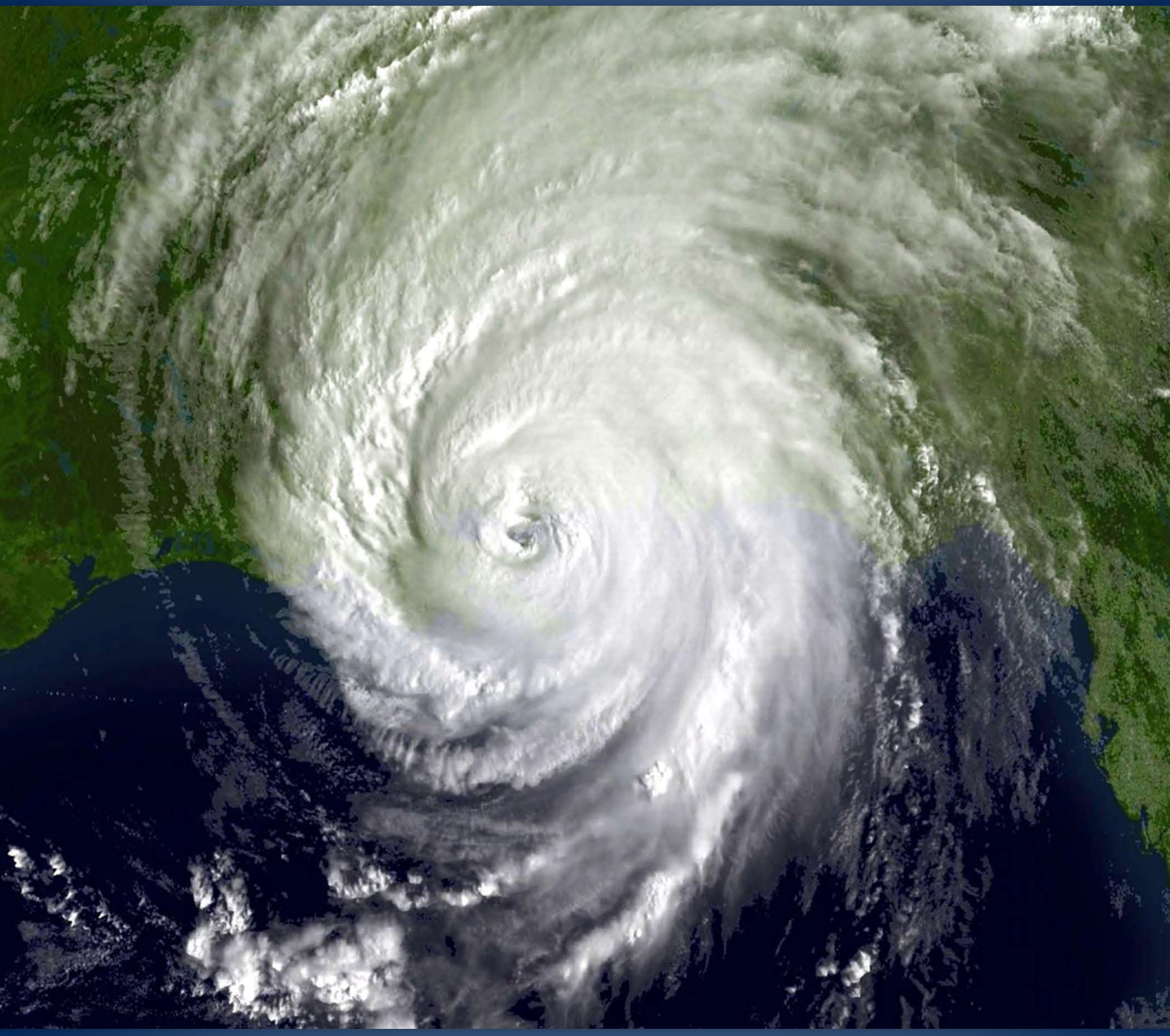
Resilient Coasts:
A Blueprint for Action



THE HEINZ CENTER

Ceres

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Preface

The Heinz Center and Ceres – along with those who have developed and endorsed this Blueprint – undertook the challenging task of forging consensus on principles and actions to increase coastal resilience for three fundamental reasons: our coasts are threatened, there are reasonable steps to counter those threats, and we as a nation are not yet taking them.

Powerful storms are wreaking increasing havoc along the world's coasts, as Hurricane Katrina and Cyclone Nagris indelibly demonstrated. A recent assessment by the Wharton School's Risk Center revealed a dramatic surge in global economic losses from natural disasters, increasing from just over $50 billion in the 1950s to almost $800 billion in the 1990s, with about $420.6 billion so far in the current decade (through 2007)[1]. Munich Re estimated worldwide economic losses from natural catastrophes at $200 billion for 2008, up from $82 billion in 2007[2]. Lloyd's of London and Risk Management Solutions (RMS) predict that flood losses along tropical Atlantic coastlines would increase 80 percent by 2030 with about one foot of sea level rise[3] – in line with the conservative estimates of the 2007 report of the Intergovernmental Panel on Climate Change.

Of particular interest are the commonsense and cost-effective steps our nation can take to drastically reduce such risks and their associated economic impacts. Five hundred commercial clients of the insurer, FM Global, experienced approximately 85 percent less damage from Hurricane Katrina as similarly situated properties[4]. This significant reduction in the amount of damage was directly attributable to hurricane loss prevention and preparedness measures taken by these policyholders. The return on investment is striking – a $2.5 million investment in loss prevention resulted in $500 million in avoided losses.[5]

An increasing number of studies underscore the value and wisdom of reducing our coastal vulnerabilities. Wharton has demonstrated that homeowners in Florida could reduce losses from a severe hurricane by 61 percent, resulting in $51 billion in savings, simply by building to strong construction codes[6]. Putting this in perspective, the same cost reductions applied to Katrina damages would have reduced the $41.1 billion worth of insured property losses to about $16.1 billion. Similarly, the National Institute of Building Sciences showed that every dollar spent on mitigation saves society about four dollars on recovery costs[7]. Despite this evidence, nearly all U.S. coastal cities and towns lack adequate land use requirements and building code standards to realize these savings. Among the additional benefits of substantially reduced risks and costs are a stabilized coastal insurance market and less expensive premiums.

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1. Wharton Risk Management and Decision Processes Center, University of Pennsylvania. "Managing Large Scale Risks in a New Era of Catastrophe." 2007 http://opim.wharton.upenn.edu/risk/library/Wharton_LargeScaleRisks_FullReport_2008.pd
2. Munich Re. 2009. NatCatSERVICE http://www.munichre.com/geo
3. Lloyd's and RMS. 2008. "Coastal Communities and Climate Change: Maintaining Insurability."
4. Dankwa, D. 2006. "FM Global Touts Underwriting by Engineering as Superior." Best's Review, p. 93, June.
5. Green, M. 2006. "Preparing For the Worst." Best's Review, pp. 40-44, April.
6. Wharton, 2007.
7. National Institute of Building Sciences/Multihazard Mitigation Council. 2005. Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities. Vol. 1. Washington, DC.

Even with stronger building codes, our coasts face escalating risks. Roads, transit lines and drinking water supplies – the lifelines of our coastal cities – are already facing pressures they were not designed to withstand. The National Research Council estimates that a sea level rise of 2-4 feet, expected to occur in the next century, would inundate 27 percent of the major roads in the Gulf Coast[8]. Yet today, in most places, even new development is not being designed to withstand the impacts of swelling seas. As the national science agencies renew their commitment to climate science, priority must be placed on providing local governments with the predictive capacities and other tools they need to adapt land use and infrastructure for an uncertain future.

The need to adapt is also an opportunity to restore our coastal ecosystems, which are a critical complement to defensive infrastructure. Wetlands provide an estimated $23.2 billion each year of storm surge and flood protection along our coastlines, according to a study by the University of Vermont[9]. Yet the combined pressures of climate change and development – over half our population lives along the coasts – have led to the systematic depletion of protective wetlands. Clearly, the resiliency of our coastal populations and our ecosystems go hand in hand.

Our goal in producing this Resilient Coasts Blueprint is to provide and inspire leadership and direction throughout our businesses, governments, and communities. The endeavor's broad-based collaboration, along with the group's intention to implement these principles where appropriate within their institutions and advocate for their broader adoption, underscores the importance of common cause and collective action. Evidence shows we can reduce our risks and our costs by 50 percent or more, creating a powerful foundation for this Blueprint – for while the threats may be inevitable, catastrophes are not.

Deb Callahan
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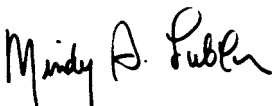

Mindy Lubber
President
Ceres

8. Committee on Strategic Advice on the U.S. Climate Change Science Program; National Research Council. 2009. "Restructuring Federal Climate Research to Meet the Challenges of Climate Change."

9. Costanza, R., Perez-Maqueo, O., Martinez, M., Sutton, P., Anderson S., and Mulder, K. 2008. "The Value of Coastal Wetlands for Hurricane Protection." AMBIO: A Journal of the Human Environment. June.

Critical Need, Immediate Opportunity

Sea level rise, temperature increases, changes in precipitation patterns and other climate-related changes are expected to occur and to become increasingly more severe over the coming decades. The need to adapt to these climate-driven changes and to better manage existing coastal risks is obvious and immediate. Changing climatic conditions pose an unprecedented threat to U.S. coastlines, where the majority of our population resides and the majority of our economic activity occurs. Over half the U.S. population lives in coastal counties and almost half of the nation's gross domestic product – $4.5 trillion – is generated in those counties and in adjacent ocean waters.[10] Further, insured property values along the Gulf and Atlantic coasts have been roughly doubling every decade.[11] By the end of 2007, these coasts had nearly $9 trillion of insured coastal property.

For the purpose of this Blueprint, coastal resilience is the capacity of humans, communities and ecosystems to withstand and bounce back from the inevitable impacts of coastal storms and climate change, including rising sea levels.

As coastal development is intensifying, so are coastal property losses. The higher wind speeds, storm surge, flooding, and erosion hazards intrinsic to coastal regions increase the likelihood of property damage, degradation of coastal ecosystems, and subsequent social costs. Changing climate trends may increase the potential for more frequent and severe damage. Routinely, policymakers, developers, and property owners are not aware of the present and future risks associated with coastal development. We must now give high priority to implementing adaptation strategies to protect the natural and built environments on which society depends.

Reducing the physical and economic risks associated with coastal hazards is not only critical, but is also often cost-effective. An analysis by the National Institute for Building Safety concluded that investments made to minimize impacts from earthquakes, flood, and wind yielded more than four dollars of benefit for every dollar spent.[12] Another study estimated that coastal wetlands in the United States provide $23.2 billion worth of storm protection services each year.[13] The new threats posed by climate change will also require new solutions. We must develop knowledge, tools and approaches for quantifying risk from climate change in a way that allows planners, underwriters and others to formulate and implement adaptation strategies. Improved land use planning and building codes, as well as the maintenance of a strong private insurance marketplace, will be central to the success of any mitigation strategy. The Resilient Coasts Blueprint outlines these vital steps.

10. United States Commission on Ocean Policy. "An Ocean Blueprint for the 21st Century." 2004 http://oceancommission.gov/documents/full_color_rpt/000_ocean_full_report.pdf.

11. AIR Worldwide. "The Coastline at Risk: 2008 Update to the Estimated Insured Value of U.S. Coastal Properties." http://www.air-worldwide.com/publicationsitem_ektid14604.aspx

12. National Institute for Building Safety, 2005

13. Costanza, R., Perez-Maqueo, O., Martinez, M., Sutton, P., Anderson S., and Mulder, K. "The Value of Coastal Wetlands for Hurricane Protection." AMBIO: A Journal of the Human Environment. June 2008.

The insured value of coastal residential and commercial properties in coastal counties in Florida and New York now exceeds $2 trillion each.

Source: AIR Worldwide. "The Coastline at Risk: 2008 Update to the Estimated Insured Value of U.S. Coastal Properties." http://www.air-worldwide.com/publicationsitem_ektid14604.aspx

This Blueprint is offered as a tool to advise the new Administration, Congress, state and local leaders – as well as their counterparts in the private sector – as they confront the unprecedented challenges that climate change poses to the American economy and the environment. The Blueprint states basic principles fundamental to coastal resiliency in the face of intensifying hazards and suggests strategies for climate change adaptation. Resilient Coast signatories endorse these principles and, as feasible and appropriate, will implement them in their own practices and advocate for broader adoption. These principles recognize long-term responsibilities and opportunities for private sector engagement and government action at all levels. We envision the Resilient Coasts Blueprint as a first step toward reconciling the ecological, social and economic health of our coasts. This reconciliation is critical to ensure a prosperous and sustainable future for coastal communities.

Resilient Coasts Principles

Identify and fill critical gaps in scientific understanding and develop the tools and methodologies necessary for incorporating climate change into risk assessments and risk mitigation decisions.

Risk-reduction strategies must be based on assessments adequate to support critical and costly risk mitigation investments. While much of coastal climate change risk results from choices on where and how we build along the coast, calculating future risks based on forecasts of climate change are fraught with uncertainties that make effective adaptation planning difficult. A critical step toward better quantifying future change is to advance scientific understanding and develop the methodologies necessary to refine forecasts and make them useful for adaptation purposes.

With the IPCC-predicted two feet of sea level rise, ocean and estuarine beaches in the Chesapeake region would experience widespread loss, declining by 58 percent and 69 percent, respectively, by 2100.

Source: National Wildlife Federation. "Sea-Level Rise and Coastal Habitats of the Chesapeake Bay: A Summary." 2008. www.nwf.org/sealevelrise

For example, current estimates of sea level rise have uncertainties both in terms of timing and extent, creating some risk in making costly and time-sensitive investments on these forecasts. These uncertainties may delay implementation of adaptation plans or lead planners to address only the higher probability, lower impact scenarios. Consequently, improving technologies and methodologies to reduce uncertainty would prove invaluable. In the case of sea level rise, as one example, the relationship between rising temperatures and ice sheet breakdown must be better understood.

Tools that can help translate expected climate change into localized impacts on the built and natural environment are also necessary. Current flood, shoreline and inundation maps, used for land use and infrastructure planning and mortgage due diligence, do not accurately reflect current risks, let alone future risks, posing significant challenges for adaptation. In the case of sea level rise, the development and dissemination of high-definition, digital flood and coastal maps, based on assessment of data from LIDAR* surveys and other data-

* Light Detection and Ranging (LIDAR) is a remote sensing system used to collect topographic data. This technology is used to document topographic changes along shorelines.

gathering techniques, is essential. These maps should be created to include a variety of scenarios for potential future sea level increases. There also is strong need for climate change models and other tools that enable improved predictions of future coastal storms and which clearly describe the uncertainties of those predictions.

Funding of this research is a top priority, as it is a critical step in implementing risk mitigation strategies. Additionally, attempts to address nearer term risks must be designed to be adapted as our understanding of climate change impacts improves.

Require risk-based land use planning.

Ultimately, federal, state, and local governments should integrate natural hazards into land use planning with a goal of protecting development from significant and frequent coastal hazards, including storm surges, storm-generated waves, and erosion. In addition, during the land use planning process, government entities should consider climate-related risks, including the likelihood and extent of climate change-related hazards, and identify actions to protect or adapt in specific geographic locations. In especially vulnerable coastal areas, government entities might designate no-build and no-rebuild zones, similar to floodway zones in riverine areas, and/or provide private property owners with incentives to relinquish property or development rights in these areas through land exchanges, land banks and the transfer or trading of development rights.

In the Gulf Coast, a 2 to 4 foot rise in sea level would put 27 percent of major roads, 9 percent of rail lines and 72 percent of ports at or below 4 feet of elevation at risk, in spite of protective infrastructure such as dikes and levees.

Source: National Research Council. "Restructuring Federal Climate Research to Meet the Challenges of Climate Change." 2009.

Design adaptable infrastructure and building code standards to meet future risk.

As part of any local adaptation plan, construction, retrofit and operational standards for new and existing public and private infrastructure should be routinely assessed and modified. Some plans may need to allow for evolving information and uncertainty about the pace of climate change. As always, local plans and investments should account for regional planning efforts and for the density of populations being protected, and also should take into consideration localized forecasts of climate change impacts. In addition, new approaches to infrastructure might be considered, such as decentralized energy and water treatment systems that would be less susceptible to catastrophic loss or disruption than the traditional centralized systems.

Likewise, standards for new building construction and for building retrofits should be modified to take into account new levels of climate change protection and risk mitigation requirements. For low-income households, the federal government and states could provide subsidies for any retrofits required because of climate change risk.

Strengthen ecosystems as part of a risk mitigation strategy.

A strong risk mitigation strategy should recognize the enormous protective value of ecosystems and other natural infrastructure, such as coastal wetlands, barrier islands, trees, mangroves and other vegetation. This natural infrastructure is essential to society's efforts to

In some parts of South Carolina, as little as one foot of sea level rise would inundate the shore up to a half mile inland.

Source: Southern Alliance for Clean Energy. "Rising Seas: Challenges and Opportunities for the Lowcountry." 2008. http://www.cleanenergy.org/index.php?/Video.html?form_id=23&item_id=5

address climate change, and these systems must be included as part of any adaptation strategy. Federal, state, local and private entities should protect and restore these natural features to mitigate threats to built and natural systems. For example, government entities can establish incentives and/or regulations to make ecosystem preservation and enhancement part of adaptation funding, risk-based land use planning and post-disaster rebuilding.

Develop flexible adaptation plans.

Given the uncertainty in many forecasts of climate change, it is essential that adaptation plans be flexible and amendable to incorporate higher levels of climate change protection as required. For example, a bridge built to function under five-foot storm surge conditions might be designed so it could be modified should higher levels actually occur.

Maintain a viable private property and casualty insurance market.

It is critical to maintain a private property and casualty insurance market by allowing private insurance companies to set risk-based premiums that thereby communicate the cost of risk to consumers. While not every risk is insurable, regardless of the price, a resiliency strategy must recognize insurance as an indispensable tool and maximize its effectiveness. Insurance can not play its role if land use regulations, building codes and physical protection are not sufficiently robust. In turn, the insurance industry must give appropriate consideration and weight to the demonstrable reduction in risk provided by improved building standards and other risk mitigation efforts.

For a 100-year hurricane, mitigation would reduce the potential losses by 61 percent in Florida, 44 percent in South Carolina, 39 percent in New York, and 34 percent in Texas.

Source: Wharton Risk Management and Decision Processes Center; University of Pennsylvania. "Managing Large Scale Risks in a New Era of Catastrophe." 2007 http://opim.wharton.upenn.edu/risk/library/Wharton_LargeScaleRisks_FullReport_2008.pdf

An empowered and stable private insurance market will help ensure that unaffected taxpayers will not bear the burden of catastrophic loss. It will also provide the right price signals and incentives for risk mitigation. As the risk to a property grows because of location or other climate-related factors, the associated insurance premiums will increase because of the greater likelihood of damage, providing an incentive to build in less risky areas and/or build or retrofit properties to higher standards. For owners of existing properties who are unable to afford steeply rising premiums, such as low-income homeowners, government should seek a transparent means of subsidizing insurance cost while also helping those receiving assistance to mitigate their risk.

Integrate climate change impacts into due diligence for investment and lending.

Wise investing will involve asset managers understanding the impacts of climate change on their investments and managing that risk, especially in real estate, infrastructure and other financial instruments. Responsible banks will need to understand the levels of exposure within their investment and lending portfolios by incorporating climate risks into their due diligence.

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