop a “Sea Level Rise and Coastal Flooding Impacts Viewer.” Available through NOAA’s Digital Coast website,⁴³ this tool uses GIS technology to help coastal residents visualize potential inundation from sea level rise, including identification and visualization of flooding impacts on neighborhoods, roads and infrastructure, wetlands, and socially and economically vulnerable populations.

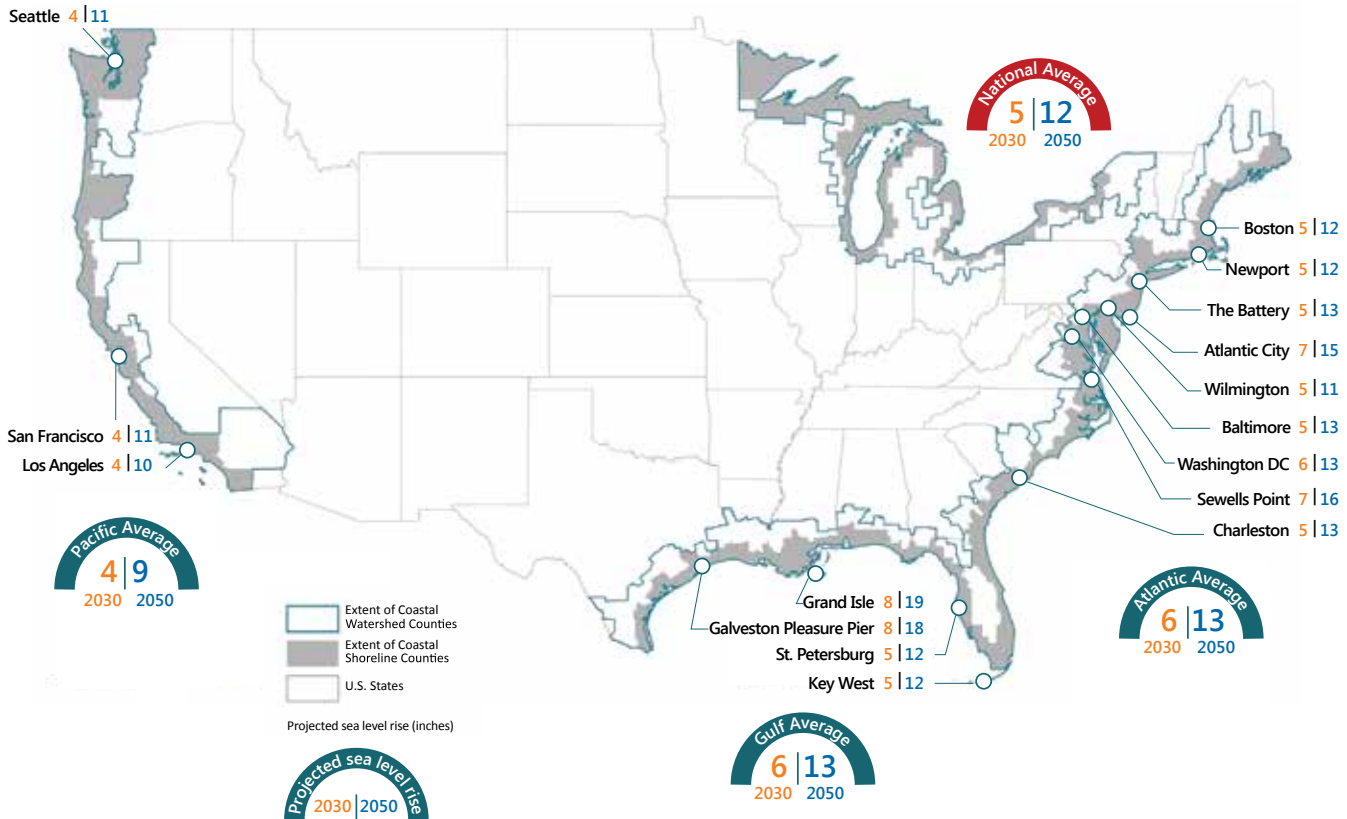


NAI WORKSHOP: New York State Floodplain Manager and ASFPM Board Chair, Bill Nechamen, presents a Sandy No Adverse Impact Workshop in coastal New York.



NOAA SEA LEVEL RISE VIEWER: NOAA and its partners developed a web-based mapping and visualization tool to help communities and residents understand their potential for flooding due to sea level rise. The tool provides information and resources to help users communicate about, plan for, and avoid future sea level rise impacts. The SLR Viewer can be found at the NOAA Digital Coast website at: <http://csc.noaa.gov/digitalcoast/tools/slrviewer>.

ESTIMATES OF RELATIVE SEA LEVEL RISE ALONG THE CONTINENTAL UNITED STATES: Scientists estimate with a 90 percent confidence level that many locations along the continental U.S. coast will experience relative sea level rises of 4 to 8 inches depending on local conditions, by 2030. Higher rises with similar confidence levels are anticipated by mid century. (Credit: data from Strauss, et al., Climate Central 2013).⁴⁴



We must improve and better coordinate data collection and sharing efforts by government agencies, academic organizations, and other entities.

Although much critical data and numerous data collection programs already exist, a holistic coasts framework would encourage greater sharing and integration of data at all levels. Appropriate data collation and sharing in support of community planning for hazards management and mitigation will likely contribute major cost savings for communities, states, federal agencies, and individuals.

We must use limited resources judiciously to obtain the most essential data for effective risk management.

The current economic climate—and associated agency funding restrictions—require agencies and scientists to focus on identifying the most essential data for risk reduction and natural resource management. Large savings can come through improved coordination among agencies and other stakeholders in sharing and using data.

We must identify the requisite data to support community and state land use and development planning, infrastructure planning and design, and insurance-related activities.

Another important consideration involves the identification of key science and data needs for all coastal-related sectors, including data for natural resources protection and management. Obtaining such information will require monitoring the relative condition of natural resources and ecosystem health and functions, along with identifying key stressors and anticipated future conditions, to develop and adjust plans for resource resiliency and sustainability.

It is important to note that current flood risk assessment methods for coastal areas are imperfect and can underestimate the true risk. Examples of underestimation (where further research may be needed) can be for coastal areas with combinations of flood risk factors such as storm surges, tide cycles and flood flows.

The new Executive Order 13653 on Climate Preparedness and Resilience calls for new information, data and tools for climate change preparedness and resilience.⁴⁵ Scientific data and insights

are essential to help communities and businesses better understand and manage the risks associated with extreme weather and other impacts of climate change. The Executive Order requires Federal agencies to work together and with information users to develop new climate preparedness tools and information to help state, local, and private-sector leaders make smart decisions.⁴⁶

Public investments in topographic, hydrologic, and hydraulic mapping data pay significant dividends by enabling the production of high-quality, accurate flood risk maps. These maps support state, local, and property owner decision making related to development planning, hazard mitigation, and emergency management, including evacuation planning. Investments in such information and data can result in large-scale savings to individuals and communities by supporting basic decisions, such as where to locate or purchase property, how to best mitigate risks, and in some instances whether to relocate. Many coastal communities still lack this basic data because federal investments in mapping have fallen short of public needs.



Recommendation 6

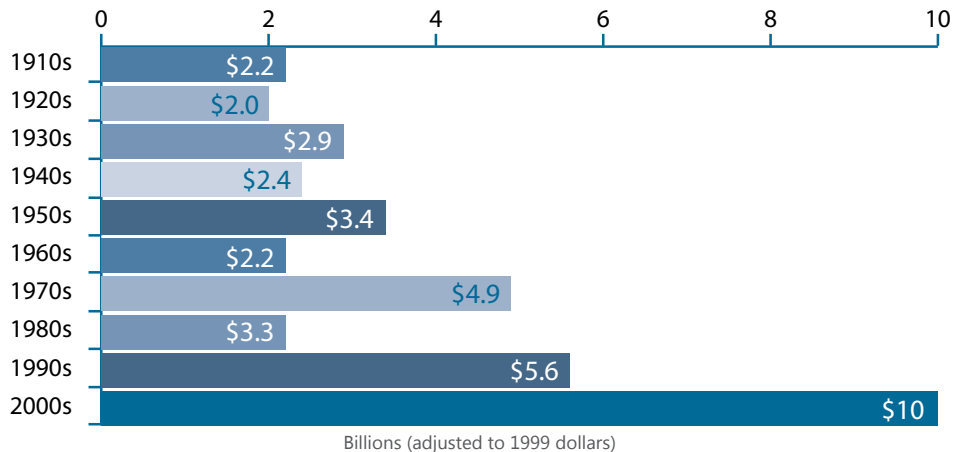
Those that benefit should pay

Our current coastal policy is neither economically nor environmentally acceptable. It is also not sustainable.

Government water policies and economic theory have generally supported a “beneficiary or user pays” principle. The goals have been to promote efficiency in the use of government-provided, non-market resources and to help equitably allocate financial resources and natural resources, whenever specific beneficiaries of the provided resources or services can be identified.⁴⁷

Certain government services, however, such as subsidized flood insurance, flood control, beach nourishment and infrastructure projects, and general disaster assistance, can engender what economists call “moral hazard.” This term refers to subsidizing or enabling risky development in hazardous areas, which leads to “externalizing” of economic or environmental costs onto neighbors or the federal taxpayers at large.

Recent studies show that increasing disaster costs now borne by the federal government—a growing proportion of which are unbudgeted—may, in effect, discourage community-based mitigation. These costs may also soon rival, in magnitude and cost, the unbudgeted level of imbalance in the Social Security Trust Funds, with outlays in the trillions of dollars.⁴⁸ This reality is an unsustainable path. Climate changes and rising sea levels are likely further to exacerbate these trends. As such, subsidies must be better managed such that those who reside in hazard-prone areas pay substantially more of the true costs associated with location in these areas.



AVERAGE ANNUAL ADJUSTED FLOOD DAMAGES HAVE MORE THAN TRIPLED SINCE THE EARLY 1900s:

Despite substantial efforts to manage and reduce flood losses, national flood losses continue to rise precipitously. Insuring against other natural hazards, such as earthquake, fires, and tornados, are the responsibility of property owners. In the case of floods, we’ve developed system that passes along substantial costs to the taxpayers. (Credit: adapted from ASFPM, 2013, from NOAA HIC data.)⁵²

The cost to the nation of coastal disasters is rising exponentially.

Of recent natural hazard events, those involving coastal disasters have proven to be the most costly and deadly. Much of the \$370 billion (2010 dollars) in federal supplemental appropriations for disaster-spending since 1989 has involved coastal-related storm events.⁴⁹ These costs are in addition to the yearly budgeted disaster funding.

Recent hurricanes, in particular, have helped drive the National Flood Insurance Program to a U.S. Treasury borrowing debt of some \$24 billion.⁵⁰ In addition, recent studies show that more than 5,790 square miles—and more than \$1 trillion in property and structures—face a potential sea level rise of up to 2 feet (66 cm) by 2050 under a “high rate” scenario, or by 2070 under a “lower rate” scenario.⁵¹

Legislation should seek to apportion costs fairly and properly.

Shifting costs from those who take the risks to taxpayers or others discourages mitigation and wise risk management. Fair, appropriate apportionment of risk and damage costs to those who benefit will reduce taxpayer expense and support smarter coastal development.

In a holistic coasts framework, individuals and households would take personal and financial responsibility for their natural hazard risks and for protecting coastal natural resources and the environment impacted by their development.

Communities would not pass the costs of unwise development to federal taxpayers or others not living with these risks. Under the holistic coasts management framework, public policies at all levels should reflect this principle.

For equity concerns, we should consider establishing community-based hazard insurance, voucher systems, or other temporary measures to help low-income households.

Simultaneously, however, a strong emphasis must be placed on long-term hazard mitigation, particularly for low-income individuals and communities. Pricing that reflects true costs and defined risks will be essential. Studies have shown that many unmitigated NFIP repetitive loss properties have continued to suffer substantial flood losses for decades, often due to under-priced insurance that shifted costs to taxpayers or other insureds.^{53, 54} At the same time, studies show that investments made in natural hazard mitigation activities on average save the nation four dollars for every one dollar spent.⁵⁵

A holistic coast strategy should evaluate and adapt programs that reward individual and community accountability.

The NFIP Community Rating System—used for rating communities’ mitigation efforts beyond minimum standards to reduce flooding and natural hazard risks—is a program and approach that warrants evaluation, refinement, and strengthening. This approach could be expanded to establish sliding scales for non-federal cost shares with federal disaster assistance, infrastructure, and other grants that will encourage states and communities to strengthen standards and improve risk management.⁵⁶

The costs to the nation of deteriorating coastal resources must be reversed, and we must focus on achieving healthy, productive ecosystems for future generations.

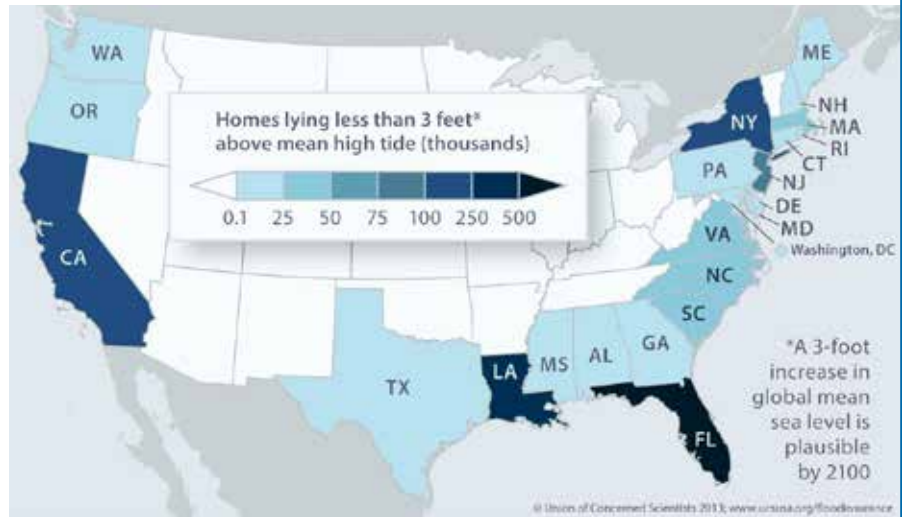
To retain and restore healthy, productive coastal ecosystems for the future, we must reduce stresses and reverse the costs of deteriorating coastal resources through better resource and land use management.

We should also promote the philosophy that those whose actions damage or diminish ecosystem productivity should bear the costs to restore these resources.

Coastal management that balances human and environmental long-term needs must take future risks into consideration.

Finally, applying the “beneficiary or user pays” principle through a holistic coasts management framework must account for future and changing risks to accommodate human and environmental needs.

A “user pays” principle will be essential to help maintain a community-based focus on current and future hazard mitigation and to support wise coastal resource management.



GROWING RISKS TO HOMES FROM SEA LEVEL RISE AND STORMS: In recent years, properties in low-lying coastal states have experienced increasing damage from storms and severe flooding. Almost 3 million people—and their homes—reside within 3 feet of mean sea level. With rising seas projected to exceed the 3-foot mark within this century, a great many homes are clearly at risk. (Credit: UCS, August 2013, map based on data from Strauss, et al., 2012.)⁵⁷

BEFORE-AND-AFTER SHOT OF THE 1970S MIAMI BEACH NOURISHMENT PROGRAM SUPERVISED BY THE U.S. ARMY CORPS OF ENGINEERS:



Miami Beach (circa 1972) has no beach along most of its length. Natural beach was lost, in part, due to storms and effects of seawall placement.



By 1981, the largest replenished beach in the United States (\$5 million per mile) had been constructed. Research shows, overall, Florida communities have spent nearly \$2 billion (2012 dollars) in federal and non-federal funds on beach renourishment in more than 400 episodes.⁵⁸ (Credit: images courtesy of U.S. Army Corps of Engineers)



Recommendations Summary

Actions and recommendations from the report

Resilient and sustainable coasts are achievable. Introduction, pp. 4-5

- Effectively address vulnerabilities and land management, while emphasizing long-term sustainability and resiliency.
- Channel public concern toward long-term planning for community resilience and sustainability; in today's ever-changing environments, expertise and data must be readily accessible to all levels of government and to the private sector.
- Implement comprehensive, integrated hazard mitigation and recovery plans to promote post-disaster reconstruction efforts that make communities more resilient and sustainable for the future.
- Support and consider further application and development of the 69 broad-ranging recommendations of the Hurricane Sandy Rebuilding Strategy to help guide Sandy recovery efforts toward more resilient communities and long-term sustainable outcomes. Many should be considered and applied nationwide on an ongoing basis.

A holistic coastal approach is necessary for success. Introduction, pp. 6-7.

- Use a holistic coasts approach to bring together the science, policy, and collective will and commitment to create long-term conditions for sustainable, resilient coastal communities and to respond to current and future challenges, including reducing costs and human suffering.
- Meld critical roles of state and local governments to frame community growth and development through infrastructure, land use, and building standards, with better alignment of federal grants and aid, and enhanced coordination with the private sector.

Establish a national holistic coasts framework. Recommendation 1, pp. 8-9.

- Establish a national holistic coasts framework to help integrate federal actions and leverage state and local roles.
- Leverage and support state, regional, and local roles in land use management and resource protection by improving policy and program integration at all levels, providing appropriate financial incentives and disincentives, and increasing the availability of information for coastal management decision making.
- Design financial incentives to reward those communities that make the greatest efforts to manage and reduce future hazard-related risks and costs.
- Set goals and measure progress in each area of concern.
- Unify and better integrate policies at all levels to support resilient, sustainable coastal communities and ecosystems into the future, while fully considering roles and responsibilities at each level.
- Recognize—and appropriately modify approaches to accommodate—regional differences and varying hazards.
- Establish an ongoing effort to improve data and information on coastal resources and hazards and make such information easily accessible and useful for all.

Realizing holistic coasts: The key is state and local leadership. Recommendation 2, pp. 10-11.

- Support state and local implementation of actions that reduce risks, protect resources, and increase community resiliency and sustainability.
- Define key state and community roles and responsibilities: establishing and enforcing land use, zoning, hazard mitigation, and building code standards appropriate to the landscapes and development within their jurisdictions; guiding economic

and community investments, including investments in infrastructure, community and human development services, natural resources, and commerce; and providing for and promoting public safety and community resiliency and sustainability.

- Adjust incentives and disincentives to support wise coastal management.
- Encourage state and local governments to adjust planning and development to accommodate changing future coastal conditions, including landward relocations, voluntary buyouts, robust building code standards and elevation requirements, greater restrictions on fill of floodplains, and protection of natural areas and ecosystem functions.
- Integrate hazard mitigation plans into comprehensive plans and general community planning and development.
- Require that hazard mitigation plans address risks associated with flood control structures and account for the impacts of climate change.
- Strengthen and regularly update state coastal zone management plans and state hazard mitigation plans to help guide coastal development, conservation, and resource protection and restoration in coastal areas.

Align federal policy and programs into a holistic coast framework. Recommendation 3, pp. 12-13.

- Require federal interagency and interdisciplinary investigations for all significant coastal flood or storm-related events to explore causes and potential solutions to enhance future resiliency and sustainability.
- Adjust federal programs to reinforce coastal risk reduction and environmental protection and restoration by states, communities, and the private sector.



- Encourage state and local community alignment with federal Coastal Barrier Resources System protections through enhanced conservation policies and removal of development subsidies.
- Strengthen horizontal alignment of holistic coastal policies across watersheds, basins, ecosystems, and within states to effectively protect and restore ecological functions through land and water planning and protection measures to support community resiliency and sustainability and long-term productivity of coastal resources.

Balance human and environmental long term needs. Recommendation 4, pp. 14-15.

- Increase planning attention at all levels to monitor, protect, and restore failing coastal ecosystems, including those in danger of collapse, such as major fisheries, bays and estuaries, coastal and freshwater marshes, mangroves, coral reefs, barrier islands, and natural beach and dune systems.
- Through effective planning efforts, address identified issues, such as overfishing, pollution, urbanization and coastal development, and effects of climate change, that alter ecosystems, reduce biodiversity, and increase stresses on wildlife and natural resources and community economies.
- Identify and differentiate among activities that must be located in hazardous coastal areas and those that can be moved to less hazardous sites.
- Improve data and understanding regarding the threats posed by coastal hazards, the values and services of healthy ecosystems, and the available hazard mitigation approaches; improve understanding of methods to design, locate, and protect key infrastructure, including utilities and energy facilities, water supplies, and wastewater treatment and transportation facilities, for greater resiliency and long-term sustainability.
- Enhance understanding that coastal ecosystems often provide critical protective and productive services, including shoreline stabilization, wave and storm surge buffering, key food sources and habitat, water filtration and water quality protection, carbon storage, and opportunities for recreation and enjoyment.

- In designing infrastructure and protection systems and developing strategies to manage and reduce hazard risks, place strong emphasis on the use of mitigation approaches that harmonize with and employ and reinforce natural processes and ecologies.

Invest in science and data to yield savings. Recommendation 5, pp.16-17.

- Ground holistic coasts framework in quality, forward-looking hazards science and data to support community decision making, and policy and decision making at all levels.
- Make important science and data widely and easily available, including the use of Internet and web-based resources.
- Generate and regularly update flood hazard mapping, based on best available science, for all coastal-related hazards, including anticipated future conditions.
- Employ new and emerging technologies to develop improved delivery and dissemination tools and techniques.
- Expand the use of coastal hazard visualization tools, making planning and decision making data easily and widely available for public use (e.g., NOAA's "Sea-level Rise and Coastal Flooding Impacts Viewer," available on the NOAA Digital Coast website⁴⁵).
- Encourage greater sharing and integration of coastal resource and hazards-related data at all levels, including government agencies, academic organizations, and others.
- Use limited resources judiciously and identify the most essential data for risk reduction and natural resources management efforts.
- Require monitoring for the relative condition of natural resources and ecosystem health and functions, including identification of key stressors and anticipated future conditions, to develop and adjust plans for community and resource resiliency and sustainability.

Those that benefit should pay. Recommendation 6, pp. 18-19.

- Continue to support the basic policy of "those that benefit should pay" (the "beneficiary or user pays" principle) to promote efficiency of government-provided

resources and to allocate fairly financial and natural resources, whenever it is possible to identify specific beneficiaries of the resources or services provided.

- Curb and minimize programs and policies that promote or support "moral hazard," those that subsidize or enable risky development in hazardous areas or externalize economic or environmental costs onto neighbors, others, or society at large.
- Apportion costs fairly and properly; individuals and households should take personal and financial responsibility for their natural hazard risks and for protecting coastal natural resources and the environment; communities should not pass the costs of unwise development onto federal taxpayers or others not living with such risks.
- Consider establishing voucher systems or other measures to address lower income hardship issues; consider community-based insurance; these efforts should also emphasize long-term hazard mitigation, especially for lower income individuals and communities.
- Set prices to reflect true costs and risks.
- Expand on measures such as the NFIP Community Rating System approach (or similar system) to reward community efforts beyond minimum standards for mitigation and reduction of flooding and natural hazard risks, and establish sliding-scales for nonfederal cost shares related to federal and state disaster assistance, infrastructure, and other grants to encourage strengthened standards and risk management by states and communities.
- Employ and utilize a "beneficiary or user pays" principle to help maintain a community-based focus on current and future hazard mitigation and to support wise coastal resource management.



Events and Sponsors

How these recommendations were generated

How these recommendations were generated

Planning for the 4th National Forum began more than two years prior to the Forum, with discussions among national leaders in floodplain and coastal management who believed the time had come to address coastal issues and flood and other hazard management. This timing was well before the human losses and major destructive impacts associated with Hurricane Sandy.

Prior to the Forum, 30 of the invited experts prepared short papers detailing their perspectives on:

- Coastal Visioning and Resource Management
- Science and Systems
- National Flood Insurance Program
- Resiliency and Sustainability
- Economics
- Policy Approaches
- State, Regional, and Local Strategies
- Climate Change and Adaptation.

(Visit http://www.asfpmfoundation.org/forum/2013_Forum_Participant_Papers.pdf.)

This background reading informed Forum participants about each other's thinking in advance. At the two-day Forum held at the George Mason University, Arlington, Virginia, February 19-20, 2013, four speakers opened, discussing major aspects of coastal management issues and future needs:

- Human use and human adjustment
- Natural resources
- International perspectives
- Domestic perspectives

A second plenary session explored coastal challenges today and into the future. Then, in facilitated, smaller group sessions, Forum participants met to define major coastal problems and concerns, as well as management opportunities and impediments, and to develop key action agenda items for broader discussion.

These outcomes were summarized and brought together during development of a summary "Holistic Coasts" definition and initial action agenda, later used as material for the current report.

The Forum concluded with a half-day "Capstone Session," which was open to the public and featured an address by White House Council on Environmental Quality Chair Nancy Sutley, presentation of the initial Forum results, and an expert panel discussion.

A summary of the Forum findings and action recommendations is embodied in this document. The professional judgments and complete recommendations of the Forum are embodied and refined in this report.

For more about managing flood risks and floodplain resources

The list of participants and more details about the issues discussed and remedies offered by the experts who made up the fourth assembly of the Gilbert F. White Flood Policy Forum can be found on the ASFPM Foundation website at: <http://www.asfpmfoundation.org/2013forum.htm>.

For more about the ASFPM Foundation

One of the goals of the Association of State Floodplain Managers Foundation is to further research and education to help reduce flood losses and achieve sustainable coastal and floodplain management throughout the United States. Facilitating the identification of gaps in knowledge and its implementation is one means by which the Foundation seeks to fulfill this mission. To find out more about the history, activities, and accomplishments of the ASFPM Foundation, visit <http://www.asfpmfoundation.org>.

For more about reducing flood losses and protecting floodplain resources

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