

What the Real Estate Industry Needs to Know about the Insurance Industry and Climate Change

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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 the 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 more than 33,000 members worldwide, representing the entire spectrum of the land use and development disciplines. Professionals represented include developers, builders, property owners, investors, architects, public officials, planners, real estate brokers, appraisers, attorneys, engineers, financiers, academics, students, and librarians.

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.

About ULI's Urban Resilience Program

The Urban Resilience Program works to help communities prepare for increased climate risk in ways that allow not only a quicker, safer return to normalcy after an event, but also an ability to thrive going forward. Through careful land use planning, wise investment in infrastructure, and smart building design, communities can protect investment, create value, and be more robust when facing adverse events. The Urban Resilience Program is funded through a generous grant from the Kresge Foundation.

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Introduction

THE INSURANCE INDUSTRY'S keen interest in climate change goes back decades. Evan Mills, a climate change researcher at the University of California who specializes in the financial services sector, explains that climate change is a “stress test” for the insurance industry because “insurers abhor unquantified and unpriced risks, as well as market distortions” introduced by public policy makers. For many insurance products, including property and business continuity insurance, climate change upends the notion that experience is a good predictor of future losses. Climate change’s destabilizing effects are also likely to increase the political pressure on governments to intervene in insurance markets.

The insurance industry has accepted a leadership role that reaches beyond the world of insurance. Climate change experts and policy makers have long recognized that the insurance industry holds a significant reservoir of needed skills and knowledge. Not only does the industry possess in-depth knowledge of extreme weather and its associated risks, but it also advances expertise in risk modeling, scenario building, and the alignment of incentives with desired actions. The insurance industry is positioned to communicate climate change’s risks and promote adaptation to its unavoidable consequences. This includes developing new insurance products.

This review of the insurance industry and climate change examines why the real estate industry can be increasingly confident in the stability and resilience of the insurance industry. Indeed, the real estate industry may even learn from the insurance industry’s advances in developing risk standards and tools for modeling and scenario analysis.

In a world shaped by climate change, however, maintaining the insurability of individual properties is not a given. Unless owners and societies take steps to reduce their exposure to the damages and losses associated with extreme weather, the overall affordability and availability of insurance will be affected.

Three Challenges: Catastrophes, Urbanization, and Climate Change

THE DEADLY AND DEVASTATING consequences of the full force of nature colliding with concentrated urban populations is at least as old as the eruption of Mount Vesuvius in AD 79 and the hundreds killed in Pompeii. In the United States, tragic disasters such as the 1900 Galveston, Texas,

hurricane in which 10,000 perished or the 1906 earthquake that destroyed San Francisco once seemed to belong to a different time, until 2005's Hurricane Katrina reminded the country of the importance of remaining vigilant. Thanks to improvements in warning systems and building tech-



Otsuchi, Japan, after 2011's earthquake and tsunami.

U.S. NAVY PHOTO BY MASS COMMUNICATION SPECIALIST 3RD CLASS DYLAN MCCORD

nologies, often at the prompting of the insurance industry, societies have shown that loss of life can be reduced. But although people may be able to reach safety, the economic losses associated with property damage and business disruption continue to climb, threatening the economic resilience of communities, regions, and nations.

For the insurance industry, Hurricane Andrew proved to be the watershed event that changed the industry's approach to quantifying the risk from catastrophes. The category 5 hurricane slammed into south Florida on August 24, 1992. Although deaths were relatively few, it left 160,000 homeless, and damage estimates reached US\$25 billion (1992 dollars). The industry faced US\$15.5 billion in losses to cover; 11 insurers went bankrupt. Since then, instead of

relying on data from the past, the insurance industry has adopted new risk standards and harnessed the increasing power of computers to advance techniques that model future catastrophes and their losses. In 2011—the worst year ever for losses from natural disasters—the global insurance industry absorbed US\$120 billion in losses without disruption.

The rapid urbanization in Africa and Asia and the continued urban intensification in the Americas and Europe mean that the potential economic impacts associated with extreme weather events and seismological or human-caused catastrophes are likely to continue to spiral upward. Urbanization brings with it increased wealth and a growing middle class. Concentrated urban populations, however,

TABLE 1: EFFECTS OF CLIMATE CHANGE ON PROPERTY VALUES

Climate aspect	Commercial and residential real estate
Rise in temperature	Reduced ground rent (lower potential revenue, in the case of regional population changes; also, increased need for cooling and thus higher operating costs)
Water scarcity	Decline in attractiveness of a region/decline in ground rent; higher costs for water supply and treatment
Rising sea level	Reduced settlement area in coastal regions
Increase in extreme weather events	<ol style="list-style-type: none"> 1. Direct loss (e.g., hail damage to buildings) 2. Indirect loss (e.g., through gaps in production or rent after hurricanes) 3. Consequential loss (e.g., declining number of tourists in flood areas, rising insurance premiums)

Source: ULI, *Extreme Weather Events and Property Values*, 2014.

are also heavily dependent on infrastructure and vulnerable to disruptions in electricity, clean water, sanitation, and transportation. Burgeoning urban regions follow the historic waterborne trade routes, the very places vulnerable to extreme weather. Urbanization disrupts natural systems, especially the movement of water, exacerbating flood risks if proper infrastructure is not in place. According to the most recent assessment report of the Intergovernmental Panel on Climate Change (IPCC), “the most important driver of increasing losses” for the insurance industry is “concentrations of people and wealth in vulnerable areas” and the increased penetration of insurance that increased urban wealth enables.

ULI’s 2014 report, *Extreme Weather Events and Property Values*, finds that the number of extreme storms and droughts has doubled worldwide since the 1980s, now averaging over 800 events per year. In just the last decade, direct losses related to real estate and infrastructure have tripled, reaching US\$150 billion annually. The ULI study concludes, “the occurrence of such events is therefore escalating and is likely to continue to do so.” (See table 1 for a summary of the effects of climate change on property values.)

For urban areas, climate change does not introduce any new type of extreme weather hazard: societies somewhere on the planet have experienced facing these hazards. But for many places, climate change increases the probability of damage occurring, including in places where certain risks were once thought negligible. Just as problematic, climate change introduces greater *uncertainty* in the likelihood of known risks occurring. For the insurance industry, uncertainty increases the difficulty of accurately pricing risks.

Scientists offer no guarantee that climate change’s impacts will be linear, increasing every year in a predictable manner. Indeed, if anything, its impacts are expected to accel-

erate over time. In addition, there will be geographic winners and losers: certain places, economies, and cultures are more vulnerable than others. For insurance, moreover, just as a severe storm can rapidly transform a landscape, climate change can prompt sudden category shifts: from moderate risk to high risk or from insurable to uninsurable.

Incorporating the threats posed by climate change into the known dynamics of rapid urbanization and natural disasters reveals that from the perspective of solutions for this triple challenge, climate change exacerbates the severity of problems that urban societies have long confronted. Decades of experience have proven the worth of what the IPCC terms “low-regrets measures,” such as warning systems; sustainable land use planning and ecosystem management; improvements to the physical, social, and economic infrastructures that support health, clean water, drainage, food distribution, and transportation; and continued technological improvements to “climate-proof” buildings and infrastructure. The challenges ahead reside in individual behavior and societal will.

Development Case Study: Arverne by the Sea

Arverne by the Sea, part of ULI's 2014 development case study series, highlights how the developers incorporated resilience to extreme weather into the community's planning, design, and construction. An excerpt follows:

When Hurricane Sandy ripped through the New York area in October 2012, Arverne by the Sea on the Rockaway Peninsula of Queens was about half completed. Located directly adjacent to the Atlantic Ocean, the Rockaway Peninsula was hit hard, and the developers of Arverne returned to the site after the hurricane with considerable trepidation, wondering whether their well-laid plans for the project had been enough to withstand the onslaught. But they also approached the site with some confidence as well, knowing that they had prepared the development for such an event. In fact, they discovered that Arverne had survived the hurricane largely unscathed, with minimal water and wind damage and no fire damage. The community and building designs and the systems they had put in place, together with strong dunes and a boardwalk along the oceanfront, had allowed the majority of the project to escape the destruction that affected other nearby areas.

Project Summary: Arverne by the Sea is a 120-acre planned community on a previously vacant redevelopment site located on the Atlantic Ocean within the Rockaway Peninsula of Queens in New York. The community is situated directly adjacent to an A-train transit station and will ultimately include 2,296 residential units in a variety of building types, including both multifamily condominium buildings and attached two- and three-story structures; many of the units are designed and sold as two-family stacked units, one for the owner to live in and a second unit for the owner to rent. The community was designed to be resilient in the face of increasing hurricane risks and rising sea levels. The developers brought in more than 500,000 cubic yards of fill to raise the level of the entire site by an average of eight feet, developed a special drainage system to reduce flooding risk, and used a variety of construction materials and design techniques to improve the resilience of the buildings.

The full case study for Arverne by the Sea and other development case studies are available at <http://uli.org/publications/case-studies/>.

Arverne by the Sea suffered limited damage from Hurricane Sandy because of a variety of resilient design features, including strengthening the dunes along the entire oceanfront of the property.



ARVERNE BY THE SEA LLC

Arverne by the Sea's resilient design features include storm drains in yards and over half a million cubic yards of fill dirt used to raise the grade of the site.



ARVERNE BY THE SEA LLC

Tools: Risk Standards, Modeling, and Scenario Analysis

THE INSURANCE INDUSTRY uses various types of models throughout its business practices to assess risk and assign prices. Models inform the pricing of risk, increasing its accuracy so that those at higher risk pay more than those at lower risk and so that risk is priced to cover losses and to encourage mitigation—i.e., steps consumers can take to lower their risks. The insurance industry's risk analysis tools have developed to the point that they may be useful for real estate investment decisions and the management of real estate portfolios.

Catastrophe models (or “cat models”) are designed to help the insurance industry cope with low-frequency but high-severity events. This includes natural disasters. For example, flood hazard models combine the sciences of geography, hydrology, and meteorology to create an analysis of how the risk of flooding varies on the land near rivers and coasts. The flood hazard model becomes a catastrophe model when it is joined with analysis of an insurance company's probable economic losses (payments to customers) based on the company's exposure to flood hazards.

Catastrophe models have become indispensable to organizations affected by natural disasters, including insurers and reinsurers. Governments and financial institutions also incorporate them into their decision making. Designed to quantify knowledge about natural phenomena, catastrophe models can also be used to probe the costs associated with climate change's impact on natural disasters.

Many catastrophe models do not yet explicitly include climate change, according to a 2014 review by Lloyd's,

the London-based corporation that oversees the Lloyd's insurance market. However, to the extent that the models incorporate recent trends data, climate change may be included implicitly. The Lloyd's review concluded that for decisions focused on time horizons of less than ten years, using recent weather trends is likely to be sufficient. Decisions with longer time horizons, however, should incorporate the findings of climate change models. Most real estate development projects fall within this latter category, at least from the perspective of the life of the buildings.

The insurance industry is also investing in developing more accurate long-range weather forecasts. Today, weather forecasts quickly lose their usefulness after just a few days, as anyone trying to plan an outdoor event knows well. The insurance industry is less concerned with whether a storm mars the wedding celebration (although weather insurance for events exists), than in testing the usefulness of long-range forecasts as compared to relying on backward-looking or historical data. Long-range forecasts using current ocean temperatures, for example, would be an immediate way to incorporate measurements of climate change while also getting a better handle on the natural variability in storm patterns.

Trevor Maynard, head of exposure management at Lloyd's, predicts that long-range forecasting “will have an increasingly important role to play in the insurance market.” For Atlantic hurricanes, for example, the prediction of a high- versus a low-hazard storm season could affect, year to year, both premiums and the amount of reserves to set aside or reinsurance to purchase.

Scenario analysis is another way to incorporate the uncertainty posed by climate change into decision-making processes. Here, again, the insurance industry has advanced techniques, combining scenario building and catastrophe modeling.

Lloyd's requires each of its syndicates to conduct annual "stress tests" that examine the impact of realistic disaster scenarios. They build updated disaster scenarios every year; the required scenarios for 2014 include eight hurricanes, windstorms, floods, or typhoons; four earthquakes;

SEA LEVELS IN JAMAICA BAY, NEW YORK, ARE LIKELY TO RISE BETWEEN 1.25 AND 6.25 FEET BY 2100



U.S. GLOBAL CHANGE RESEARCH PROGRAM



Scenarios Depicting Flood Hazard Areas in 2100

- Limit of 1 percent special flood hazard area (SFHA) in 2014
- Low sea-level rise (SFHA + 1.25 feet)
- Low/middle sea-level rise (SFHA + 1.83 feet)*
- High/middle sea-level rise (SFHA + 4.17 feet)*
- High sea-level rise (SFHA + 6.25 feet)

*The most likely amount of sea-level rise falls between these two middle scenarios.

This map, courtesy of the U.S. Global Change Research Program, depicts flood hazard areas in 2100 based on regional scenarios of sea-level rise developed by the New York Panel on Climate Change. It was created using the Sea Level Rise Tool for Sandy Recovery (<http://www.globalchange.gov/browse/sea-level-rise-tool-sandy-recovery>). Additional mapping tools examining American coastal regions are available from the Digital Coast (<http://www.csc.noaa.gov/digitalcoast/>) a project of NOAA's Coastal Services Center. ULI is a member of the Digital Coast Partnership.

and two terrorism events. Each scenario describes the geographic extent of damage with a map and the breakdown of property losses by type.

Scenarios include specific details about the event. For 2014's "two windstorm event," the scenario requires modeling a hurricane hitting the northeastern United States, followed immediately by a hurricane hitting South Carolina with no time to purchase additional reinsurance protection. The northeastern hurricane does the most damage in western Long Island and southwestern Connecticut, with some damage extending from Delaware to Maine. The scenario also identifies major ports and airports and describes losses of US\$47.5 billion for residential property and US\$30.5 billion for commercial property.

These improved tools for modeling and scenario building enable the adoption of risk standards across the insurance industry. The emerging standard for risk tolerance in insurance contracts is a 1 in 200-year level of confidence. This means that an insurance company should be able to pay all claims and remain solvent after experiencing the worst possible 12 months, with "worst possible" defined as the event or combination of events having a 1 in 200 (0.5 percent) chance of occurring each year. The 1 in 200 risk is the current risk, not the historic risk.

For the real estate industry, although climate change scenarios may not yet be ready to become a routine part of a pro forma's sensitivity analysis, using scenarios may become daily practice in ways small and large. For example, scenarios provide a solution for how to size heating and air conditioning when a "typical meteorological year" no longer exists. Climate change scenarios could also inform the rainfall events that engineers use to model drainage and fill needs on a development site.

Indeed, best-practice recommendations from the University of Michigan and the U.S. Green Building Council already

advise using scenario analysis techniques that model "building performance under a range of possible future conditions under climate change" for both new and existing buildings. The real estate industry may also benefit from modeling the impacts of climate change on consumer preferences and consumer costs, including customers' likely response to a range of costs for insurance.

Real estate investors and portfolio owners may also benefit from adapting the insurance industry's approach to risk standards. A 2014 white paper produced by the Willis Research Network, an organization focused on enabling the integration of science into the risk and (re)insurance sector, proposes that more industries adopt risk tolerance tests for natural catastrophes. As a "stress test" for resilience to extreme natural disasters, the author recommends that a business calculate the maximum probable annual loss for an extreme disaster scenario having a 1 in 100 (1 percent) annual risk. In the paper's example, the stress test leads the managers of a property portfolio to reduce the "proportion of highly exposed locations unless properties focus on optimal building codes and resilience characteristics."

Through risk standards, modeling, and scenario building, the insurance industry is preparing itself for the higher risks and increased uncertainty that come with climate change. For those who depend on being able to purchase insurance, growing confidence is warranted that the industry will rise to the challenges ahead. However, insurance customers should expect to pay for their increased risks through higher premiums or deductibles. They should also incorporate into their decision making the potential for insurance costs to become more volatile. The economic benefits of incorporating risk-mitigation measures into property acquisition decisions, site preparation, building design, and construction techniques are likely to grow.

The Industry Organizes in Response to Climate Change

The insurance industry leads on climate change through national and international research and advocacy organizations.

Just one of several organized responses of the insurance industry, ClimateWise was launched in 2007 as a not-for-profit organization of more than 40 insurance agencies and organizations who have committed to principles designed to “better understand, communicate, and act on climate risks.” Its membership hails from Asia, Europe, North America, and southern Africa, and it is headquartered in the United Kingdom and facilitated by the University of Cambridge Institute for Sustainable Leadership.

Members file annual reports charting their activities and progress toward the six ClimateWise principles:

1. Lead in risk analysis;
2. Inform public policy making;
3. Support climate awareness among our customers;
4. Incorporate climate change into our investment strategies;
5. Reduce the environmental impact of our business; and
6. Report and be accountable.

ClimateWise members advance climate risk research and regularly lead educational efforts targeted at the public and policy makers. In addition, principle 4 commits members to incorporating climate change into their investment strategies.

Likewise, the Munich Climate Insurance Initiative (MCII) has worked since 2005 to connect insurance industry expertise with climate change and policy researchers and to pilot new products. The Reinsurance Association of America (RAA) has also identified the economic consequence of extreme weather as an area of growing concern. In June 2014, along with other representatives of the insurance industry, RAA participated in a White House roundtable on resilient communities. They discussed shar-

ing data and improving communications about risk and resilience to policyholders, communities, and taxpayers. Without solutions to increase resilience, RAA president Frank Nutter warned that “the cost of refinancing catastrophic losses” is on “an unsustainable track.”

The United Nations Environment Programme–Finance Initiative (UNEP-FI) launched the Principles for Sustainable Insurance in 2012, inviting signatory companies to work to ensure that actions “in the insurance value chain, including interactions with stakeholders, are done in a responsible and forward-looking way,” defined as advancing environmental, social, and economic sustainability. To date, there are more than 40 signatory companies.

In November 2013, ClimateWise, MCII, and UNEP-FI jointly released a global insurance industry statement issuing a “collective call to action” on “building climate and disaster-resilient communities and economies.” It called on the insurance industry to exercise leadership both in reducing the emissions of greenhouse gases and in adapting to climate change’s unavoidable impacts, including strengthening disaster resilience. Engaging public and private actors is identified as key to this mission.

Similarly, the Geneva Association—an international research institute founded in 1973 to conduct objective research on the relationships between the economy and insurance—released its statement of climate change principles as its General Assembly held in May 2014. The chief executives of 67 leading insurers, with customers in over 140 countries, confirmed their commitment to exercise leadership by continuing research into climate risks; developing new products that help reduce greenhouse gas emissions; supporting the development of low-carbon energy sources; and working with policy makers to offer affordable private insurance solutions for individuals, businesses, and nations.

Case Comparisons: Flood Insurance in Four Countries

IN 2011, THE GERMAN INSURANCE ASSOCIATION publicly announced that it had modeled Germany's climate change risks through the year 2100 and found that natural hazards would remain insurable. By this the association meant that its members would remain in the business of insuring natural hazards. It did not mean that individual properties were guaranteed to remain insurable. Many likely will not.

Flooding related to the increasing frequency of heavy rainfall events and sea-level rise is one of the most well understood impacts of climate change. Increased flooding, moreover, is not just predicted, it is already occurring. The IPCC concludes that the frequency of heavy precipitation events has increased globally since 1950 and is likely to continue to do so. In the United States, 2014's Third National Climate Assessment finds that since 1991 the number of very heavy rainfall events has increased by more than 30 percent in some places, when compared with the decades earlier in the 20th century. States in the Midwest and the Northeast have been especially hard hit by the increased flooding. For the Northeast, precipitation in heavy rainfall events has increased by 71 percent between 1958 and 2010.

Countries take very different approaches to managing the risk from flooding, including whether flooding is even insurable. In Canada, "overland" flooding—storm surge on the coasts and river flooding—is considered uninsurable. In contrast, in Germany, the private insurance industry offers insurance for all but high-risk properties. In the United States, the public sector—through the federal

government—offers flood insurance to all property holders in participating at-risk communities, but the amount of coverage is capped. The United Kingdom is in the midst of renegotiating the public/private partnership that had made flood insurance available to all properties, except for developments built in high-risk areas after 2009.

TABLE 2: STANDARDS FOR WHEN PRIVATE INSURANCE FOR NATURAL HAZARDS IS VIABLE

1. Risk and losses can be accurately priced.
2. Premiums are affordable to consumers, while compensating insurer costs.
3. Premiums are sufficient to generate profit for assumed risk.
4. Premiums incentivize actions or investment in risk mitigation.

Source: Thistlethwaite and Feltmate, *Assessing the Viability of Overland Flood Insurance*, 2013.

An examination of these four countries reveals different approaches to seeking the optimal balance between affordability and profitability required for viable natural hazards insurance markets (see table 2). Key distinctions appear with regard to who pays for damages (government or private insurance), what is considered insurable, how risk is communicated through flood-hazard mapping, how reinsurance is obtained, and approaches to growing and diversifying the pool of policyholders and reducing underinsurance.

Canada: Flooding Uninsurable; Government Funds Flood Recovery

The private insurance industry does not offer insurance for “overland” flooding—storm surges or flooding from rivers and streams—to the vast majority of property holders in Canada; the one exception is for commercial property at low risk. In the wake of flooding events, the federal and provincial governments—i.e., taxpayers—share the cost of flood recovery through Disaster Financial Assistance Arrangements (DFAA). The provincial and territorial governments allocate and manage disbursements to victims for damages. Payments are often capped, and typically only municipal governments, homeowners, farmers, and small businesses are eligible. Not until 2008 was mitigation to prevent future losses eligible for funding under DFAA.

Although various government programs have supported mapping flood risks, a 2010 overview of Canadian flood mapping found the maps to be “inconsistent, often difficult to attain, and incomplete.” Not surprisingly, a 2013 survey of insurance industry executives cited the inadequacy of existing flood-risk maps as the number-one problem preventing them from entering the market.

The June 2013 flooding in Calgary and southern Alberta was one of the worst natural disasters in Canada’s history. Damage estimates reached over C\$6 billion, with the provincial and federal governments covering C\$5 billion. (Sewer backup is insurable, so private insurers did incur some loss.) As of May 2014, private property owners had been deemed eligible for C\$3.1 billion in reimbursements from the federal government, of which C\$425 million had been paid to families and business owners.



RYAN L. C. OJIAN

Downtown Calgary, Canada, during 2013 floods.

Germany: Private Sector Offers Insurance, Except in High-Risk Areas

The private insurance industry offers flood insurance, along with insurance against other natural hazards, as part of comprehensive property insurance policy. Both the insurer and the consumer, however, retain the ability to decide not to offer or purchase the natural hazards bundle. Storm surge is not considered insurable, nor is flooding in very high-risk zones near rivers. Natural hazard insurance in high- and medium-risk zones is available if certain loss prevention conditions or higher deductibles are met. The insurance industry buys reinsurance on the international market.

The private insurance industry, through the German Insurance Association, has taken the lead on flood-risk mapping, developing a computer-driven risk-mapping platform that

divides the country into four flood-risk zones. The digital maps became available to the public in 2012. The federal government has prohibited new development in flood-prone areas since 2004.

The market penetration of natural hazard insurance has been traditionally low, and government steps in to help with flood recovery. When the Elbe and Danube Rivers and their tributaries experienced severe flooding in 2013, damage estimates rose to over US\$15.8 billion (€12 billion). The federal and regional governments scrambled to come up with US\$10.6 billion (€8 billion) for government-sponsored rebuilding, partly financed by new debt. Property owners were required to document damages and faced “dauntingly long” applications, according to newspaper accounts, to receive government aid. Insurers paid out only US\$2.5 billion (€1.8 billion) in claims because most owners did not have insurance.



Ludwigshafen am Rhein, Germany, during 2013 floods.

IMMANUEL GIEL

The German Insurance Association has successfully argued against periodic government proposals to make the purchase, and therefore sale, of flood insurance mandatory. After the 2013 floods, the association president publicly stated that “obligatory insurance is a last resort.”

United States: Federal Government Offers Flood Insurance to All Regardless of Risk

The federal government is directly responsible for the vast majority of flood insurance policies sold in the United States. The private sector sells insurance for other natural hazards, although in states with areas at high risk for hurricanes or earthquakes, various state-sponsored insurance arrangements exist.

Congress launched the National Flood Insurance Program (NFIP) in 1968, after decades of flood-related disasters that had burdened the federal treasury, compounded by the lack of viable alternatives in the private insurance market. The Federal Emergency Management Agency (FEMA) administers the program, in partnership with nearly 90 private insurance companies who retail and administer the policies.

For the federal government, the NFIP was—and is—seen as a way to engage property owners and communities in risk-reduction activities, as well as a way to use the sale of insurance to lower the government’s financial obligations for recovery and rebuilding.

The federal government takes the lead in flood-risk mapping, determining areas of low, medium, and high risk in at-risk communities. In the program’s early decades, flood-risk maps indicated only flood area, not elevation. Fees on policies and other federal funding pay for map modernization, including the transition from paper to digital maps. Incorporating flood elevations and wave heights for coastal areas has been an ongoing priority. FEMA also requires

owners of large development projects to submit flood elevation studies where they are not yet available.

Flood-risk maps are to be updated every five years through a public process that involves community leaders and property owners. Property owners have the right to appeal new risk designations.

No flood risk, including storm surge, is considered uninsurable, nor can the NFIP drop policies after multiple claims. Insurance policies, however, are available for purchase only in communities that agree to participate in the NFIP’s flood zone management program. Because all land use authority in the United States resides in state and local governments, this community participation requirement is the lever the federal government uses to prompt risk mitigation through minimum standards for land use planning, subdivision ordinances, and building codes. New and substantially improved buildings must be protected so that they are no longer considered at high risk of flooding. To date, more than 21,000 communities, or about 90 percent of at-risk communities, participate in the NFIP.

Homeowners, renters, commercial property owners, and businesses can buy flood insurance through the NFIP, with the premiums based on risk categories, including adjustments for flood elevation. Flood insurance coverage, however, is capped at \$250,000 for a single-family house and \$500,000 for a business structures. Coverage limits also apply to building contents. Purchasing insurance is voluntary, although property owners at high risk must purchase flood insurance to be compliant with the rules for mortgages from federally regulated or insured lenders.

Special policy discounts are available in communities that go beyond the minimum standards, although a 2014 Government Accountability Office report found that relatively few communities—only about 1,200—participate in this incentive program.

American governments cannot simply ban development in high-risk areas. The U.S. Supreme Court has ruled, in a case involving beachfront properties, that using regulations to deprive property owners of all economic use of a property is unconstitutional. FEMA's recommended floodplain regulations take this into account, and FEMA offers grant programs that can assist local governments in purchasing high-risk properties and taking other mitigation activities. FEMA regularly receives grant applications for mitigation activities totaling far more than available appropriations from Congress.

The federal government does not require the NFIP to purchase reinsurance; instead, FEMA borrows from the U.S. Treasury to pay claims exceeding reserves. Until 1985, Congress appropriated funds to repay the Treasury. After 1985, FEMA promptly repaid its debts using premiums and other sources of income until Hurricanes Katrina, Rita, and Wilma struck in 2005; FEMA took on additional debt after Hurricane Sandy in 2012. Since 2010, FEMA has made interest payments on its debt, but instead of making principal pay-

ments, FEMA has chosen to build up its reserves. As of the end of 2013, FEMA owed the Treasury US\$24 billion.

Despite the NFIP's emphasis on outreach to owners of high-risk and medium-risk properties, the Government Accountability Office considers NFIP participation rates to be low, while acknowledging that comprehensive data are limited. Past studies, now somewhat dated, estimated penetration rates at 50 percent of all high-risk properties. In 2013, 61 percent of all policies were in high-risk areas, skewing the balance of the insurance pool.

The NFIP prices a minority of policies—about 19 percent in 2012—below known risk; these policies are not “actuarially rated.” This is either because the policies predate the change to including flood elevation or wave height in setting premiums or because the properties were “grandfathered” after updated mapping transferred them to higher-risk categories. In 2012, Congress tried to hasten phasing out these subsidized policies by increasing the annual cap on premium increases from 10 percent to 20 percent. After a public uproar, Congress backpedaled and



in 2014 reduced the cap on premium increases to 18 percent for homeowners, supplemented by an annual flat fee on all policies (US\$25 for primary residences; US\$250 all others) until all policies are actuarially rated. “Grandfathering” was also restored for properties newly rated high risk.

The federal government also pays for flood damage through the Stafford Act, which provides grants to state and local governments after natural disasters to rebuild public buildings and infrastructure.

United Kingdom: Renegotiating the Public/Private Partnership to Create Shared Reinsurance

Flood insurance in the United Kingdom is the product of negotiations, currently ongoing, between the Association of British Insurers and the national government. The most recent agreement, adopted in 2002, extended the private insurance industry’s willingness to sell flood insurance on

existing high-risk properties in exchange for the government’s commitment to fund mitigation measures designed to lower flood risks and provide flood-risk data and mapping. The agreement does not extend to properties built in high-risk areas after 2009. For commercial properties, businesses negotiate private flood insurance policies based on individual needs.

The national government takes the lead in flood-risk mapping, dividing the country into low-, medium-, and high-risk zones. Although local governments control building decisions, the national government does advise that development should be steered toward low-risk areas first and medium-risk areas second. Only when no other land is available does the national government advise local governments to allow development in high-risk areas.

Flood insurance is bundled into standard homeowner or building insurance policies, although technically purchase is not required. Because of the bundling, market penetration is high across all risk categories. The high market penetra-

Pumping floodwater into River Parrett, Somerset, England, during 2014 floods.



RHYS O'LEARY/MOD

TABLE 3: DEFINITIONS OF ANNUAL FLOOD RISKS FOR INSURANCE IN THE FOUR COUNTRIES

Risk category	United States	Germany	United Kingdom	Canada
High risk Risk is defined as the probability of a flood occurring each year. For example, 1/100 = 1 percent annual risk.	1/100 or greater	Storm surge: Uninsurable 1/10 or greater: Uninsurable Between 1/10 and 1/50: Insurable with mitigation and accumulation cover	Storm surge: 1/200 or greater River: 1/100 or greater	Storm surge and river flooding are not considered insurable.
Medium risk	Between 1/100 and 1/500	Between 1/50 and 1/200: Insurable with mitigation and accumulation cover	Storm surge: Between 1/200 and 1/1,000 River: Between 1/100 and 1/1,000	
Low risk	Less than 1/500	Less than 1/200	Less than 1/1,000	

Sources: Sandink et al., *Making Flood Insurable for Canadian Homeowners*, 2010; FEMA identification of flood hazard areas and risks.

tion and cross subsidies from lower risk categories were intended to be a way to keep flood insurance affordable for high-risk properties. The private insurance industry taps the international market for reinsurance.

The partnership agreement expired in 2013 and is now being renegotiated, with reforms expected to be in place by 2015. The chief reform is how to maintain the affordability and availability of insurance for homeowners at high risk. A new program, called Flood Re, sets up a not-for-profit flood reinsurance fund owned and managed by the insurance industry. Residents in high-risk areas will still buy household property insurance from private insurers, but premiums on high-risk policies will be capped, and flood damages will be covered by Flood Re. High-value properties, however, are not eligible for capped premiums, nor

is new development built since 2009 in high-risk areas. Flood Re is funded by the premiums from high-risk policies and a fee on all household property policies, regardless of risk, levied annually at 2.2 percent of total policy value to the industry. This fee is predicted to average about £10.50 (US\$17.13) per policy.

Despite horrendous flooding in 2013 and 2014, development continues on land deemed at high risk. An investigation by the *Independent* in early 2014 found that during the previous year 87 developments involving 560 homes in England and Wales had received local planning permission over the protests of the national government's environment agency. This trend is increasing: the number of development proposals in flood-prone areas climbed by a third between 2012 and 2013.

Incorporating Climate Change into Flood Risk and Insurance

When climate change is included in flood-risk models, the areas designated at high and medium risk grow larger over time. Accordingly, the number of acres (hectares) and existing buildings with risk impairment increases. In communities with flood hazards, the amount of land at low risk of flooding, preferred for development and redevelopment, will decrease, sometimes significantly.

For property owners and investors, this means that a property previously thought to be of low or medium risk may suddenly become identified as high risk, either as revealed through a flooding event or by science-based adjustments to official flood hazard models. This will, of course, affect insurance prices, land value, and building costs. Indeed, a recent New York University study comparing flood hazard maps from 1983 and 2013 found that two-thirds of New York City's properties at medium risk for flooding shifted into the high-risk category by 2013. Currently, 95,000 buildings and 397,000 housing units are at high and medium risk for flooding, including 87,000 high-risk housing units on the ground floor.

In Canada, without overland flood insurance, the pricing of insurance cannot contribute to communicating the increasing risk or even the relative risk of properties. Communicating risk will be left to government land use planners and experts who advise property investors. Insurance prices in Germany, the United States, and the United Kingdom can and will continue to communicate increasing and relative risk, especially as flood hazard models become more and more sophisticated.

In Germany, currently buildable property may become uninsurable against riverine flooding or vulnerable to uninsurable storm surges. In the United States and the United

Kingdom, safeguards are in place to prevent a shift to uninsurable status for at least some types of property, but the cost of these safeguards is high premiums and public pressure for subsidies through premium caps or grandfathering. Ironically, the insurance schemes in the United States and the United Kingdom—by appearing to manage risks—may have actually encouraged development on land that will soon become high risk or building to standards that are now in danger of becoming inadequate. The United States does not currently have a way to declare property uninsurable for flood or to ban all development on private land, short of outright public purchase.

Neither the German nor the American approach appears to have protected the national governments from the hits to their budgets necessitated by stepping in to help private property owners recover in the wake of flooding disasters. With climate change, the national governments in Canada, Germany, and the United States can expect these budget shocks to continue. In the United Kingdom, the consequences if the Flood Re reinsurance pool is unable to handle losses from a major flood are currently unclear.

Over the decades ahead, as an increasing number of property owners discover their new vulnerability to flooding and its associated costs, public protest and political conflict are likely in Germany, the United Kingdom, and the United States. With affordable housing stocks and the economic viability of entire communities at stake, national and local governments may well face demands for subsidies for insurance costs, relief from demanding land use and building regulations, and aid to help pay for defenses and prevention.

Adaptation and Resilience: Insurance Products and Practices

WHEN A CATASTROPHE HITS a community, research from the insurance industry shows that the magnitude of uninsured losses determines the community's economic resilience: the higher the percentage of uninsured losses, the greater the likelihood that a natural disaster will have long-term negative economic consequences. Underinsurance is a problem even in high-income countries. According to the IPCC, data from 1980 to 2011 show that for high-income, middle-income, and low-income countries, insurance covered 35 percent, 5 percent, and less than 1 percent, respectively, of direct losses from natural disasters.

The consequences of underinsurance affect individuals and the entire community. Individual property owners are far from being made whole if they are the lone insured island in a sea of uninsured property. For businesses, being insured or even taking strong steps to prevent damage may not be enough if the majority of a business's workers or customers are not so protected. Residents and businesses, moreover, both depend on infrastructure owned and operated by governments.

As shown with flooding, unless individuals, communities, and governments act to mitigate the risk of extreme weather events and natural disasters, certain hazards may become uninsurable. Even when insurable, premium increases, higher deductibles, and coverage caps may well mean that the total amount of potential damage covered by insurance will decline.

Traditionally, the private insurance industry views high risks as uninsurable, but the industry also has a long

history of undertaking activities designed to "lay the foundation for insurability," as described in a 2014 report by the sustainable investment and business leadership organization Ceres.

Chief among the industry's methods are conducting research, disseminating knowledge, and advocating for government policies that reduce risks, both to protect their own financial stability and to expand the potential market for their policies. Through various organizations, the industry has sponsored extensive research that publicizes the risks associated with natural hazards to help make the case that governments and individuals should act to lower their risks.

Incentives built into insurance products can also help prompt decisions and behaviors that lower risks through awarding premium discounts or being willing to lower deductibles or decrease coverage limits as a reward for taking actions aimed at reducing the risks of natural hazards. These incentives can become part of the negotiations with government regulators. After Hurricane Katrina, Allstate Insurance Company agreed to return to writing homeowner and business policies in Mississippi after it had negotiated increased rates with the state insurance commission and an incentive program for buildings built to higher standards.

New insurance products are adapting to the demands of a globalized, urbanized world. For example, traditional business and contingent business interruption insurance once focused on damages to the policyholder's and suppliers' physical facilities. Business losses related to disruptions

in electricity or water supply were not typically covered. Modern supply chain insurance, however, looks to provide cover for costs related to delayed or cancelled deliveries, alternative sourcing, or other disruptions caused by a wide range of reasons. Policies can extend into the medium term—for example, a maximum length of five years—which could be useful for large, complex construction projects.

In addition, parametric or indexed products are tools under examination for their usefulness in boosting eco-

nomics resilience in the wake of natural disasters. Unlike traditional indemnity-based insurance policies, which are triggered by damage or losses, payments under parametric products are triggered by a specific extreme weather event, regardless of the extent of the damage. Payment levels are agreed at the time of the sale of the policy. Examples of parametric triggers related to extreme weather include a location exceeding a set amount of rain in a 24-hour period or a category 3 hurricane coming within a set amount of miles of a specific location. The

Insurance Products to Reduce Greenhouse Gas Emissions

Leaders in the insurance industry also take actions to mitigate or ease the threats posed by climate change through products that encourage reducing greenhouse gas emissions.

Of primary interest to the real estate industry are insurance products that provide incentives or otherwise support energy efficiency and the use of renewable energy systems. A recent international survey of insurance products related to climate change found 130 products and services supporting green buildings. Another survey concluded, “virtually every property and casualty insurer in the U.S. offers green building insurance products.” Premium credits for energy-efficient buildings are a popular offering. Another important innovation is insurance that pays to rebuild properties to higher energy efficiency standards, especially useful as governments update their building codes.

The insurance industry also supports the constantly evolving renewable-energy industry, smoothing the way for everything from equipment manufacture to energy market fluctuations to the final consumer. Developing warranties for solar voltaic panels reduce

consumer risk, as does focusing ongoing research in building technologies on, for example, how to reduce the vulnerability of solar panels to hail damage.

The industry also targets automobiles, another major source of greenhouse gas emissions that brings consumers into the insurance marketplace. Incentives include premium reductions for fuel-efficient vehicles or insurance for the charging equipment used by electric vehicles. Insurers are also developing pay-as-you-drive insurance products, which charge based on actual distance driven, as reported by in-vehicle monitoring. Depending on the per mile (kilometer) charge, this provides an incentive to drive fewer miles or at least reduces the amount that low-distance drivers subsidize high-distance drivers.

Ironically, national and international attempts to stem climate change at its source—by reducing the burning of carbon-based fuels—adds another layer of uncertainty to the decisions insurers must make. They must factor into their risk analysis both the likelihood of society acting to prevent climate change and the effectiveness of these actions.

moment the occurrence of the triggering event is verified, payment can be sped to the policyholder's account.

Parametric products in the form of catastrophe bonds have the potential to solve a vexing problem for governments, which otherwise have to negotiate support from national or international agencies before recovery can begin. Catastrophe bonds are also used as a source for reinsurance.

Sixteen Caribbean governments are currently members of the Caribbean Catastrophe Risk Insurance Facility (CCRIF), formed in 2007 with capitalization assistance from the international community. Members pay fees, and parametric triggers for hurricanes and earthquakes drive payments after natural disasters. In 2014, the World Bank issued the CCRIF's first catastrophe bond, a US\$30 million transaction that will provide three years of protection. The CCRIF sought the catastrophe bond to diversify its reliance on the traditional reinsurance market and to take advantage of the competitive prices in the bond market. The state of Alabama has also bought parametric insurance against hurricanes.

Parametric products—in the form of microinsurance—are being explored as a way to increase economic resilience after natural disasters in countries without the economic and social infrastructure in place to manage the transaction costs of indemnity-based insurance. Affordable policies that can quickly and easily provide cash to families and businesses after disasters could be a way to decrease uninsured losses in low-income countries. The model could even be adapted to cover households or businesses in entire communities, with government, a social organization, or a business association facilitating the purchase.

The chief benefits of parametric products and catastrophe bonds are the speed of payment, which minimizes transaction costs after the disaster, and access to the bond market, which is subject to financial dynamics independent

of insurance markets. Thus, large property holders in the private sector may find benefits in catastrophe bonds.

However, because parametric products substantially weaken the link between how risk exposure connects to consumer costs and to covered damages or losses, they are not the most economically efficient means of transferring risk. Consumers with very different risk profiles pay the same price for the same coverage. Consumers may end up overpaying for protection, on the one hand, or discovering too late that they are underinsured, on the other. Parametric products, moreover, significantly dilute the incentive to take actions that reduce risk, with implications for both individuals and societies. Lloyd's, for example, advises that indemnity-based products continue to provide the most effective means of transferring risk.

Comprehensive Solutions: Insurance, Infrastructure, and the Built Environment

AS THE INSURANCE INDUSTRY would be the first to point out, the real estate industry cannot insure its way out of adapting to climate change. ULI's 2014 white paper, *Resilience Strategies for Communities at Risk*, includes the importance of "accurately pric[ing] climate risk into property value and insurance," while also acknowledging the challenges this poses for insurance markets and certain vulnerable populations. This recommendation, however, is joined by 21 other recommendations covering land use and development; infrastructure, technology, and capacity; finance and investment; and leadership and governance.

Accurately priced insurance can provide information about the relative risk of alternative real estate investments and an incentive to reduce the risks associated with extreme weather and natural hazards. But as the Ceres report concludes, "although pricing signals are an important influence on behavior, they are not sufficient in and of themselves to incentivize new ways of thinking about climate risks."

Even the signals and incentives communicated by insurance prices have their limits. Although the insurance industry can conduct research and develop educational programs that communicate the long-term and potentially escalating risks of climate change, the industry's main product—the annual insurance policy—is designed to communicate the risk over the next year, not the risk in 30 years. In addition, the risks associated with extreme weather and climate change are not the only factors that influence premiums and coverage limits for natural hazard insurance, especially in competitive insurance markets where consumers may find a range of prices on offer.

A 2013 study of homeowners' insurance in Virginia concluded that it is not currently possible to discern the impacts of climate change from other risk factors, including characteristics of the owner, when investigating insurance prices. In addition, practices that seek to increase insurance penetration and reduce underinsurance, such as bundling earthquake, flood, and wind risks into a single natural hazards policy or bundling natural hazards into a comprehensive property insurance policy, may dilute the climate change adaptation signal sent by insurance prices. As noted earlier, parametric insurance is also weak on incentivizing risk mitigation.

Moreover, although the insurance industry continues to advocate for risk reduction investments and policies targeting climate change, it is the responsibility of the real estate industry and governments to make the decisions that will be the ultimate means of adapting to a world shaped by climate change—decisions about changes to development practices, investments in infrastructure, reforms to building standards, and revisions to land use planning and site selection. Successful approaches to extreme weather and its effects on urbanized societies will be found in comprehensive solutions that build on the strengths of the insurance industry, government, and the real estate industry.

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