

Risk & Resilience in Coastal Regions

A ULI Global Policy and Practice Forum Report

ULI Climate, Land Use, and Energy (CLUE) Initiative

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**Urban Land
Institute**



Foundation

About the Urban Land Institute

The mission of the Urban Land Institute is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI is committed to

- Bringing together leaders from across the fields of real estate and land use policy to exchange best practices and serve community needs;
- Fostering collaboration within and beyond ULI's membership through mentoring, dialogue, and problem solving;
- Exploring issues of urbanization, conservation, regeneration, land use, capital formation, and sustainable development;
- Advancing land use policies and design practices that respect the uniqueness of both built and natural environments;
- Sharing knowledge through education, applied research, publishing, and electronic media; and
- Sustaining a diverse global network of local practice and advisory efforts that address current and future challenges.

Established in 1936, the Institute today has nearly 30,000 members worldwide, representing the entire spectrum of the land use and development disciplines. ULI relies heavily on the experience of its members. It is through member involvement and information resources that ULI has been able to set standards of excellence in development practice. The Institute has long been recognized as one of the world's most respected and widely quoted sources of objective information on urban planning, growth, and development.

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Letter from the CEO

Dear Reader:

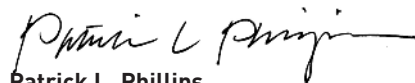
In January 2013, ULI convened an interdisciplinary group of market stakeholders to explore the implications of new environmental risks in coastal regions on real estate practices and markets. This leadership dialogue amplifies ongoing engagement by ULI in the issues of coastal planning, climate change, and post-disaster community rebuilding and gives shape to future research and programs across ULI's member networks. This report reflects the dialogue at the forum and is the first step in framing a broader set of activities that likely will engage many coastal communities for some time.

In addition to individuals representing the diversity of the real estate industry, forum participants included professionals from the insurance industry, government, and non-profit organizations. Many shared valuable insights derived from their engagement in these issues and signaled that coastal risk is a business issue to be discussed today, not tomorrow.

ULI members are at the forefront of adapting to new environmental realities in the marketplace. Whether engaged in the emotionally charged process of rebuilding a community after a natural catastrophe, providing leadership in structuring new legal frameworks to govern shoreline land use, helping facilitate new intergovernmental strategies to reprioritize infrastructure investments, or helping align real estate investors and lenders around new criteria of land valuation, ULI members are already engaged. The participation of the insurance industry in the forum seeks to build on common interests in advancing responsible land use practices that mitigate risk to communities and form a basis for a sustainable real estate marketplace.

ULI is making decisive contributions to advancing land use and real estate practices in the context of global climate change. We welcome your engagement in this critical endeavor as we provide leadership in the responsible use of land in local communities—globally.

Sincerely,



Patrick L. Phillips
Chief Executive Officer
Urban Land Institute

Introduction

As global greenhouse gas emissions increase beyond modeled worst-case scenarios, changing climate and weather patterns introduce new dimensions of uncertainty into a rapidly evolving real estate marketplace. Along with economic, demographic, and societal changes, uncertainty in future climate conditions and the underlying vulnerability of coastal areas are necessitating a critical review of coastal development and management practices.

Market demand for new building in coastal regions can be driven by growing communities or by the recovery or rebuilding of existing communities. Whatever the market driver, innovation in coastal land use practices, building standards, and urban infrastructure can help mitigate the growing risks presented by weather volatility and sea-level rise, while enhancing the livability of communities and strengthening their economic base, as well as restoring the integrity of natural resources.

Land use decisions have always been informed by considerations of risk—be they associated with market fundamentals, regulatory frameworks, community process, or the myriad construction and

How do we manage the unavoidable, and how do we avoid the unmanageable? Resilience has to be not only attacking the symptoms of the problem, but getting at the root cause of the problem, which is the emission of greenhouse gases.

—FRED KRUPP, PRESIDENT OF THE ENVIRONMENTAL DEFENSE FUND AND KEYNOTE SPEAKER AT THE RISK AND RESILIENCE IN COASTAL REGIONS FORUM

What Is Resilience?

Resilience—from the Latin *resilio*, meaning “to spring back”—is the ability to recover after an impact or misfortune. It is the ability to adapt to the consequences associated with an instance of failure or systemic breakdown.

While there is no single professional or technical definition for the term, recently, in the wake of Hurricane Sandy and after several years of record losses from weather-related disasters, *resilience* is a term being used to describe the inherent qualities or capability of organizations and communities to recover quickly and resume their activities after natural catastrophes. In this context, resilience encompasses a wide variety of risk-mitigation strategies that seek to respond to vulnerabilities in communities and the built environment or to adapt to recent or anticipated risks associated with climate change.

Coastal resilience means building the ability of a community to “bounce back” after hazardous events such as hurricanes, coastal storms, and flooding—rather than simply reacting to impacts.

—NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION

Applying “resilience thinking” to cities and communities requires us to think not only about bouncing back from environmental, economic, and social crises, but adapting to changing circumstances by “bouncing forward” through new frames, processes, and ways of working.

—FORUM PARTICIPANT, CITING EMERGING SOCIAL SCIENCE DISCOURSE ON ADAPTIVE CHANGE

An Updated Overview of Climate Change in the United States

The following summary is taken from the *2013 Draft National Climate Assessment Report*, prepared by the U.S. Global Change Research Program, a collaboration of 13 federal science agencies. Released by the government in January 2013, just a few days before the ULI forum, it represents the most recent consensus-based scientific report available on climate change. Its findings include the following:

Climate change. Global climate is changing primarily due to human activities and is projected to continue to change over this century and beyond.

Temperature. The average temperature has risen about 1.5 degrees Fahrenheit since 1895, with 80 percent of this increase occurring since 1980. The most recent decade was the warmest on record. Warming is superimposed on a naturally varying climate and has not been, and will not be, uniform across regions over time. Temperatures are projected to rise between three and eight degrees Fahrenheit by 2100, depending on the region and projected future emissions scenarios.

Average precipitation. Average precipitation across the United States has increased since 1900, but some regions have seen decreases. The Midwest, southern Great Plains, and Northeast have had the largest increases. Portions of the Southeast, Southwest, and the Rocky Mountain states have had decreases.

Extreme precipitation. Heavy downpours are increasing in most regions, with the largest increases occurring in the Midwest and Northeast. Further increases in frequency and intensity of extreme precipitation events are projected for most areas.

Extreme weather. Certain types of extreme weather events have become more frequent and intense in some regions, including heat waves, floods, and droughts. The prevalence of increased intensity of heat waves has been in western regions. Many of the intense flooding events have been in eastern regions.

Hurricanes. There has been an increase in overall strength of hurricanes and the number of strong hurricanes in the North Atlantic since 1980. The intensity of hurricanes is projected to increase as the oceans continue to warm.

Sea levels. The global sea level has risen by about eight inches since reliable record keeping began in 1880. It is projected to rise an additional one to four feet by 2100 and will vary across regions.

Ocean acidification. Oceans are absorbing about a quarter of the carbon dioxide emitted to the atmosphere annually and as a result are becoming more acidic.

Source: *2013 Draft National Climate Assessment Report*, U.S. Global Change Research Program, January 2013, <http://ncadac.globalchange.gov/>.

other execution risks of project development. Throughout history, geographic and environmental constraints have directly informed land use decisions, in many instances constituting the driving factor for where economies have thrived or faltered.

Today, a new trend of increased property damage associated with storms and flooding is emerging in coastal regions around the world. Communities have been devastated and local property markets have faced costly losses and disruptions because of their proximity to the very bodies of water that provided the genesis for their economic vitality. Emerging risks associated with extreme weather events, rising sea levels, and ocean surges must now be acknowledged as key factors in determining the responsible use of land in coastal regions.

An unprecedented global trend is taking place in which populations are migrating to and concentrating in cities and metropolitan areas in coastal regions. This burst of unprecedented global urbanization is transforming coastal regions into some of the most valuable and densely developed land around the world. In the coming decades, 75 percent of the world's rapidly urbanizing population is expected to be concentrated in urban areas located in coastal regions.

Emerging Coastal Resilience Initiatives

Cities and governments worldwide are devoting resources to coastal resilience. Northern European communities have long understood the threat that floods along the Atlantic coast present and have created localized governance to protect the floodplains since before the Netherlands was even a country. More recently, European countries have implemented numerous adaptation measures such as constructing seawalls, raising buildings, relocating harbors, and designing innovative buildings and public spaces to accommodate flooding. The risk of tsunamis in Asia has fostered heightened review of community preparedness and economic vulnerability. In the past, other "new" risks in the built environment have been identified and successfully mitigated, such as risks associated with seismic activity, fire, and public health. New innovations have demonstrated dramatic success in protecting cities and buildings, and the people who inhabit them.

Following Hurricane Katrina, the U.S. Army Corps of Engineers invested more than \$14 billion in the redesign and reconstruction of both natural and civil engineering infrastructure to protect Gulf Coast communities. Major initiatives are underway along the Gulf Coast, southern Florida, the coastal Carolinas, and the San Francisco Bay area. Following Superstorm Sandy, dedicated planning and rebuilding initiatives have commenced with great public attention in the New York City region. The impact of these planning trends at all levels of government will contribute to the evolution of the professional practice of real estate investment and development—supplemented by an evolution in the pricing of these risks by the insurance industry. These emerging trends were the subject of the forum dialogue.



An aerial photograph showing a residential neighborhood completely inundated with floodwater. The water is a murky, brownish-grey color. Several large, multi-story houses are visible, some with porches and balconies. A white boat is floating in the water near the bottom left. In the background, a beach and the ocean are visible, with waves breaking on the shore. A semi-transparent dark grey rectangular box is overlaid on the upper portion of the image, containing the text "Emerging Themes of Content" in white, sans-serif font.

Emerging Themes of Content

THEME

1

Land Use Markets Embracing Coastal Regions, Globally

For the most part, the best real estate markets in the world are in coastal regions.

—FORUM PARTICIPANT

The biggest market event of the 21st century will be the rise of the global middle class.

—FORUM PARTICIPANT

Whereas 3.5 billion people, or roughly half the global population, live in coastal regions today, demographic trends suggest that over 75 percent of the world's population, or more than 7 billion people, will live in coastal communities before the end of the century. The combination of migration to coastal regions, population growth, rise of the global middle class, and accompanying economic development will drive dramatic growth in coastal real estate markets over this period. The value of insurable real estate assets in coastal cities will rise even faster than the population. These economic and demographic forces will combine with climate-change impacts to introduce new dimensions of market risk.

Developable land at the water's edge has long been considered prime real estate. This is where demand is high and where returns can be made—where people want to live and work and where transportation and other infrastructure connections have been concentrated through legacy infrastructure investments.

Coastal areas around the world have experienced rapid population growth and economic development over the past several decades. Of the ten most populous cities in the world, seven are located on the coast. Coastal populations are not only growing, but also urbanizing. Economists expect the 21st century to be defined by the rise of the middle class in the developing world, which will transform urban communities and infrastructure in coastal regions around the world.

For example, the value of insurable properties along the U.S. Gulf and East coasts was estimated to be more than \$10 trillion in 2012, an increase of almost 15 percent from 2007. This value is concentrated

Estimated Value of Insured Coastal Properties Vulnerable to Hurricanes, by State, 2012 (Billions of Dollars)

Coastal states	Coastal exposure	Total exposure ¹	Coastal as a percentage of total
Florida	\$2,800.8	\$3,562.7	79%
New York	2,679.5	4,385.7	61
Texas	1,143.5	4,406.7	26
Massachusetts	807.2	1,505.1	54
New Jersey	706.5	2,081.2	34
Connecticut	542.5	843.8	64
Louisiana	275.1	790.4	35
South Carolina	229.6	814.7	28
Virginia	176.7	1,685.9	10
North Carolina	159.6	1,756.2	9
Maine	157.7	273.6	58
Alabama	118.7	903.9	13
Georgia	101.8	1,861.7	5
Delaware	76.9	200.5	38
New Hampshire	61.0	259.9	23
Mississippi	59.0	464.5	13
Rhode Island	55.6	199.5	28
Maryland	17.1	1,262.2	1
Total, coastal states	\$10,168.8	\$27,258.3	37%
U.S. total	\$10,168.8	\$62,091.1	16%

Highly developed regions have greater amounts of insurable properties and a higher percent of that property in coastal regions.

Source: AIR Worldwide, 2012.

Note: Figures include residential and commercial properties.

1. Total exposure is an estimate of the actual total value of all property in the state that is insured or can be insured, including the full replacement value of structures and their contents, additional living expenses, and the time value of business interruption coverage.

in six states, with the majority located in Florida and New York. It is reasonable to assume that the value of this property will continue to climb as coastal communities continue growing in these states. This trend is indicative of trends occurring in many other coastal regions globally, such as the cities and urban regions along the Pacific Coast of North America, the South China Sea, the Bay of Bengal, the Persian Gulf, and the Mediterranean.

I just flew down the Eastern Seaboard of the United States on a beautiful, clear day, and as I looked out the window I saw billions and billions of dollars of prime real estate and infrastructure jammed against the coastline.

—FORUM PARTICIPANT

THEME

2

Climate Change as a New Source of Coastal Market Risk

Today's flood is tomorrow's high tide.

—FORUM PARTICIPANT

Some streets are flooded in Miami whenever we have high tide during a full moon. The water backs up through the sewers and a pool forms in front of someone's building.

—FORUM PARTICIPANT

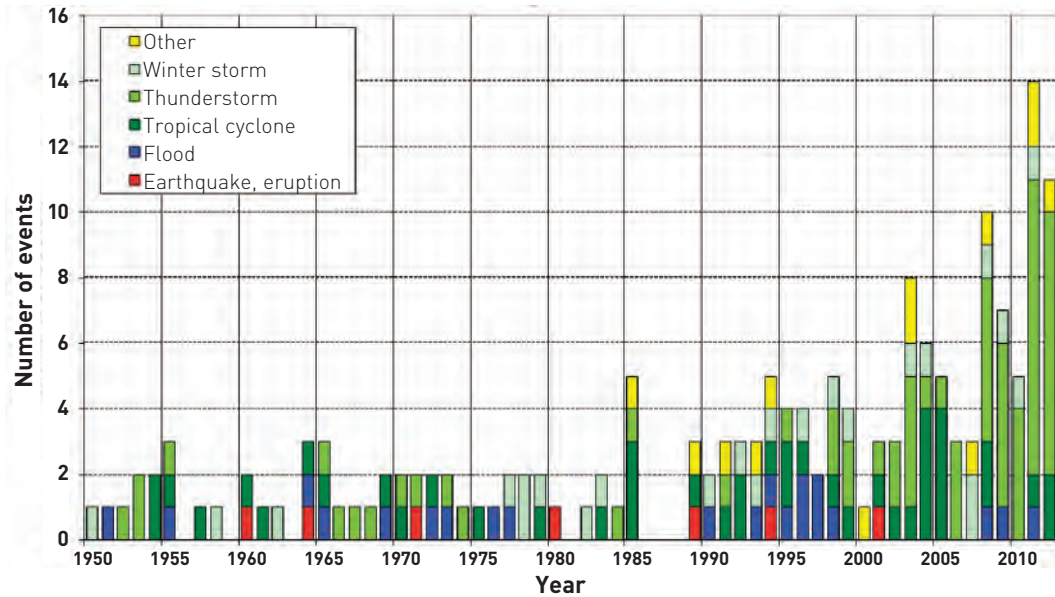
Rising sea levels and sea surface temperature over the past century are documented realities. Floods, hurricanes, and other extreme weather events are becoming more frequent or more intense, or both. These trends are expected to continue and worsen, especially if global greenhouse gas emissions continue unabated. The physical characteristics of the existing built environment do not reflect the underlying design criteria and the safety factors needed to address or mitigate these new risks.

As coastal real estate markets continue to change and expand through ongoing investment, the climate and coastal environment will be changing as well. Over the past 150 years, the earth's surface, oceans, and atmosphere have been getting warmer, with the National Oceanographic and Atmospheric Administration (NOAA) reporting accelerating rates of increase in the past few decades. Arctic ice is melting, glaciers are retreating, and the sea level is rising. Hurricanes are expected to become more intense and already appear to be striking farther inland. Other heavy-precipitation events, storms, and flooding are occurring more frequently and with more intensity in many places. These trends are expected to continue as U.S. land surface temperatures are anticipated to rise two to four degrees Fahrenheit in most areas over the next few decades. By the end of this century, temperatures will be anywhere from three to eight degrees warmer in the United States, depending on regional location and on future global greenhouse gas emissions. The sea level has risen eight inches over the past century, with a much greater rate of increase since 1990, and is expected to rise one to four feet by 2100.

If these trends continue as expected, "today's flood will be tomorrow's high tide," and tomorrow's flood will be much worse than today's. Sea-level rise combined with hurricane wind speeds will cause significantly greater storm surge and coastal inundation. Sea-level rise by itself is projected to flood coastal settlements in low-

Significant Natural Catastrophes

Events with \$1 billion in economic losses and/or 50 fatalities



Source: Munich Re, 2013.

lying areas during the course of this century, calling into question the potential resilience of a cross-section of land uses in many coastal communities around the world.

Documented trends of increased property damage and associated economic losses are already discernible as market trends in the United States. The combination of population growth, more coastal development, and higher real estate asset values—coupled with projections of sea-level rise and more extreme weather events—points to increasing market risk factors in coastal regions.

The number of natural catastrophes causing \$1 billion in economic losses, 50 fatalities, or both is increasing, with most concentrated in coastal regions.

THEME

3

The Rise of Modeling and Future Risk Scenarios

With each storm, the signal becomes louder and clearer that these storms represent an ever-worsening trend line.

—FORUM PARTICIPANT

The science is there. Change is happening. If your business horizon is next week, then no need to worry. If it's 50 to 100 years, you should worry. From a perspective of societal responsibility, you can't argue with the good science that is there.

—FORUM PARTICIPANT

Backed by unprecedented data collection, financial and other climate models and interactive web-based assessment tools are already being employed to characterize and quantify property casualty risks according to both current conditions and future emissions and climate scenarios.

NOAA's Digital Coast Initiative has mapped sea-level and flood risks for hundreds of counties along U.S. coasts for both the present and future scenarios. Private companies model storms and their impacts to estimate the likelihood and magnitude of site-specific property damage. These tools quantify and characterize important baseline conditions for the insurance and real estate markets, as well as for community and land use planning.

Predictive data are based on forecasts from complex climate models that estimate future sea-level rise, temperature rise, and other impacts of climate change using varying assumptions about future levels of greenhouse gas emissions and resulting atmospheric concentrations of these gases.

Data collected with laser remote sensing (or LIDAR, for laser imaging detection and ranging) are used to make detailed, highly accurate topographical maps of coastal landscapes, shallow water areas, and project sites. These maps enable the impacts of sea-level rise to be determined and graphically illustrated using web-based tools. LIDAR data have been combined with socioeconomic data to indicate the social and economic vulnerabilities of different floodplains. The impact of future sea-level rise and storm surge on sensitive ecological areas has also been modeled using LIDAR mapping. All these tools, created by NOAA, are available to the public at <http://www.csc.noaa.gov/digitalcoast/>.

Catastrophe models (or cat models) are sophisticated tools used by the insurance industry to estimate average financial losses for properties in specific locations in the event of a variety of natural disaster scenarios, including hurricanes, storm surge, and windstorms. In addition to using modeled relationships of storm characteristics, they



use detailed information on property conditions, infrastructure, and other factors, along with a localized understanding of topography. Some models result in a street-by-street analysis of vulnerability across the urban environment that is used to estimate damages and economic losses from a given type of storm for both property damage and business interruption.

Although cat models typically rely on historical data to determine the characteristics and frequency of disasters, they can estimate financial losses under longer-term future climate-change scenarios and thus assist in cost/benefit analysis for resilience planning.

NOAA's Digital Coast initiative provides interactive mapping tools that provide a visual representation of how upland areas will be affected by rising sea levels and flooding. Site-specific scenario mapping can be explored at <http://www.csc.noaa.gov/digitalcoast/>.

THEME

4

How Will Markets Price the New Climate Risks?

Smart CEOs should be talking about risk as often as they talk about profit.

—FORUM PARTICIPANT

The need to better price climate-change risk is not mainstream thinking in the real estate industry today, although some investors are starting to understand this need. Hidden in every real estate portfolio is a climate-change time bomb.

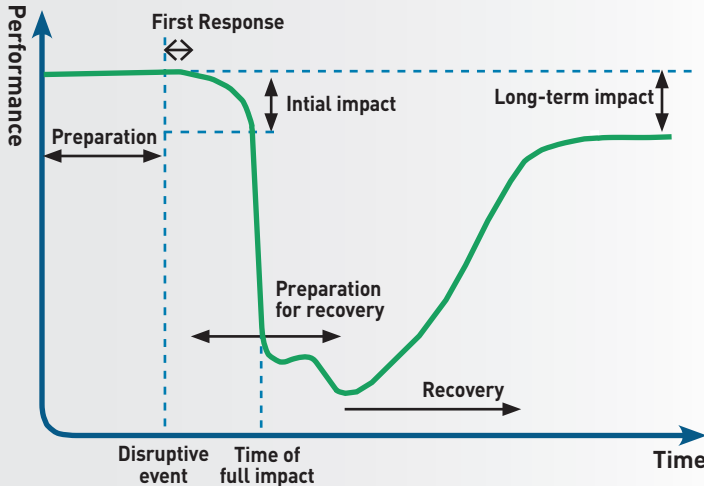
—FORUM PARTICIPANT

Insurance and property markets will begin to price climate-change risks in a more thorough manner as those risks become more clearly characterized and widely accepted by market participants, policy makers, and regulators. As this happens, project-based factors of resilience will become increasingly important for insurance, investment, and lending transactions. Though the insurance industry already prices risk in its insurance products, prevailing underwriting practices do not reflect long-term projected risks in typical property casualty insurance policies. Similarly, flood insurance is publicly subsidized through the National Flood Insurance Program and is currently being critically reviewed with respect to risk pricing.

Real estate asset values are directly influenced by the cost and availability of insurance products. As climate risks affect the availability and cost of insurance, they will also influence the availability of capital investment for increasing numbers of at-risk properties. The real estate market will respond more broadly to support risk-mitigation measures and make changes in asset valuation models that are more cautious and take a longer-term view. Commonsense criteria such as location, construction type, and access to infrastructure already contribute to asset value. How quickly the markets price climate risk depends on the increased evidence of climate-change impacts, the building of consensus among regulatory frameworks, and the dissemination of knowledge and data.

The insurance industry provides financial incentives for risk mitigation through risk-based premium pricing. For example, through adherence to more-stringent building standards or siting require-

Business Performance after Disruption



This concept diagram illustrates the financial losses that businesses face over short- and long-term time frames after a catastrophic event.

Source: Yossi Sheffi & James B. Rice Jr., *MIT Sloan Management Review*, 2005.

ments, risks from extreme weather events will be reduced and terms and availability of insurance coverage will improve. However, insurance mechanisms cannot incentivize the uninsured or self-insured to mitigate risk, and the ability of the insurance industry to influence customers to reduce greenhouse gas emissions is limited.

In addition, the industry is not always allowed to price premiums based on risk. Politicians want to provide their constituents with low-cost insurance. In some cases, state-run insurance programs supplant and underprice the private market—a practice that both encourages unsustainable development and results in taxpayers as a whole paying directly for losses after a disaster. Direct government intervention as a provider of insurance at lower rates than the private market offers is counterproductive in achieving resilience.

As a corollary example of market transformation, the increased attention to the efficient use of energy in buildings is already valued by many segments of the real estate market. Some investors are considering climate-change risk as a regulatory risk that can be avoided by owning energy-efficient, low-carbon-emission buildings, as evidenced by participation of companies as members of the ULI Greenprint Center for Building Performance. In the United Kingdom and Tokyo, Japan, where greenhouse gases associated with buildings are regulated, higher taxes are assessed on buildings that do not use energy efficiently, and, in some cases, such buildings are not allowed to operate without mandatory retrofits.

THEME
5

Uncertainty in Preparing for Future Events

You can make a deterministic decision and avoid a specific risk, or you can make a stochastic decision and hedge risk across the spectrum of dynamic market trends and environmental factors.

—FORUM PARTICIPANT

The biggest issue is not a lack of engineering solutions; it is getting an agreement that the problem of climate change needs to be solved. Choosing not to act is where we are failing.

—FORUM PARTICIPANT

Responsible planning for probable future events is a must and should not be limited to recovery planning for post-disaster circumstances. Advancing resilience is hindered by information gaps; uncertainties about the path climate change will take, especially in a specific geographic area; lack of political will; and misaligned public policies—not to mention market uncertainty regarding where sources of investment and financing will be found. Most communities—even those that have completed a climate adaptation plan—do not integrate considerations associated with resilience into day-to-day decisions, while others still debate the reality and cause of climate change, choosing to rebuild “as was” instead of forging new strategies that anticipate new conditions. Coastal communities have the choice and the opportunity to make investments in their long-term sustainability and avoid costly and disruptive impacts when the next storm hits.

Climate scientists are unsure of the precise path climate change will take in specific locations or the extent to which greenhouse gases can be reduced to soften their worst impacts. Efforts are underway to refine and localize climate-change predictions to make them more useful for urban and regional planning. But existing knowledge should be enough to begin the revision of standards and practices for the building or rebuilding of communities to make them more resilient.



Communities are becoming engaged in the sustained effort to better understand the uncertainty associated with a new generation of coastal risk factors that are unique to individual regions. For example, Building a Resilient Energy Gulf Coast is a consortium of companies and stakeholders dedicated to identifying, documenting, and quantifying new risk factors along the Gulf of Mexico. Highlights from the consortium's data collection and risk assessment (available at <http://entergy.com/gulfcoastadaptation>) include the following statements regarding economic vulnerability and uncertainty in the Gulf Coast over the next two decades:

- Uncertainties could represent cumulative economic damages of up to \$350 billion, including impacts on growth and reinvestment trajectories.
- Uncertainties include climate-change scenarios that could increase loss scenarios by up to 60 percent of baseline assumptions.
- Uncertainties include a lack of understanding of how individual adaptation measures might produce economic benefits.
- Uncertainties include a lack of understanding of how benefits are produced in the context of conflicting interests of community and market stakeholders.

It is not known with certainty how high sea levels will rise or when the next hurricane will strike, but the emerging threats that climate-change factors introduce to coastal infrastructure are having a material impact on communities.

THEME

6

Resilience Is Interdisciplinary and Systems Based

A city or a town is a system of systems, and today most property investors take the many forms of public infrastructure of a city for granted, whether they be physical or social.

—FORUM PARTICIPANT

No matter how well designed, buildings will not be resilient if the systems they depend on, such as water, transportation, communications, and electricity, are not resilient.

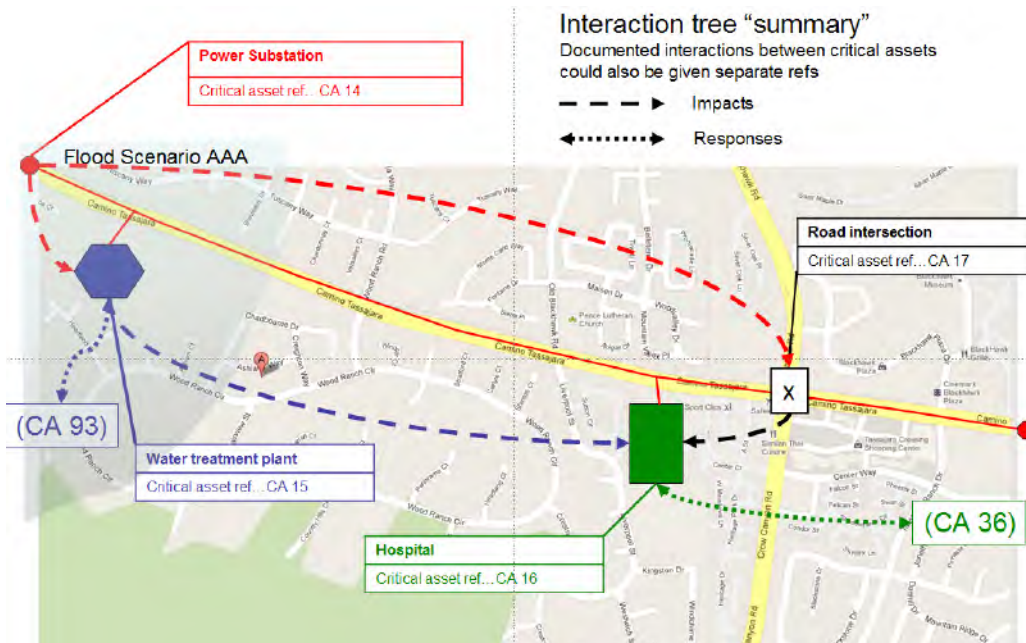
—FORUM PARTICIPANT

It is a new day for urban planning, in light of the need for new risk-management considerations to be integrated and reconciled across multiple sectors of local economies. Whether embracing new paradigms of economic development, transcending social networks, harnessing communication technologies, or anticipating the new trends in service delivery, planning for urban investment has revealed the complexity of cities themselves. Planners, investors, water and electric utilities, telecommunications companies, and insurers are all helping create and implement new strategies for the design and operation of infrastructure, including energy, communications, transportation, water, and other systems.

The challenge is to minimize the risk that these individual systems fail, as well as to avoid potential cascading effects within one system or across the “system of systems.” Indeed, insurance claims data indicate that disruptions in business operations, including supply chains—frequently a direct result of failures in electricity, transportation, telecommunications, and water and sewer systems—are often more costly than direct property damages.

Causes of systems damage in recent natural catastrophes—such as the elevation and location of mechanical equipment, the prevalence of old wiring, or the weakness of levees—indicate that many investments in community resilience are necessary in order to contain and reduce impacts and losses. Resilience is enhanced by the choice of where to locate assets as well as how to build them. Regional planning of green infrastructure, such as wetlands and dunes, can have profound impacts on site-based resilience.

Critical Asset Management: System of Systems Impacts



This IBM diagram illustrates that urban systems are interlinked and rely on each other to service individual sites. Community resilience strategies should recognize that interdependent systems need to function together in order to avoid cascading failure. IBM Corporation.

Individual properties are supported by common systems and infrastructure. No matter how well designed a building is, the occupants will not be resilient if the urban systems they depend on—water, transportation, communications, and electricity—are not also resilient. A systems approach is needed to assess critical infrastructure systems and interrelationships among various parts so that strategies can be devised to avoid cascading failures.

For example, smart grids, net metering, and distributed generation will allow identification and separation of damaged areas of the grid during a natural catastrophe. A smart grid will help reduce emissions by supporting renewable energy and introduce the potential for efficiencies from demand-response behaviors. It also will accommodate additional renewable energy in the grid, thereby helping reduce emissions from buildings.

Building owners and tenants should work together and with insurance companies to mitigate site-specific business interruptions, including disruption in their supply and value chains. On average, an estimated 50 percent or more of the insured losses following severe coastal storms are attributed to business interruption rather than property damage.

Differences in cohesion, social networks, and governance across communities and regions have an outsized impact on community resilience and the effectiveness of emergency response. Cultivating a common understanding across communities by building trust, improving communications, and engaging multiple stakeholders is a necessary part of the process.

Approaches to Assessing Community Risk and Resilience

Systems approach: looking at critical assets and the interrelationships among them, whether infrastructure or real estate assets.

Addressing operational risks: assessing the risk of business interruption, including supply chain disruption.

Boosting community social capital: improving governance, communications, education, and consensus building.

Hedging risks: Accommodating a multiplicity of uncertainties through multiple risk-management strategies.

Preparedness: having the response mechanisms in place to adequately perform after impact or disruption.



Evolving Professional Practices

Following the damage of Superstorm Sandy, we had to go back and reeducate ourselves on what we were and were not insured for and figure out arcane definitions, such as how the deductible was calculated for damage due to wind-driven rain.

—FORUM PARTICIPANT

Taking action on coastal resilience means modifying and enhancing professional standards and practices in many aspects of real estate and land use. The potential for innovative practices abounds. Land use zoning and building codes in at-risk coastal regions are beginning to reflect the heightened risks of floods and storm surges. Existing buildings and infrastructure are being assessed according to future climate-change scenarios, and new, more resilient retrofits and designs are being proposed for buildings, infrastructure, and public spaces.

Responsible practices are critical to bringing about lasting resilience—from investors and developers setting requirements that exceed current standards to planners, architects, and engineers creatively achieving new performance criteria in cost-effective ways.

Frames of Innovation

The concept of resilience is the basis for a host of innovations in professional practices associated with the built environment:

- retrofits and new design strategies for buildings, infrastructure, and public spaces;
- context-sensitive land use zoning that in some cases provides for incremental retreat;
- higher-quality engineering standards for building design;
- measures to reduce greenhouse gas emissions in buildings, systems, and infrastructure;
- disaster preparedness strategies that concurrently reduce emissions; and
- disaster recovery strategies that advance long-term comprehensive resilience plans.



New Waterfronts and Legacy Districts

Newly redeveloped urban waterfronts are being designed to account for new environmental variables. Surrounding upland areas that have not had their elevation raised over the years and that are served by legacy infrastructure networks are often more vulnerable. This waterfront project in Washington, D.C., includes design features that anticipate multiple storm and surge factors, such as “bathtub” parking, elevated grades, district-based cogeneration, and raised vent openings. EE&K Architects/Perkins Eastman.

Land use professionals are in the position to develop new standards. Innovative real estate investment strategies will have an outsized influence on improved practices, and the success stories will become models used to shape new regulations.

Setbacks from the coast may be required by law or determined by the investor, lender, insurer, designer, or builder. No-build zones and “retreat” are being discussed as options in response to the trends related to future severe coastal storms, increases in sea-level rise, and the expansion of floodplains. Florida and North Carolina provide examples of how building codes and erosion setbacks have been changed in response to losses from weather-related natural disasters—policies that could be translated and implemented elsewhere.

Specific engineering improvements required by insurers post-Hurricane Sandy likewise can be adopted for use in other locations. Models for resilient design in planned communities, urban open spaces, and large-scale development near the water have been offered as solutions and can be replicated. Real estate owners have championed green building design and management and will continue to do so, thereby demonstrating leadership in reducing greenhouse gas emissions. Win-win design solutions are those that reduce risk from extreme weather while reducing emissions.

While the major market actors look forward in their valuation analysis, most of the state regulators look backward at historical benchmarks. Meanwhile, sustained political pressure seeks to keep flood insurance rates below risk-adjusted levels.

—FORUM PARTICIPANT



Aligning Stakeholders

These solutions require industry, regulators, and the government to coalesce around a common set of goals. It's a long-term issue for all coastal stakeholders.

—FORUM PARTICIPANT

When the evidence is incontrovertible, people from across diverse communities can agree upon a call to action.

—FORUM PARTICIPANT

Private solutions won't fix the elevation of the sidewalks, curbs, and storm drains outside your building.

—FORUM PARTICIPANT

Individuals, businesses, civic organizations, and government must work together to define, fund, and implement long-term measures that make coastal communities more resilient. The real estate and insurance industries are natural partners in designing and implementing weather-related risk-mitigation measures for real estate. Individual properties cannot be resilient to new coastal risks if the supporting public infrastructure is not also resilient. Investment and land use decisions must both respond to market demand and conform to regulatory requirements in a way that reduces community vulnerability.

The real estate, insurance, and finance industries share an interest in preserving and protecting the built environment, but they can only provide effective long-term solutions within the framework of sound markets that are governed by responsible and efficient public policies and regulations. Private stakeholders must work with all levels of government to help shape policies. Likewise, all stakeholders must come together to strategically fund, finance, and implement resilience measures.

Working together, the stakeholders can improve policies related to zoning, building codes, protection of natural buffers, insurance regulations, and other elements that foster and promote thriving communities. In turn, insurance price signals can help advance new land use regulations and broader regional policies that take climate-change risks into account.

The Southeast Florida Regional Compact and the New York State 2100 Commission are excellent examples of local or regional initiatives that bring stakeholders together to address the many complex



Cofferdam Construction in New Orleans

Projects of regional interest require broad stakeholder alignment, which often includes federal, state, and local regulators, as well as alignment with the local community, business interests, and nonprofit stakeholders. Whether the project involves affordable housing strategies, shoreline protection, or regional green infrastructure, achieving political alignment is never easy or fast. U.S. Army Corps of Engineers.

challenges of stakeholder alignment and community investment. Longer term, it likely will be necessary for these initiatives to evolve into public/private partnerships that align and coordinate public and private sources of capital as all stakeholders explore responsible and creative ways to fund needed changes in a feasible way.

The ULI network is an excellent resource for bringing diverse stakeholders together. ULI can disseminate information and introduce programs through its network of district councils, as well as work with city, county, and development officials from central governments.

If a community has been hit, responders need to understand the psychology of loss and formulate an appropriate timeline to engage all stakeholders.

—FORUM PARTICIPANT



Forum Panel Summaries



The Risk and Resilience in Coastal Regions Forum was organized around a series of panels, each moderated by a ULI CLUE adviser, followed by interactive discussion. Panels were interspersed with a workshop and individual speeches or presentations. The forum agenda was designed to engage the following questions:

- What are the available data sources for changing weather and sea levels?
- How are private entities using risk-related models to support market decisions?
- How is the property insurance marketplace responding to emerging risks?
- How have communities responded after being struck by a natural disaster?
- How are real estate investors placing a value on these trends?
- How do coastal risks vary across regions?
- How do coastal risk profiles vary across the metropolitan landscape?
- How are coastal risks informing individual projects or investment decisions?

NOAA's Digital Coast Initiative

In a workshop, representatives of the National Oceanographic and Atmospheric Administration described NOAA's Digital Coast initiative. Digital Coast provides geospatial and other data on a county basis in U.S. coastal areas, along with tools, training, and management strategies that communities and businesses need in order to understand weather-related risks and vulnerabilities and address coastal risk. This is accomplished through a service center and "a constituent-driven, integrated enabling platform supporting coastal resource management." This interactive website supports county-level coastal resource management in a site-specific manner.

A major Digital Coast product is topographical data collected with laser remote sensing, or LIDAR, in coastal mapping to show impacts of sea-level rise. Digital Coast is only authorized to acquire LIDAR data within certain parameters along coasts. This geospatial data set is focused on the United States and the Caribbean and is likely the most advanced in the world.

The NOAA Sea Level Rise Viewer integrates multiple scientific data sets and makes them easily accessible to users in a web-based platform. The platform also links socioeconomic and geospatial data, as well as information on environmental hazards and ecosystem resources. The Nature Conservancy, a Digital Coast partner, works with academic institutions to estimate impacts of future climate change scenarios on natural areas such as bird habitat and wetlands on Long Island Sound and the Gulf Coast.

Other topics discussed included integration and accessibility of data; national-level coastal data sets; use of International Panel on Climate Change scenarios combined with Digital Coast technologies to visualize and analyze coastal impacts of future climate change; and use of ecosystem resources to protect coasts. Digital Coast provides training courses in use of its resources, including webinars and other web-based guidance.

NOAA's recent work has prioritized outreach to the local public sector and creation of information frameworks that allow for locally generated data overlays that respond to site- and community-specific issues and concerns. By its own admission, NOAA has not aggressively conducted outreach to

private sector stakeholders but expressed enthusiasm for working with ULI as a future partner.

Dialogue included:

- To make your community resilient, you must first understand your own vulnerability; each community is unique and faces its own challenges.
- Resilience results from a combination of understanding your own community and understanding the strengths and vulnerabilities of its natural resources.
- NOAA has created a viewer that enables anyone to visualize the impacts of climate change. But why aren't more people using it?
- Floodplain maps are in the process of being updated; the Federal Emergency Management Agency (FEMA) is responsible for this. Digital Coast overlays its data on FEMA maps.

Informing Markets with Dynamic Information

Panelists covered a variety of approaches to risk-management and resilience planning and the associated information flow. One panelist discussed catastrophe modeling, or cat modeling, a sophisticated data- and computer-intensive tool that assesses and values risk of all natural perils for the insurance industry, its customers, and the capital markets. Cat models calibrate risk and provide estimates of damages to insured books of business, of financial loss, and of specific building vulnerabilities based on storm characteristics. A model for storm surge that simulates hurricane flood surge and estimates damages on a street-by-street basis in lower Manhattan was presented.

Another panelist discussed a resilience process based on a “system of systems” approach that includes energy, water, and transportation systems, as well as ecological and social systems. If something goes wrong in a system, it is necessary to anticipate what else will go wrong in that system and other systems as a result. Resilience measures range from long-term advance risk prediction and mitigation to event response and rebuilding after a disaster, including obtaining information and setting strategy at various points in this resilience “spectrum.” New, hand-held phones and

internet-linked devices providing real-time information flow were identified as tools that can aid in the monitoring of and response to emergencies.

A third panelist spoke about hedging strategies for resilience planning under conditions of volatility and uncertainty. If a decision maker knows something is certain, a deterministic decision should be made, and if something is less certain, the risk should be hedged. For example, the question is not whether nuclear power is needed—the near-term need for nuclear power in the energy mix is widely acknowledged—but rather how much is needed. Examples cited of policies that hedge risks are a pilot project in Montreal that gives lower mortgage rates and cheaper lines of credit to buildings that use energy efficiently, and a policy in Singapore that taxes high-carbon-emission cars and gives bonuses for low-emission cars.

Dialogue included:

- Climate-change risk could lead to limitations and prohibitions on development on what many consider the most valuable land available—that in the coastal regions.
- Studies show the disaster mortality rate is higher in less socially adhesive communities.
- Solutions are needed that are both resilient and sustainable—that is, that help reduce greenhouse gas emissions. The smart grid is a solution that is both.
- This century will be about high volatility across a variety of factors.
- Virtually nobody in the world has taken a full inventory of critical assets necessary for resilience.
- Buried in every real estate investment portfolio are a number of unaccounted-for risks associated with climate change.

Trends in the Insurance Marketplace

The insurance panelists discussed the trend of increased weather-related insured and economic losses in recent years. Panelists agreed that these losses likely will continue to increase as a result of population growth, economic development, the

rise of the global middle class, and more weather volatility, including volatility in storm frequency or storm intensity, or both.

The global reinsurance industry, which is located mainly outside the United States, is currently robust. Large insured losses from storms such as Hurricane Sandy result in changes in insurance deductibles, premiums, and coverage. For example, higher-quality construction, revised electrical and structural standards, and different placement of generators and sprinklers will be required post-Sandy for insurance renewals and to help lower insurance costs in some high-risk areas. Losses from Sandy are not enough to affect the market overall, but changes will be made in some insurance renewals. Someone acquiring a real estate asset should determine if upgrades are needed. Buildings certified under the Leadership in Energy and Environmental Design (LEED) program are sometimes deemed to be less risky because of the high quality of construction.

Larger losses from natural catastrophe every year are leading to other insurance underwriting changes. For example, some insurance policies may require water treatment backups to address the potential for fuel spills or asbestos release after storms. On average, about 50 percent of insured losses are related to business interruption, though the figure varies widely by individual case.

Reinsurers, cat modelers, and insurance rating agencies evaluate risk in forward-looking ways, some using climate change theories and expected changes in sea temperatures to estimate increased frequency of severe weather events. However, state regulators look backward at historical trends and subsidize rates in environmentally sensitive areas.

If regulators do not allow private insurers to base premiums on actual risk, properties may become uninsurable by the private insurance market. State-run insurance pools may underprice insurance in the name of affordability—a practice that is financially and environmentally unsustainable because it creates financial incentives that lead to higher land use risk. The National Flood Insurance Program and Florida's Citizens Property Insurance Corporation were suggested as examples of programs that underprice risk. Consumers in unaffected areas outside high-risk coastal locations are effectively subsidizing those who have properties in

high-risk locations when state-run insurance pools do not have the money to pay claims.

The insurance industry is trying to find cost-effective ways to mitigate risks—for example, through the Institute for Business and Home Safety. An emerging combination of advocates that includes environmental groups, the insurance industry, and taxpayer advocates makes a powerful coalition supporting risk-based insurance pricing.

Dialogue included:

- The insurance industry is paying out ever higher property casualty losses related to natural catastrophes, regardless of the public's opinion of climate change. The insurance industry is actively debating what its long-term business model will be in an era of increasing frequency of catastrophic weather events.
- In the past decade, seven of the ten largest natural catastrophes in terms of insured property loss occurred in the United States.
- The political, regulatory, and economic systems may be inadequate in their response to the increased frequency of weather events.
- Most of the public is not aware that it is supporting the subsidy of flood insurance for the few property owners who own buildings in high-risk locations.
- After Sandy, from a property casualty perspective, how many of the severely affected properties should be rebuilt? And Sandy's impact on insurance underwriting practices will not be as great as that of hurricanes Katrina, Wilma, and Rita.
- Big storms are not just hitting first-tier counties; they are now extending farther inland. Inland assets are not built to the same standards as coastal assets. The example was given of the flooding in Vermont after Hurricane Irene in 2011.

Report from the New York State 2100 Commission

In December 2012, New York Governor Andrew M. Cuomo convened the New York State 2100 Commission to outline action to prepare for increased severe weather attributable to climate

change. The recommendations of the report, which was issued in January 2013, fall into five categories:

1. Protecting and upgrading existing infrastructure;
2. Rebuilding to higher standards to mitigate risk (e.g., raising infrastructure such as water, sewer, and transportation);
3. Natural solutions in lieu of “hard” infrastructure (e.g., planting trees rather than installing drainage pipes to prevent runoff is cheaper and has more ancillary benefits);
4. Revisions of land use frameworks (e.g., the evaluation of places where rebuilding should be limited or prohibited); and
5. Institutional coordination, including integrated planning, improved data and tools, governance, education and training, and ways to finance needed improvements.

Dimensions of Community Decision Making

Dinner discussion convened ULI members who have participated in post-disaster rebuilding. Dialogue focused on the community aspects of coastal reconstruction and resilience, using Galveston, Texas, as a case study for how communities rebuild after flooding. Studying past recovery efforts like the ones in Galveston and New Orleans can indicate which policies were successful and the mistakes that should be avoided in future rebuilding efforts.

The discussion included the strategies used to mix private and public investment to finance the rebuilding of 10,000 houses in Galveston.

Other themes were the importance of giving the affected community time to grieve, and the tension between rebuilding strategically and the need to speed reconstruction for economic reasons. The dialogue acknowledged the tension between the emerging professional cadre of community rebuilders and the need for communities to create the institutional capacity to lead their own resurgence. Yet, it was also acknowledged that more natural disasters will take place in the future and society cannot continue to make the same mistakes again.

The Changing Landscape of Business and the Environment

In his keynote address, Fred Krupp, president of the Environmental Defense Fund, said society cannot simply treat the symptoms of climate change, but rather must address its cause by reducing greenhouse gas emissions. Emissions mitigation, which is getting at the root cause of the problem, must be part of building resilience with the goal to avoid the unmanageable (reduce emissions to avoid ever greater impacts) and manage the unavoidable (build resilience into communities in order to be able to withstand or adapt to impacts). The scientific community states there is an urgent need for action and a limited time to act.

The focus on resilience needs to be for the long term. It includes redundancy, backups, flexible design, and ways to cordon off parts of the system that fail. Resilience can be enhanced through decisions about *where* projects are built, as well as *how* they are built. Natural barriers and protections should be used to mitigate weather-related risk whenever possible—for example, stabilizing sand dunes and rebuilding wetlands around New Orleans after Hurricane Katrina. The power grid should be attended to by developing micro-grids, heat and light islands, and smart grids that allow identification and separation of damaged areas of the grid during a natural catastrophe; reducing energy use during peak demand periods; and integrating more renewable energy in the grid.

Emissions can be reduced through more efficient energy use and use of cleaner energy. President Obama deserves credit for doubling vehicle fuel efficiency standards and implementing rules for carbon emissions from power plants, Krupp said. Restoration of coastal Louisiana after the oil spill, introduction of a cap-and-trade program for greenhouse gases in California, and renewable energy development in New Jersey represent recent advances. The United States is not yet ready for a national climate bill, so politically a bipartisan path with business cooperation is needed. It is real estate companies and insurance companies that will be on the front lines of these changes.

Dialogue included:

- For a successful dialogue, we need to start with what we can agree on.

- It is clear that there are going to be some areas where it is just not appropriate to rebuild. Conversely, there will be other areas where we simply cannot afford to retreat.
- The president needs to lead the national conversation.
- We need to learn to work more with Mother Nature instead of against her.
- Today's grid is still operating the way Thomas Edison laid it out 100 years ago. Then, it was visionary; today, it is outdated.
- Society needs to spend a lot of money on infrastructure no matter what. We always have. It just makes sense to spend it wisely—to make things better rather than worse.
- We need to get Congress back in the game, and we need to change the politics on this issue. That's where the voice of business needs to come in.

Inside the Investment Committee

As real estate markets in coastal regions display great vibrancy, climate-change risks create new challenges for investors and developers. Panelists indicated that leading real estate investors are starting to consider long-term risks associated with climate change, both in terms of climate mitigation and adaptation. Myriad forces are present in the marketplace that are already affecting real estate investment portfolios, lending criteria, and insurability.

Given the diversity of the real estate marketplace, the impact of these issues is not uniform and takes many forms across geographic and industry submarkets. Even in the case of lower Manhattan, some buildings continue to be bought and sold while others undergo remediation or rehabilitation in order to reopen to serve tenants who want a presence in that unique market. Panelists cautioned that in many locations, the memory of past disasters is short and markets continue to thrive, while in others, owners are having trouble selling properties and exiting the marketplace.

Panelists agreed that investors are accustomed to managing risk; as such, coastal risks become one among many important risk factors in real estate.

Beyond the fundamental decisions regarding a building's location, the panelists agreed that many of the issues related to coastal resilience fall in the realm of public infrastructure, and all agreed that representatives of the property markets have a special responsibility to engage the public sector regarding resilient infrastructure.

Panelists also agreed that the financial partners in real estate investment—lenders and insurers—so far have not properly priced risk in their approach to underwriting. If they had, they would not be financing buildings in coastal regions in the same way they do in other regions. Better pricing of risk will require buildings to meet higher building and zoning standards to get a loan or insurance. Asset valuation needs to change to account for the likelihood of more storms like Sandy in the future. Higher insurance costs related to climate risk will show up over time, and some assets may even become uninsurable.

After having priced coastal risk appropriately, investors continue to focus on the long-term investments necessary to achieve greater resource efficiencies that lower carbon emissions. More-efficient buildings have lower operating costs, and lower operating costs equate to higher asset value and higher base rent for the owner or investor. All agreed that in the future the carbon intensity of individual buildings may be priced even more into building prices. It will create a two-tier market, with lower prices for less energy-efficient buildings.

In addition to physical risk, there is also regulatory risk associated with low energy efficiency. In the United Kingdom, a carbon tax is imposed on buildings according to an energy efficiency rating: the lower the energy efficiency, the higher the tax. Making buildings more energy efficient in the United States today will reduce the risk that they could be subject to regulatory risk in the future.

Dialogue included:

- There is an opportunity cost to not investing in coastal markets because some of the best real estate in the world is located there. The challenge is to understand the site and the factors that reduce risks.
- The need to better price climate-change risk is not mainstream thinking in the real estate industry.

try today, although some investors are starting to understand this need.

- Memories can be short; investors are already buying hotels in New Orleans without fully understanding flood and hurricane risks.
- Carbon is the new asbestos. The difference between carbon and asbestos is that carbon is a continuous long-term cost whereas getting rid of asbestos involved a one-time payment.
- Asset valuation clearly needs to evolve and use an enhanced set of metrics that properly assess a building's energy performance and resilience.

Assessing Risk across Regions and Markets

Climate-change risks vary by region. Though differences in governance, infrastructure, and land use, in addition to physical difference in coastlines, make it hard to develop specific recommendations for resilience measures across regions, communication among sectors that prepare for emergencies is important everywhere. Speakers highlighted the need for more stringent building codes, zoning restrictions, use of natural buffers and barriers, and new public/private partnerships to reach common goals.

The U.S. Department of Homeland Security has conducted a regional climate-change risk assessment and concluded that risks vary widely because of the nature of the threats and because governance, regulatory structures, and technical capabilities differ greatly across regions. Community leadership—as well as communication and coordination among sectors—on planning before and action during a disaster is critical.

Pricing of insurance premiums needs to reward resilience and incentivize risk mitigation, thereby reducing the overall cost of climate risk to the economy. Since insurers expressed the need to make a larger underwriting profit (because they can no longer achieve high investment returns), they will need to be sure that premium pricing reflects true risk.

While media attention is focused on metropolitan markets affected by recent storms, rural areas, such as North Carolina's Outer Banks, exhibit

dramatically different land use characteristics. In North Carolina, resilient land use policies are being introduced with the following practices:

- a requirement that structures be built with a setback that is 30 times the rate of erosion, which coincides with the typical 30-year term of a mortgage;
- rules establishing that the bigger the building, the greater the setback;
- dedicated setback lines for beach nourishment and dune protection;
- increasingly stringent building codes, with some structures sitting on pilings above flood elevation;
- a prohibition on use of hardened structures like jetties and seawalls to prevent erosion; and
- establishment of no-build zones.

Dialogue included:

- There is no guarantee that another storm like Hurricane Sandy (or any other precedents) will be repeated. There are many other potential events that could happen.
- The government cannot assume the financial responsibility for all damages. Building owners and the broader public need to come to understand this.
- While there is a growing understanding that communities need to plan for resilience, how do you get stakeholders to define and understand the real risks?
- Despite increased attention to community resilience, insurance premiums in high-risk areas will continue to rise as more climate-change impacts are felt.
- Many coastal communities are regional drivers of economic activity. These economic engines can only attract business if their social, economic, and environmental underpinnings are intact.
- Across a variety of regions, the issue of coastal retreat represents a political challenge whenever property owners prioritize their own interests above all else. Many multimillion-dollar homes and hotels are located on the coasts, and no one will want to leave those properties behind.

Diversity across the Metropolitan Region

The panel discussed specific measures for resilience across the diversity of neighborhood communities in urban areas. Downtowns, inner-ring neighborhoods, and suburbs, as well as seaside destinations, represent different land use contexts for resilience planning. Community strategies in one neighborhood may be very different from those in another, even while baseline issues such as protecting residents and emergency planning are championed as critically important throughout the metro region. Disparities in the social and economic attributes of a neighborhood are factors that cannot be overlooked when assessing how successful it will be at managing a storm or flood.

The example of the Southeast Florida Regional Climate Compact was explored to illustrate how new partnerships are being formed to develop regional climate-change action plans in order to help achieve consensus on needed investments. The southeast Florida coast is predicted to add 3 million residents over the next 50 years. Part of the political decision-making process is to determine where construction should be encouraged and where it needs to be prohibited. Though forecasts indicate Miami Beach will be underwater by 2050, retreat is not being considered as an option, and new infrastructure investments that will further “harden” this core area are being explored. Canals dug for agricultural land are projected to no longer provide enough gravity drainage at the seasonable high tides to prevent flooding in some parts of the metro area.

One panelist emphasized that individual properties cannot be resilient if the community’s interconnected systems are not. Frustration was expressed that not enough is being done to document how urban systems relate to each other in order to prioritize future investments. Consensus was reached on the panel that while necessary engineering solutions are either already known or readily feasible, the primary challenge is getting agreement that political action must be taken. People and communities choosing not to act will ultimately represent both negligence and failure.

Another panelist discussed the importance of getting communities to understand the issues. Diverse communities need to be empowered to both plan

and act. Special care needs to be taken to create a focus on how community stakeholders communicate and work together when seeking to bridge the gap between long-term planning and emergency management.

In a review of the lessons of infrastructure reconstruction in New Orleans, it was pointed out that none of the stakeholders knew at the outset how much the new water-related infrastructure for the Gulf Coast would cost. The ultimate budgets penciled out to be \$14 billion for levees, pumping systems, and green infrastructure restoration, while new designs for floodgates incorporated renewable energy projects (windmills) that would never have been contemplated before Katrina.

Dialogue included:

- Across metro regions, planners must contemplate not *where* communities are rebuilt as much as *how* they are developed.
- Nature will always win. There is no way that individual neighborhoods are going to design themselves out of coastal risks, even with unprecedented infrastructure investments.
- Urban politics is an important consideration in any planning process, and stakeholders cannot act as if there is a single shared and coherent set of resilience priorities.
- Planners must understand that the overriding objective must be to protect people and mitigate the risks posed to communities.

On Site: Mitigating Risk in the Project

This panel explored how resilience affects individual businesses or individual projects through direct property casualty, weather-related business interruption, or value-chain disruption. The conversation began with the immediate site design of resilient waterfront developments and extended to evaluating site-based risk—determining what risk is known and quantifiable and what is not known and needs to be mitigated. Well-planned, highly resilient developments like Battery Park City in Manhattan recently demonstrated how private developers can protect their buildings from flooding and water damage.

Panelists observed that:

- Owners of large buildings are taking steps to reduce new risks, such as hiring consultants to assess property-based risks on a short- and medium-term basis and to draft site-specific emergency plans.
- Supply-chain disruptions from natural events can cripple businesses and economies. For example, ash from the eruption of Eyjafjallajökull in Iceland in 2010 had real impacts on the European economy. Disruption in the Toyota supply chain due to flooding sent ripple effects around the world.
- While the impacts of storm events vary, property damage is usually 35 percent of the economic cost of a hurricane; business interruption is 65 percent; and up to 20 to 30 percent of shareholder value can be lost in a supply-chain disruption.
- Marine insurance will typically cover loss of inventory, but not costs of delay. States such as California do not permit essential infrastructure to be constructed along its waterfront; only leisure, nonessential facilities are allowed.

Dialogue included:

- Natural disaster or disruption is one of many variables that must be taken into account in managing site-based risk. Direct and in-direct impacts can also extend to the corporate or reputational brand risks associated with overcoming a natural disaster.
- While recent attention has been focused on new waterfront developments being designed for a variety of scenario-based alternatives, far more sites exist in historic cities that lie within flood-prone areas and are dependent on legacy infrastructure. These sites may often lie several blocks or even miles upland from shorelines.

The Road Ahead

The forum closed with a discussion of next steps that ULI can take to promote resilience to climate change. Suggestions included:

- disseminating information on the topic to ULI members at the district council level;

- working with city, county, and development officials to understand the investment implications of various new policies;
- developing a framework of coastal risk issues that vary by levels of economic feasibility and by public/private responsibilities;
- learning from the more recent experiences in the New York/New Jersey region to share emerging practices to ULI networks globally;
- helping bring more knowledge context to politically sensitive local zoning changes; and
- working to facilitate communications among regional stakeholders by serving as an “honest broker” to establish dialogue on the topic among advocates of diverse perspectives and interests.

Finally, forum participants embraced the idea of ULI as a leader in advancing cross-sector or interdisciplinary partnerships that at once explore new challenges associated with climate change and champion a new generation of responsible professional practices in the context of the built environment. By bringing real estate investors together with representatives of the insurance industry, ULI can produce new insights into how value and risk can be managed in local communities.

Selected Resources

U.S. Government

2013 Draft National Climate Assessment Report

National Climate Assessment and Development Advisory Committee, 2013

This report, an up-to-date government summary of climate change research, highlights the past and projected trends associated with climate change.

<http://ncadac.globalchange.gov/download/NCAJan11-2013-publicreviewdraft-fulldraft.pdf>

Designing for a Resilient America: A Stakeholder Summit on High Performance Resilient Buildings and Related Infrastructure

U.S. Department of Homeland Security, 2011

Emerging from a 2011 summit, this report outlines recommendations offered by national hazard and building experts to the U.S. government for increasing national resiliency.

<http://www.dhs.gov/xlibrary/assets/designing-for-a-resilient-america-11302010-12012010.pdf>

Adapting to Climate Change: A Planning Guide for State Coastal Managers

NOAA Office of Ocean and Coastal Resource Management, 2010

Addressing a call from local governments, the National Oceanic and Atmospheric Administration walks decision makers through the process of implementing and maintaining an effective adaptation strategy.

<http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf>

Insurance Industry

Severe Weather in North America: Perils, Risk, Insurance

Munich Re, 2012

The escalation of extreme weather events is greater in North America than anywhere else. This report, intended for underwriters and clients, was produced by Munich Re to provide in-depth analysis

of how weather hazards and changing exposures affect loss figures and risk.

http://www.munichreamerica.com/ks_severe_weather_na_order.shtml

“The Climate Risk Challenge: The Role of Insurance in Pricing Climate-Related Risks”

Zurich Financial Services Group, 2009

Zurich emphasizes the need for policy makers to create a structure of sustainable, market-friendly incentives for climate-risk adaptation and mitigation that permits insurers to reflect the cost of prospective risk in their assessments.

<http://www.zurich.com/sitecollectiondocuments/insight/climateriskchallenge.pdf>

Managing the Escalating Risks of Natural Catastrophes in the United States

Lloyds, 2011

Highlighting the role of the insurance industry in natural disaster recovery efforts, this Lloyd's publication addresses the interface between public and private insurance programs. The report calls for developing a responsible attitude toward risk by improving cooperation among the government, insurers, and planners.

<http://www.lloyds.com/~media/Lloyds/Reports/Emerging%20Risk%20Reports/7549%20Lloyds%20Natural%20Catastrophes%20in%20the%20US%20V5a.pdf>

“Flooding the Market: The Distributional Consequences of the NFIP”

Institute for Policy Integrity, 2010

A 2010 policy brief on the National Flood Insurance Program (NFIP) is critical of the debt-ridden system whose costs are widely distributed to taxpayers yet whose benefits are enjoyed largely by wealthy U.S. counties and individuals.

<http://policyintegrity.org/documents/FloodingtheMarket.pdf>

Integrative Risk Management: Fostering Infrastructure Resilience

Swiss Re Centre for Global Dialogue, 2012

Swiss Re assembled articles from leading businesses and agencies that address the risk that rising sea levels pose to critical infrastructure, including food, transport, electricity, communications, and public health. The publication offers several integrative risk solutions directed at the insurance industry to ensure resilient supply and demand of essential goods.

http://media.swissre.com/documents/A11903_Risk_Dialogue_Series_Resilience.pdf

Other Reports

“Resilient Coasts: A Blueprint for Action”

Ceres/The Heinz Center, 2009

Advocating collective action in the face of rising seas and severe storms, this report emphasizes the commonsense and cost-effective aspects of climate-change adaptation in regards to land use.

http://www.heinzctr.org/Major_Reports_files/Resilient%20Coasts%20Blueprint%20for%20Action.pdf

“Using Nature to Reduce Climate and Disaster Risks”

The Nature Conservancy, 2012

Through case studies and analysis, the Nature Conservancy outlines how planners can use the capacity of natural systems to create more resilient shorelines before resorting to costly hard infrastructure.

http://coastalresilience.org/sites/default/files/resources/tnc_cc_UsingNature_v7b_web.pdf

Restore-Adapt-Mitigate: Responding to Climate Change through Coastal Habitat Restoration

Restore America’s Estuaries, 2012

Serving as a go-to guide for those considering coastal habitat restoration as a means to strengthen the coastline, this report from a non-profit can inform planners, ecologists, communities, and governments that aim to restore their shores.

http://www.estuaries.org/images/stories/RAE_Restore-Adapt-Mitigate_Climate-Chg-Report.pdf

Challenge Paper: Natural Disasters

Wharton Center for Risk Management and Decision Processes, 2012

In light of the increasing frequency of natural disasters, a team from the Wharton Risk Center published this report for Copenhagen Consensus 2012 containing a methodological approach for evaluating cost/benefit analyses of disaster risk-reduction measures.

http://opim.wharton.upenn.edu/risk/library/CopenhagenConsensus2012_NaturalDisasters.pdf

“Building a Resilient Energy Gulf Coast”

Entergy/America’s Wetland Foundation/America’s Energy Coast, 2010

A series of practical solutions offered in this report aim to address the daunting risk profile of the Gulf Coast. Recommendations include leadership from policy makers, prioritizing adaptation investments with strong benefits, and focusing adaptation to address near-term risks and mitigation to address longer-term risks.

http://www.energy.com/content/our_community/environment/GulfCoastAdaptation/Building_a_Resilient_Gulf_Coast.pdf

Recommendations to Improve the Strength and Resilience of the Empire State’s Infrastructure

New York State 2100 Commission, 2013

Governor Andrew M. Cuomo’s NYS 2100 Commission recently released this report on post-Sandy efforts. The study emphasizes soft infrastructure improvements, transportation investment, and broadened insurance coverage, among other long-term goals.

<http://www.rockefellerfoundation.org/uploads/files/7c012997-176f-4e80-bf9c-b473ae9bbb3.pdf>

Climate Change Adaptation in New York City: Building a Risk Management Response

New York City Panel on Climate Change, 2010

As a component of PlaNYC, the New York City Panel on Climate Change published a 2010 report that outlines how New York is more exposed to the effects of extreme weather events than ever before and suggests adaptation strategies.

<http://onlinelibrary.wiley.com/doi/10.1111/nyas.2010.1196.issue-1/issuetoc>

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ULI Statement on Climate Change, Land Use, and Energy

The Urban Land Institute will bring its organizational resources to the complex issues surrounding energy and climate change, acknowledging that the successful global reduction of greenhouse gas (GHG) emissions requires substantial investments in local communities. We believe ULI has the ability to foster new policies and solutions to address global climate change that are both feasible and effective at the nexus of land use, real estate, energy, and infrastructure.

As an organization, we seek to move forward with new urgency by fostering leadership among ULI members and identifying the tools, techniques, and best practices needed to address difficult choices and tradeoffs for which there are no precedents to measure the effectiveness of decisions. We seek to empower individuals and organizations to solve one of the most important and complex long-term challenges ever faced by communities around the world in a manner that meets the needs of the present without compromising the ability of future generations to meet their own needs.

ULI recognizes that effective strategies to combat global climate change will require cooperative effort by all segments of the economy and all segments of society around the globe. Given the multifaceted challenge and the many exemplary efforts by organizations around the world to meet this challenge, ULI does not seek to duplicate the effective efforts of others, such as those focused on transportation technologies or building technologies. By focusing on issues at the core of the ULI mission—the responsible use of land—ULI seeks to make an important contribution within the emerging chorus of collaboration and partnership.

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