

Financing and Development

An Ounce of Prevention: Investing in Preparedness and Resilience

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Climate Change Finance Challenges

Misalignment in timeline and risks

Investors more concerned with short term risks

Risk associated with climate change (can be) long term

Focus on lack of bankability

Patient capital, benefit cost analysis, multi-functional projects

Definition-challenged, metric-challenged

Lack of investible products and opportunities

An Ounce of Prevention Tool: Benefit Cost Ratios

| Mitigation Category | Cost | Benefit | BCR |
|--|---------------|----------------|------------|
| Riverine Flood | \$0.91 | \$4.30 | 5:1 |
| Hurricane Surge | \$0.01 | \$0.05 | 7:1 |
| Hurricane Wind | \$0.72 | \$3.80 | 5:1 |
| Earthquake | \$1.20 | \$4.30 | 4:1 |
| Wildland-Urban Interface Fire | \$0.80 | \$3.00 | 4:1 |
| Total for select measures to exceed I-Code requirements | \$3.60 | \$15.50 | 4:1 |

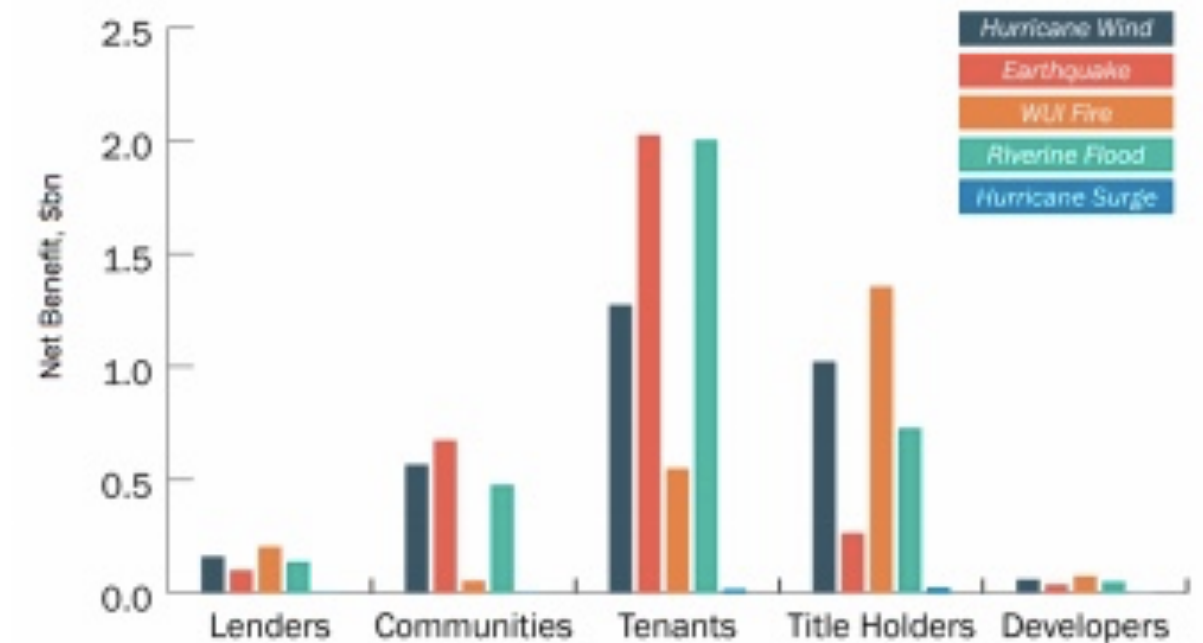
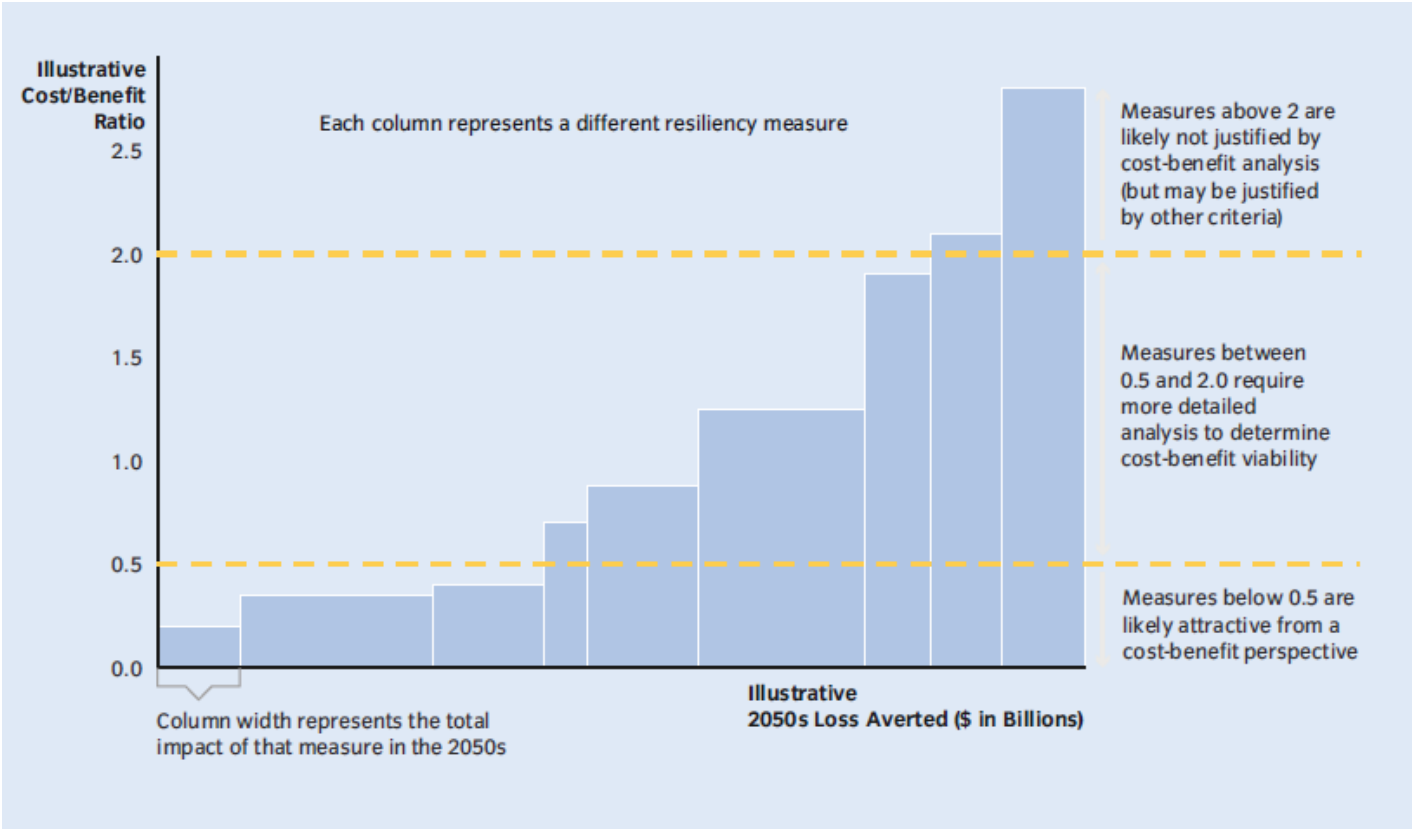


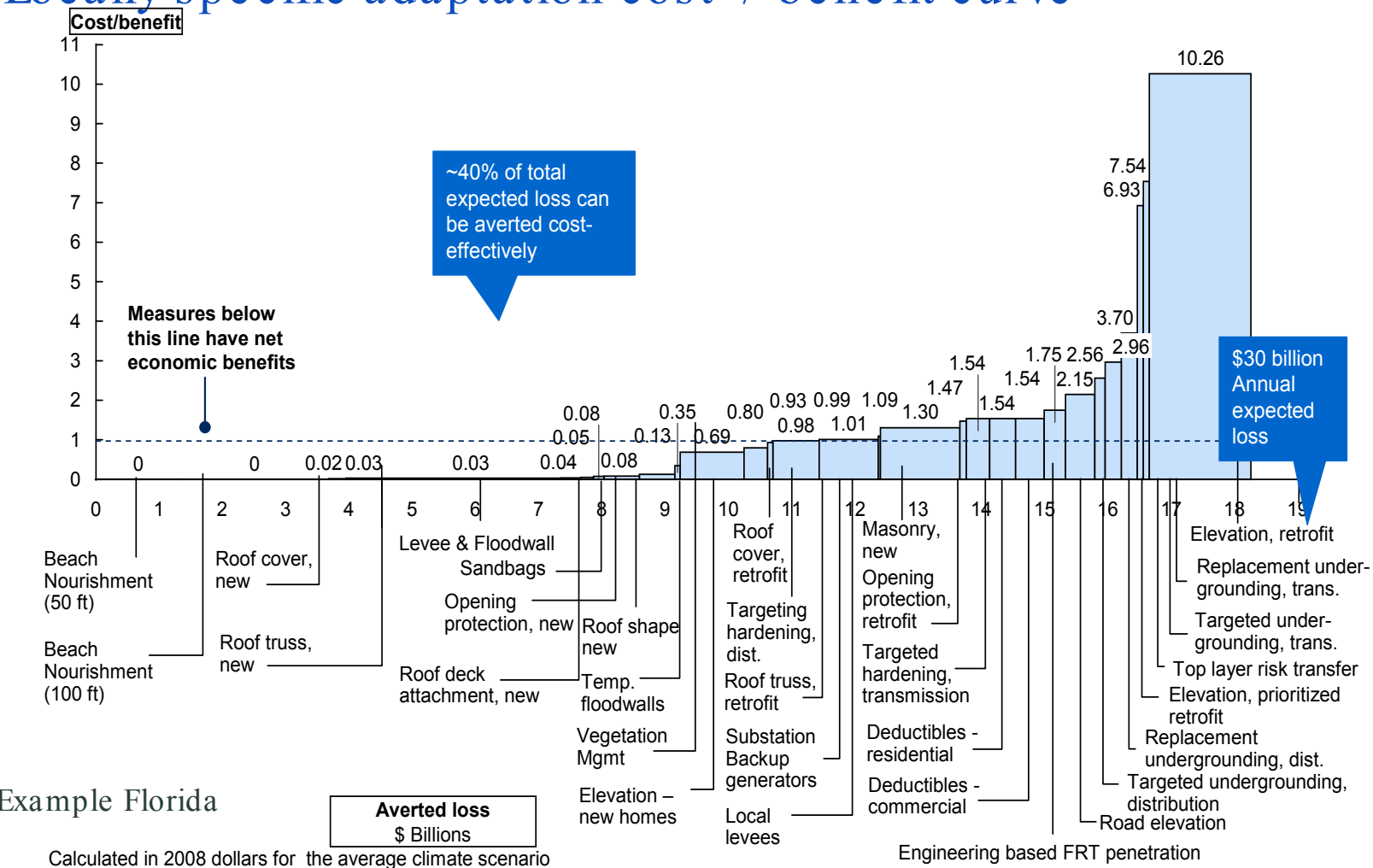
Figure 1. Stakeholder net benefits resulting from one year of constructing all new buildings to exceed select 2015 IBC and IRC requirements or to comply with 2015 IWUIC.

Tools: Resilience Cost Curves

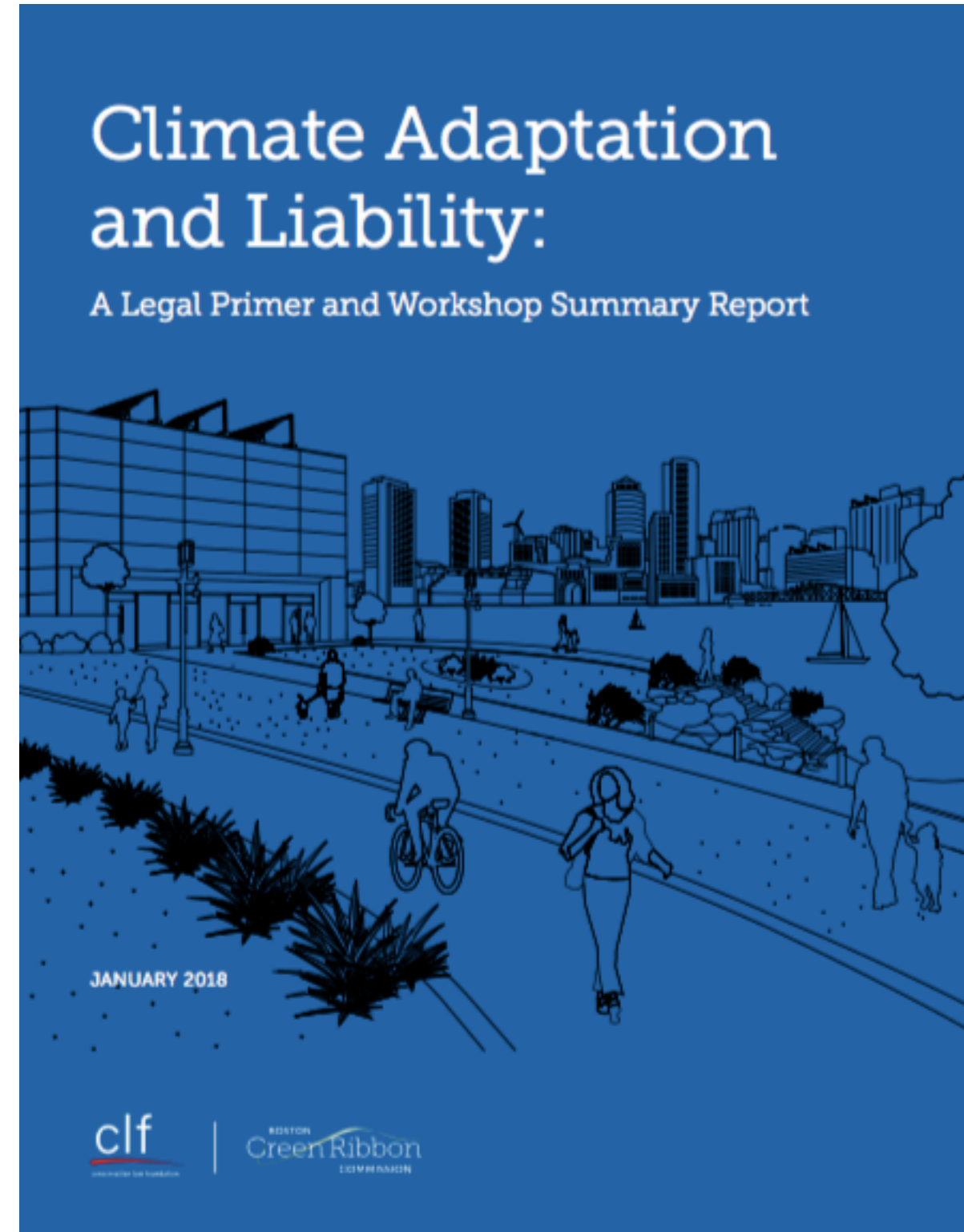
A resilience (adaptation) cost curve



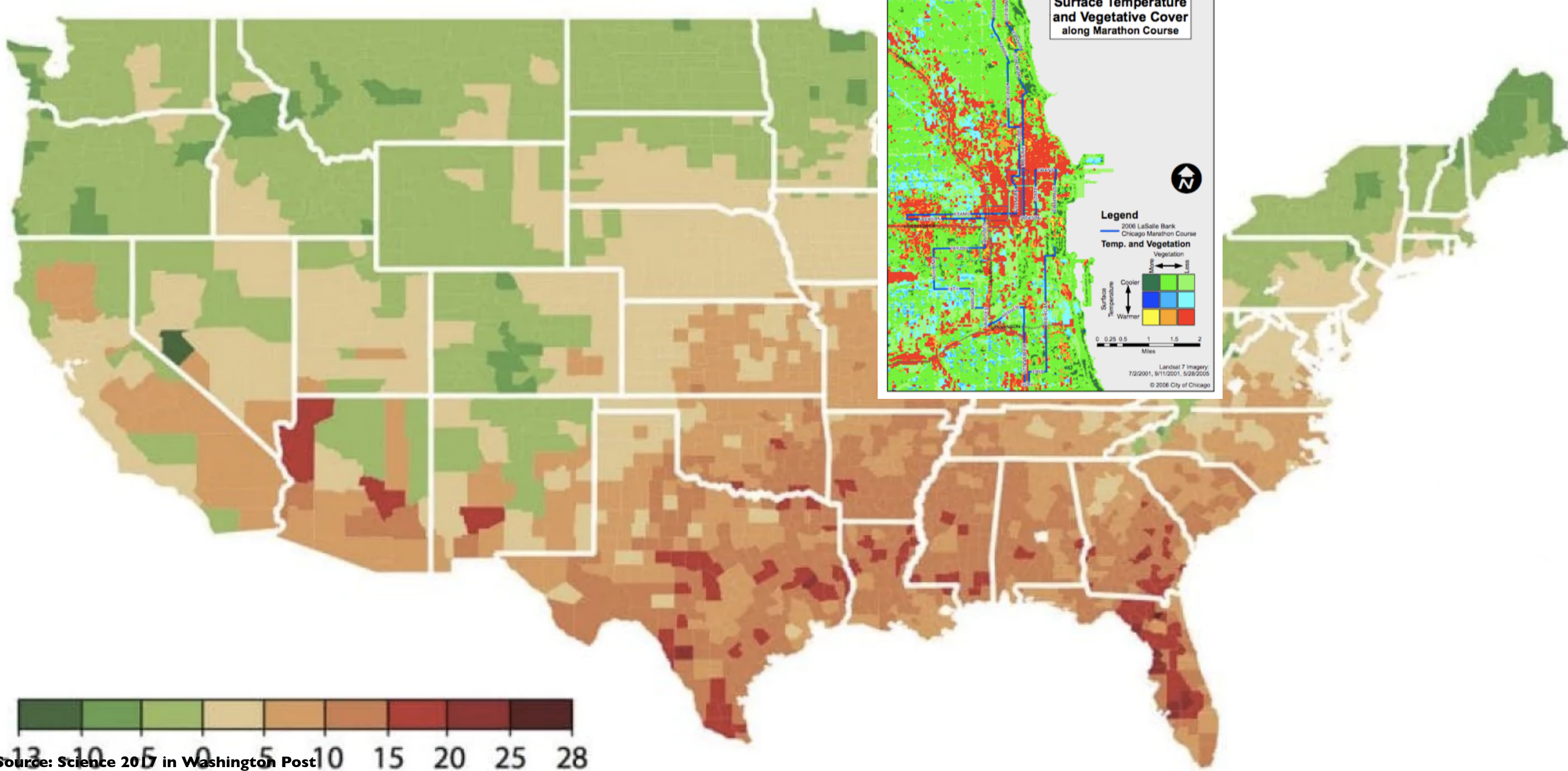
Locally specific adaptation cost / benefit curve



Tools: Threat of Liability

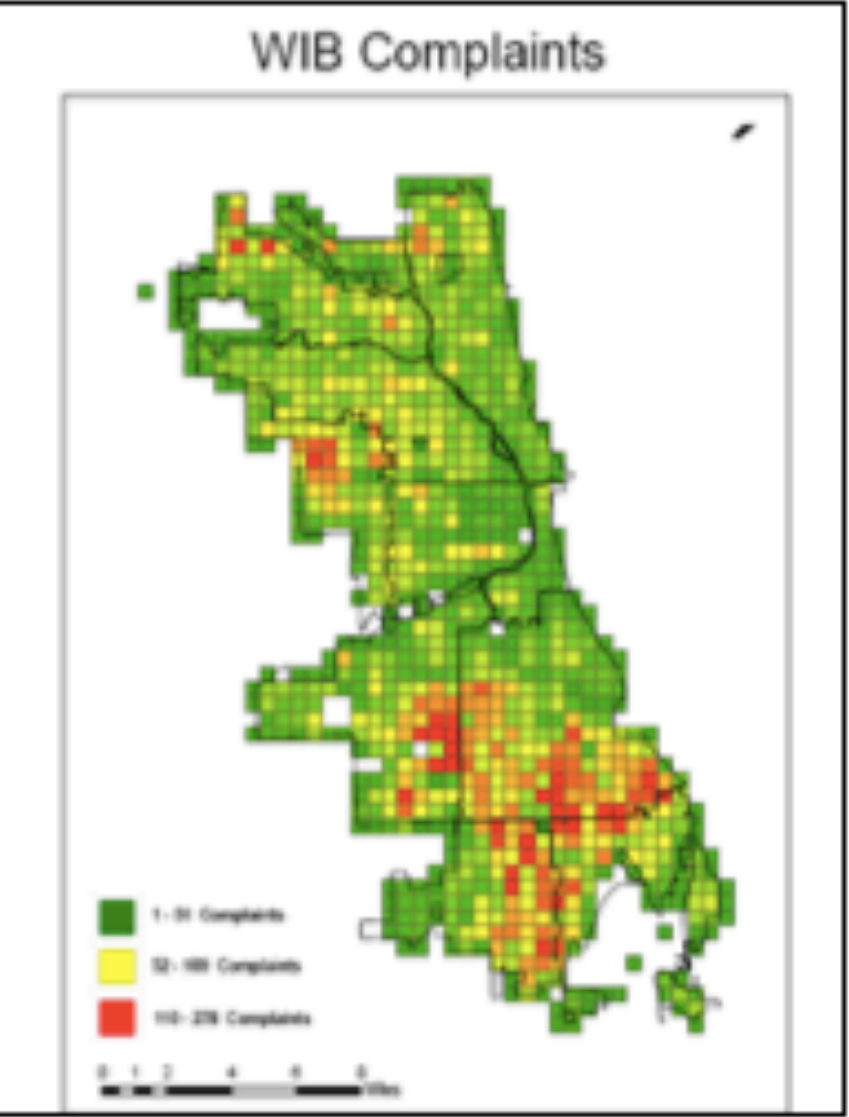


Disproportionate Risk: Growing Injustice

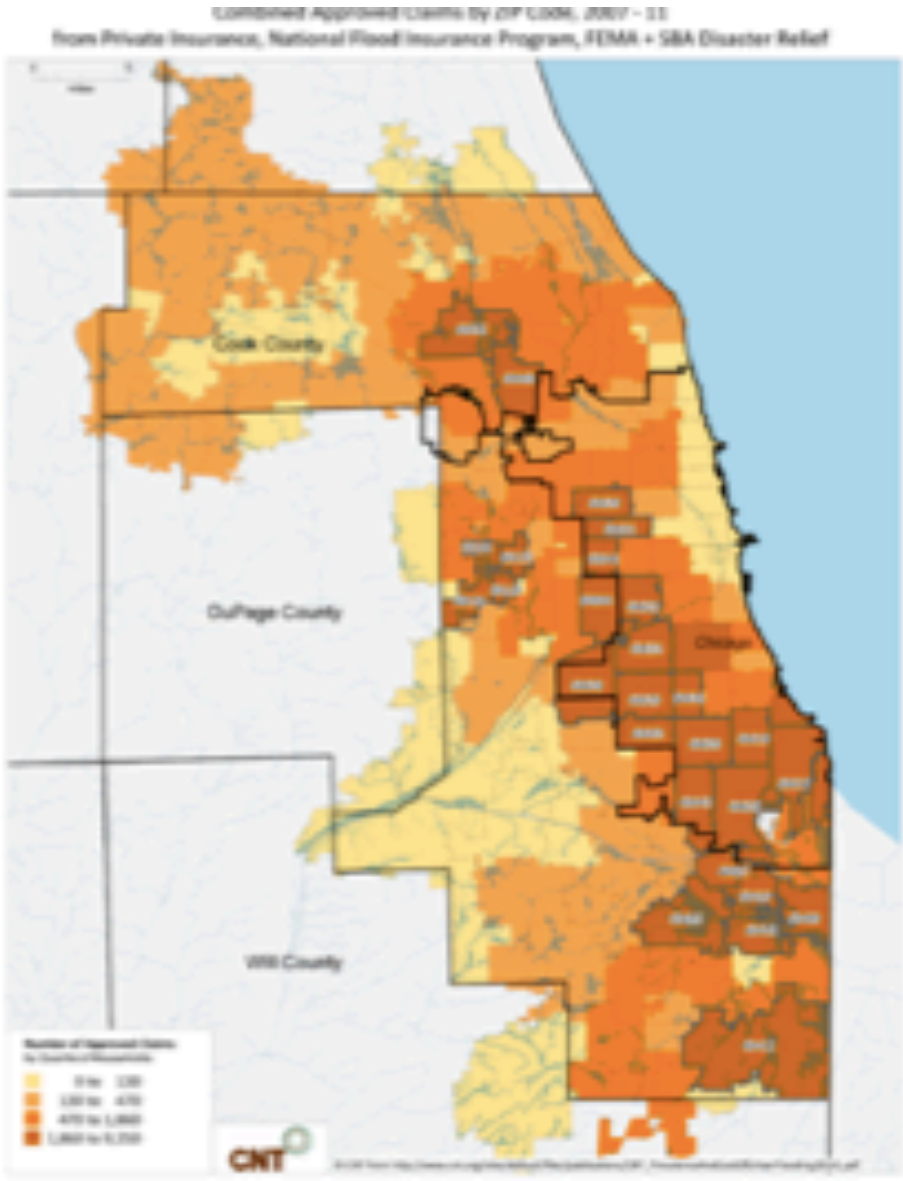


Source: Science 2007 in Washington Post

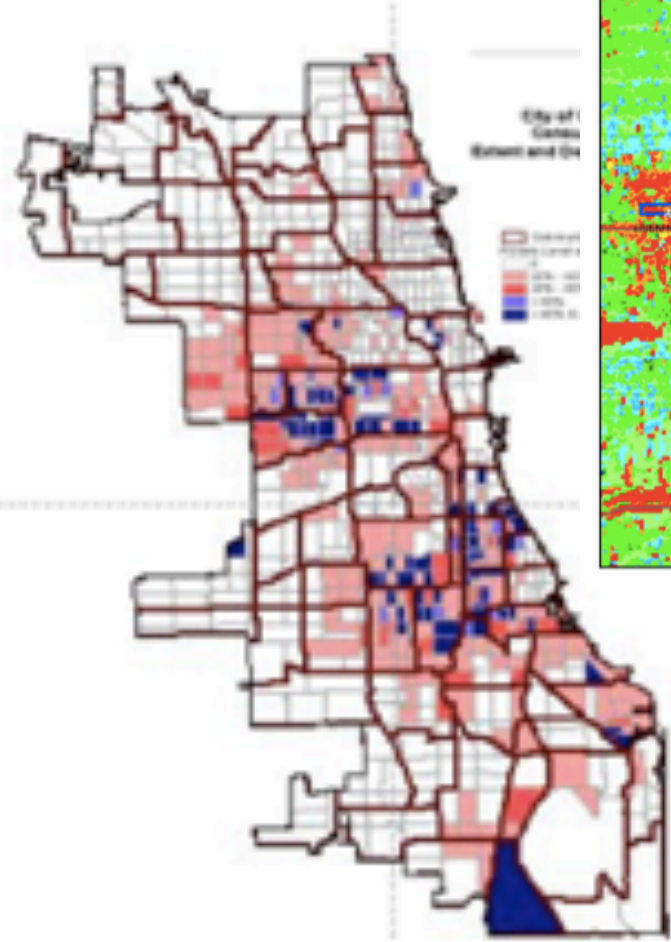
Give investors the Story



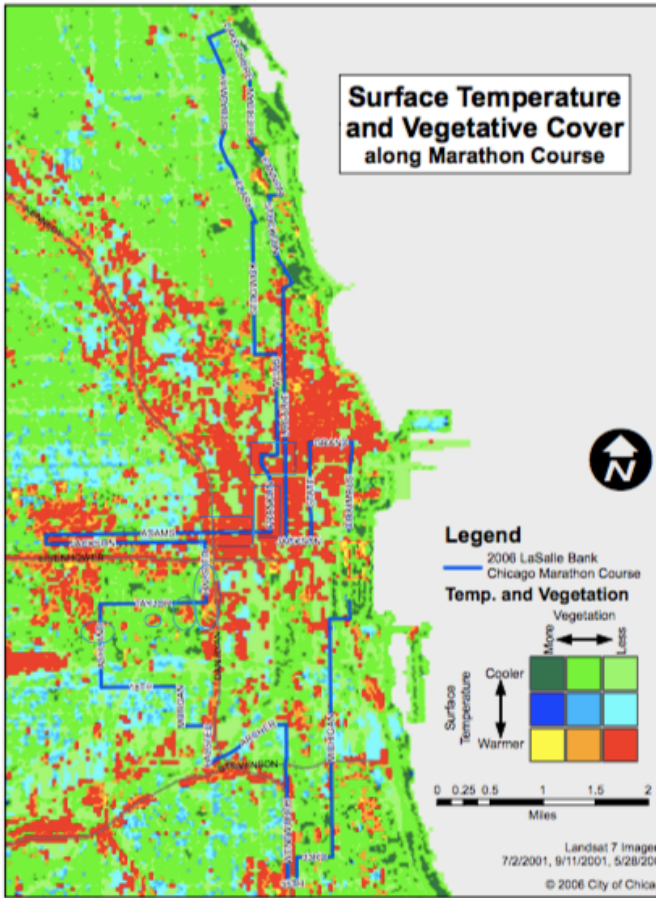
Number of "water in basement" complaints filed by single family home residents in 2010. Map from City of Chicago Department of Water Management presentation.



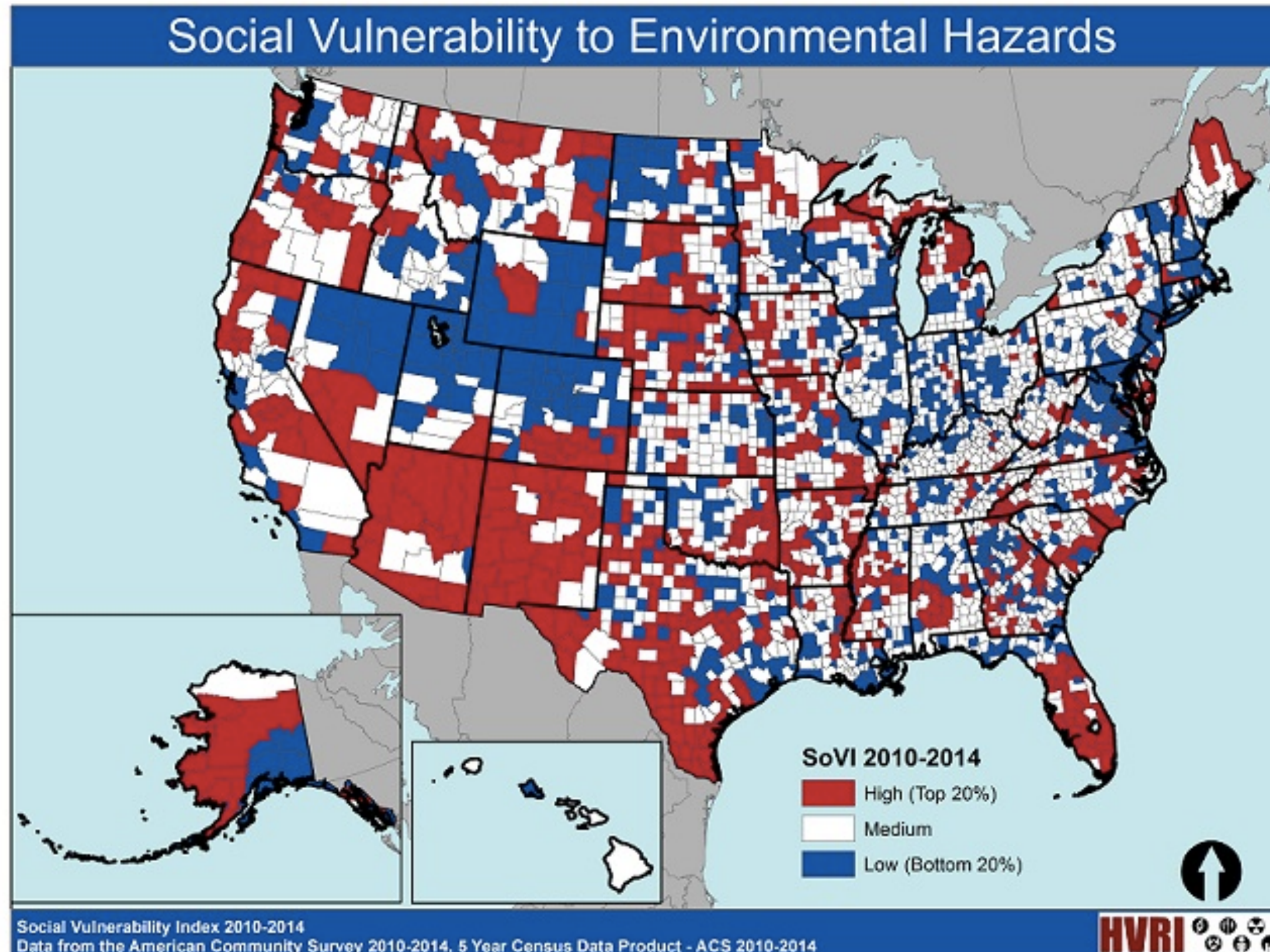
Combined Number of Approved Claims by Zip Code, 2007-2011 from Private Insurance, National Flood Insurance program, FEMA + SBA Disaster Relief. The Prevalence and Cost of Urban Flooding: A Case Study of Cook County, IL. Center for Neighborhood Technologies, May 2014



Poverty data from 2010 US Census. Map created by HorizonMapping.net



A Word on Equity (The Social Kind)



Source: Social Vulnerability Index 2010-2014

Dozens of Finance Options

SMART CITIES FINANCING GUIDE

Expert analysis of 28 municipal finance tools for city leaders investing in the future



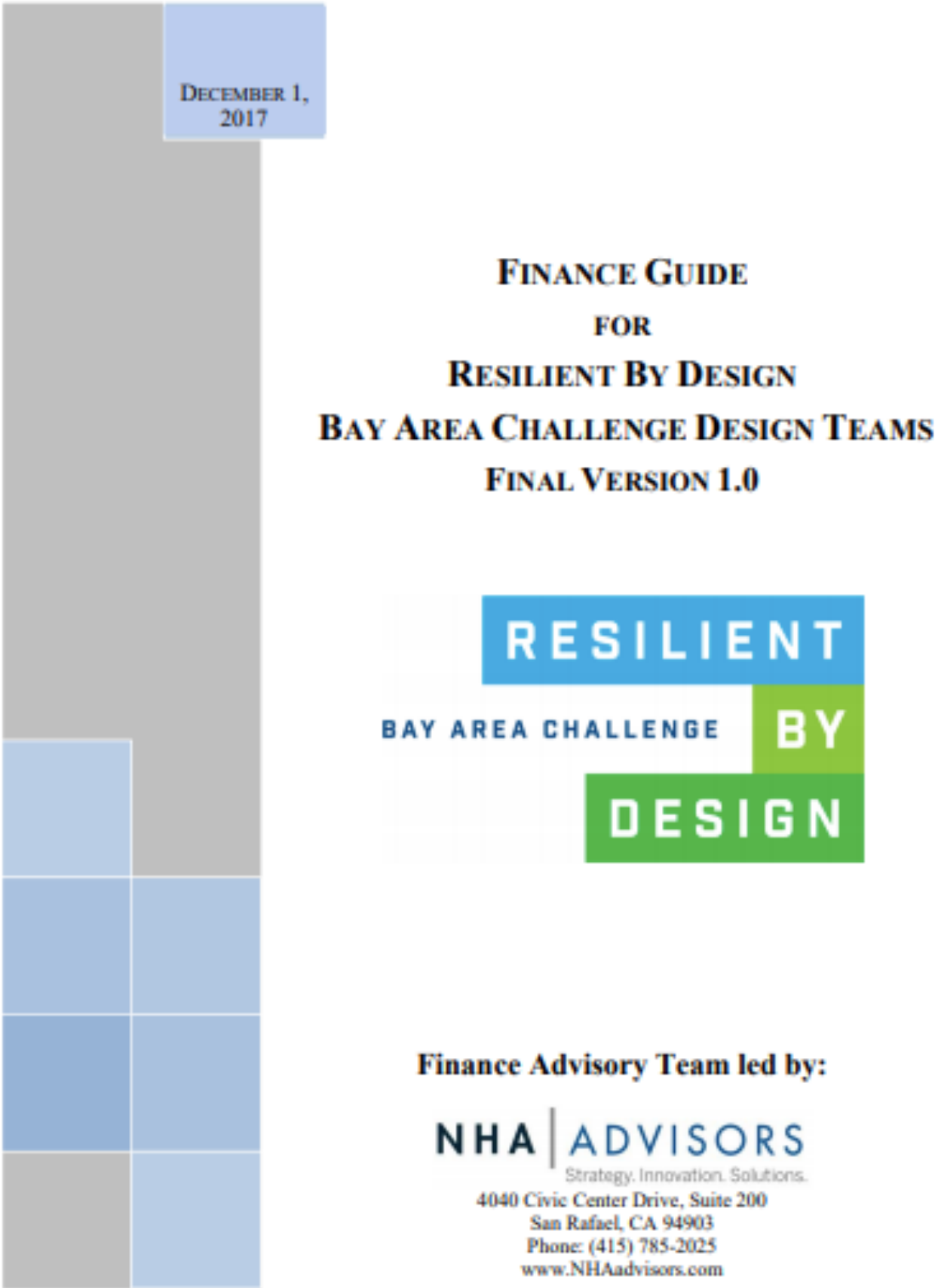
ASU Developed by the Center for Urban Innovation
at Arizona State University

SmartCitiesCouncil
LIVABILITY | WORKABILITY | SUSTAINABILITY

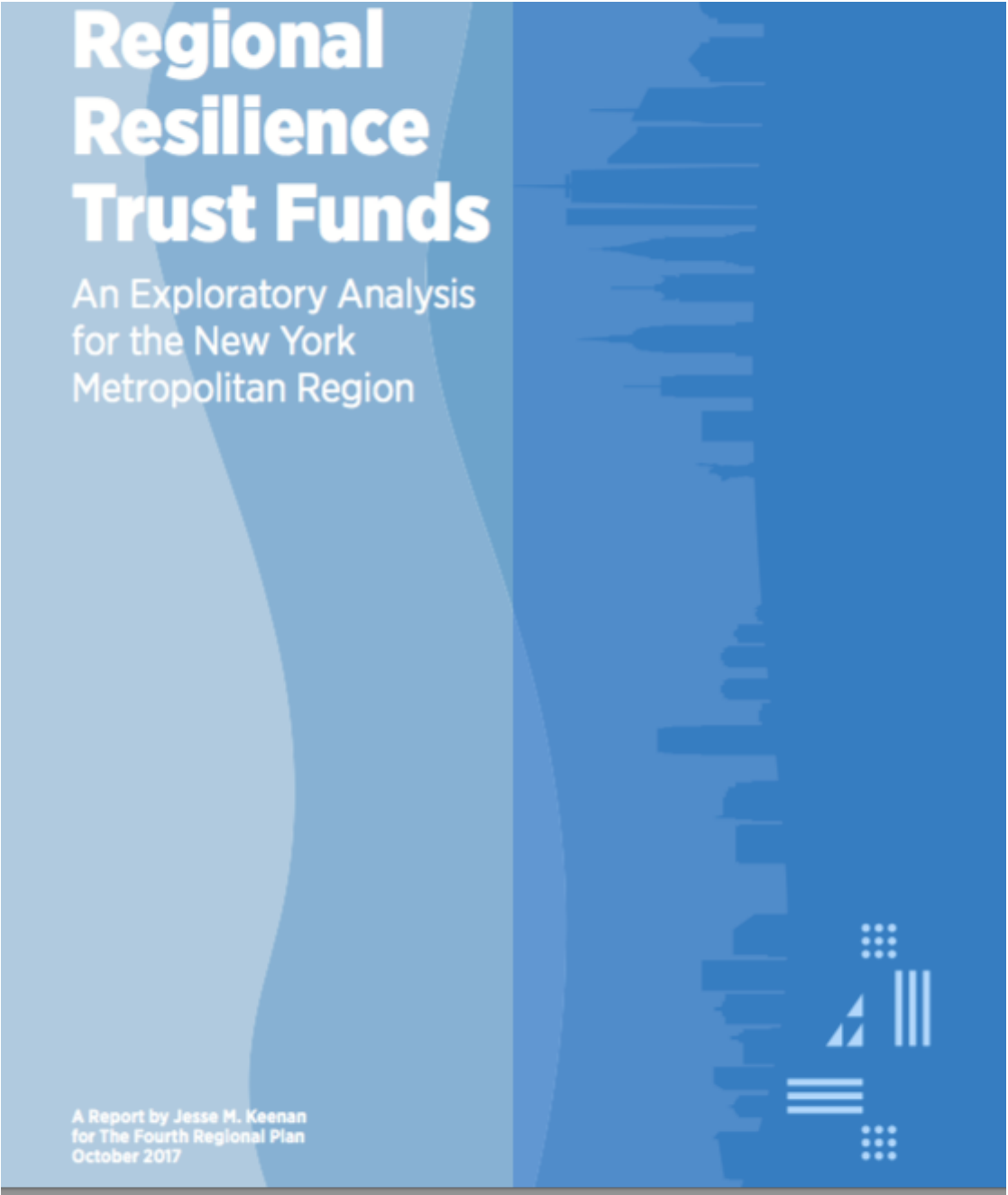
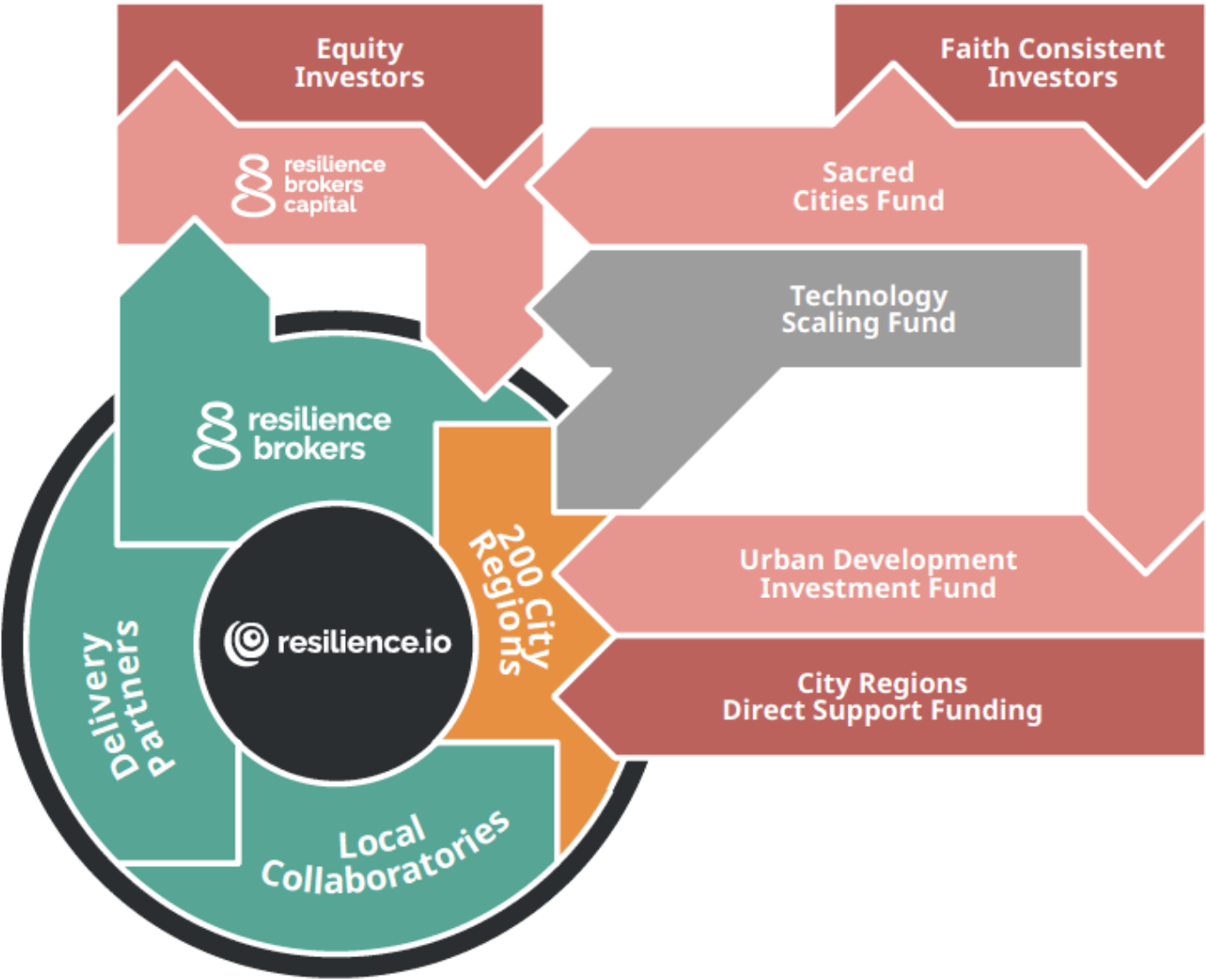
Table 1: 28 Municipal Finance Tools at a Glance

| Government-based Finance Options | Development Exactions | Public and Private Options | Private Sector Leveraging |
|---|-------------------------|---------------------------------------|---------------------------------|
| General Obligation Bonds | Dedication Requirements | Public-Private Partnerships | Loan Loss Reserve Funds |
| Revenue Bonds | Tap Fees | Pay for Performance | Debt Service Reserves |
| Industrial Revenue Bonds | Linkage Fees | Securitization and Structured Finance | Loan Guarantees |
| Green Bonds | Impact Fees | Catastrophe Bonds | On-Bill Financing |
| Qualified Energy Conservation Bonds | | | Pooled Bond Financing |
| Social Impact Bonds | | | Pooled Lease-Purchasing Finance |
| Public Benefit Funds | | | Value Capture |
| Linked Deposit Programs | | | Tax Increment Financing |
| Energy Efficiency Loans | | | |
| Property-Assessed Clean Energy Programs | | | |
| Greenhouse Emissions Allowance Auctions | | | |
| User Fees | | | |







Resilient by Design Finance Guide



Urban Development Investment Funds/Regional Resilience Trust Funds



Equity Investors

| Vertical Investments | Sample Sub-Segments | Examples of Identified Companies |
|--|--|---|
|  <p>Water</p> | <p>+ Water efficiency products (low flow, loss reduction), desalination and re-use</p> | <p>+ Company that treats and recycles water</p> |
|  <p>Agriculture</p> | <p>+ Drought resistant seeds, drip irrigation, precision agriculture, resilient food storage & logistics</p> | <p>+ Company that examines weather data to provide insurance to farmers</p> |
|  <p>Healthcare</p> | <p>+ Pharma, vaccines vs. new disease vectors (e.g., blue tongue, dengue), resilient facilities for extreme weather events</p> | <p>+ Company that provides climate health analytics to hospitals</p> |
|  <p>Energy</p> | <p>+ Resilient generation: CHP, distributed, backup; Resilient distribution: micro-grids, storage and disaster recovery</p> | <p>+ Company that manufactures systems for wind and solar assessment</p> |
|  <p>Coastal Area</p> | <p>+ Early warning systems, advanced weather/ climate resilient materials, design tech</p> | <p>+ Company that provides flood maps for coastal regions</p> |
|  <p>Insurance / Financial</p> | <p>+ Specific climate related risk insurance, risk assessment, micro-lending and micro-insurance related to adaptation efforts</p> | <p>+ Company that provides parametric insurance services</p> |

Green Bonds

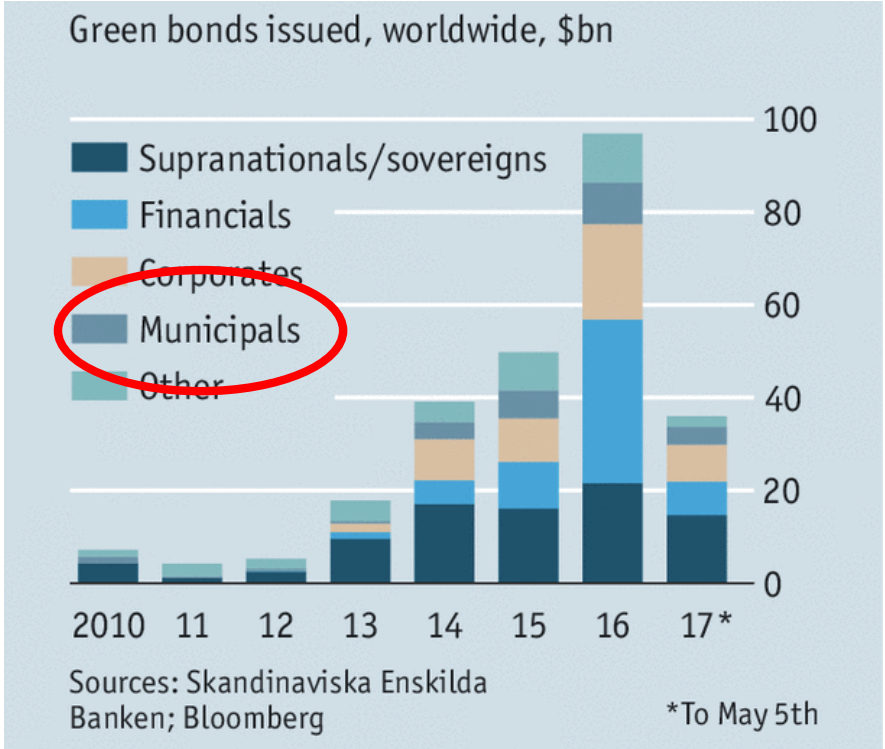
The Water Criteria of the Climate Bonds Standard
Phase 1: Engineered Water Infrastructure

ABSTRACT
What can be certified and under what eligibility conditions?

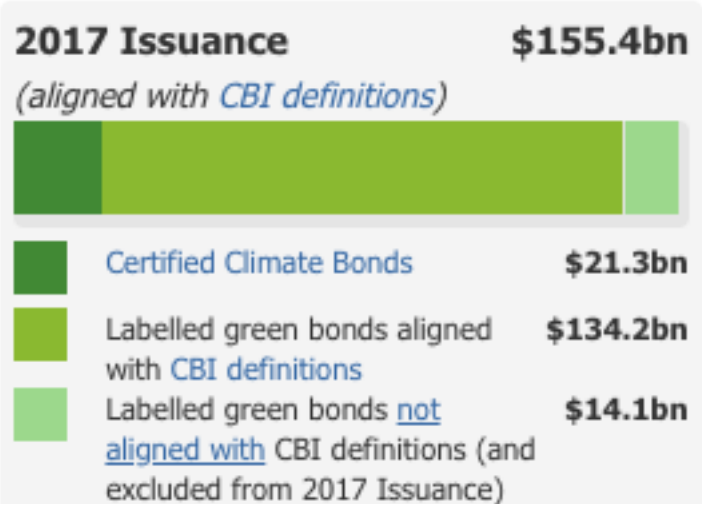
Issue Date 14 October 20



Source: Climate Bonds Initiative, The Economist, WEF Forum

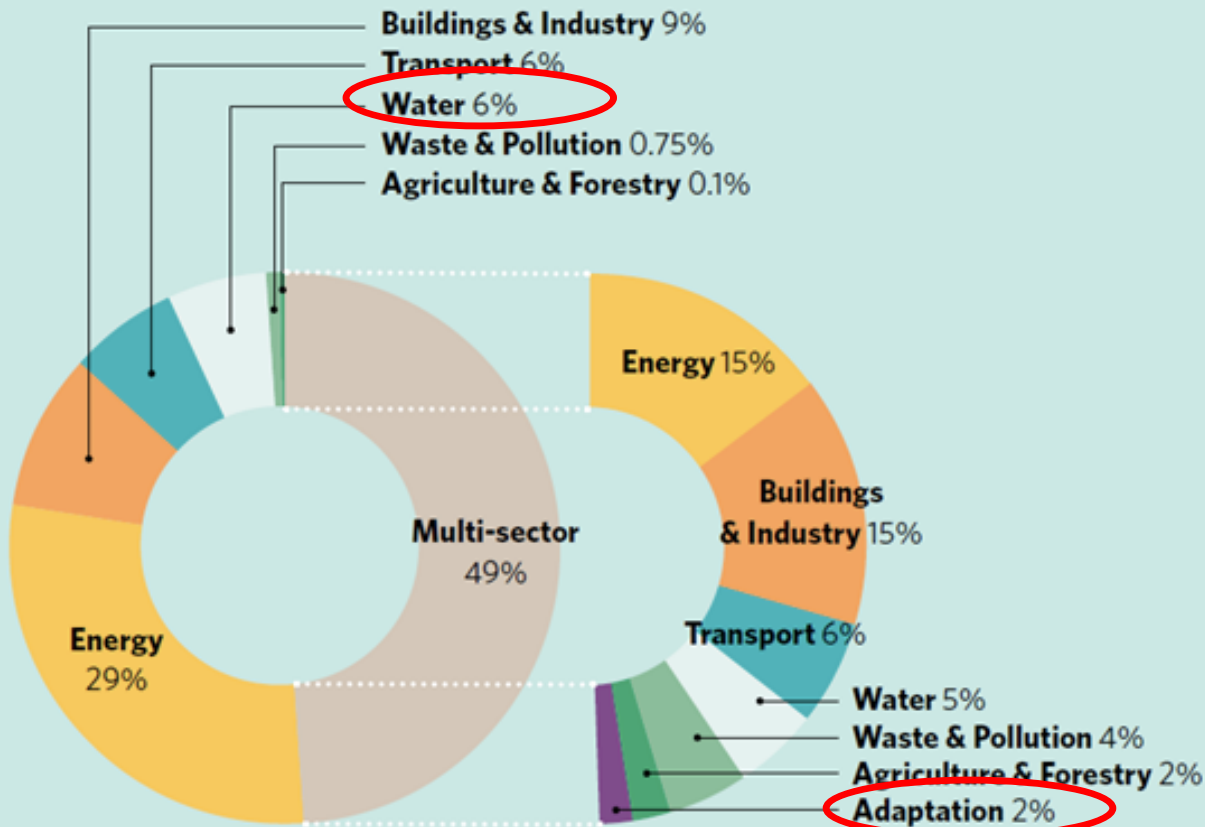


Green Bonds Market 2017



2018 Estimate **\$250-300bn**

The sectors covered by the green bond market



Don't forget GO Bonds!

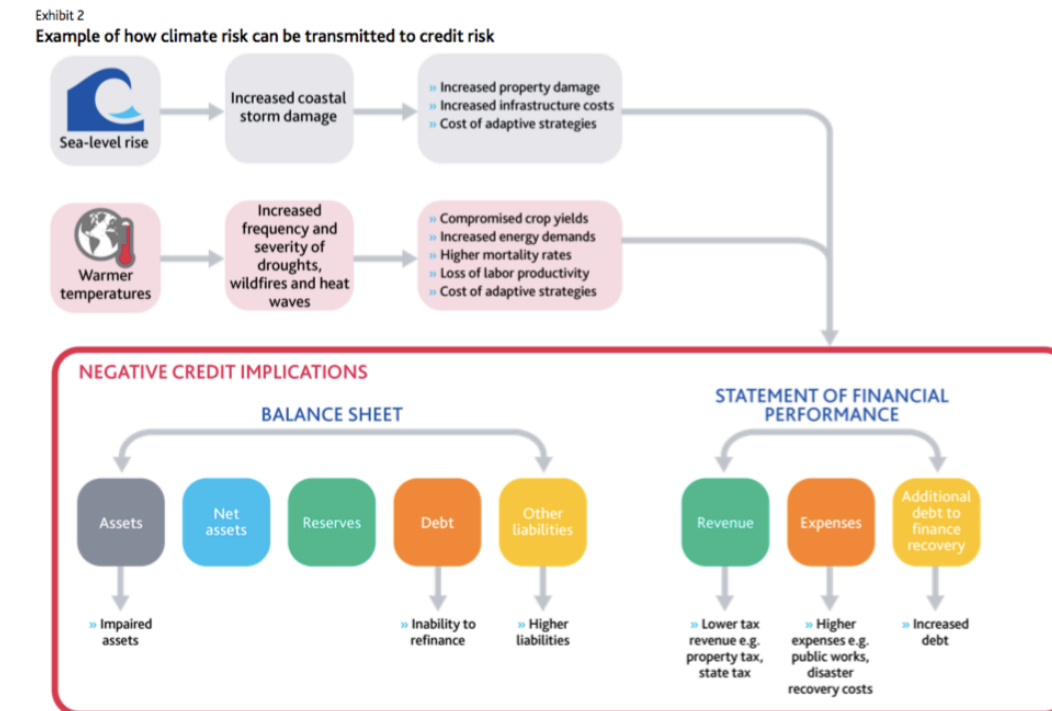
Table 2: Summary Characteristics for General Obligation Bonds

| Characteristic | Score |
|-----------------------|---|
| Source of capital | Private bond buyers |
| Number of parties | 3: The issuing government, the bond broker and the investors buying the bonds |
| Ease of financing | 3 - medium: Varies based on the fiscal health of the issuing community |
| Duration of financing | Varies. Rarely used for quick financing, but very common for most long-term financing |
| Risk to investors | 2 - relatively low risk: Ratings help determine risk with higher returns on riskier purchases; could lose investment if jurisdiction became insolvent which is rare |
| Risk to borrowers | 2 - relatively low risk: As long as jurisdiction is not overstretched on other demands for its revenues |
| Tax implications | Tax exempt |
| Source of repayment | Usually tax revenue |
| Advantages | Relatively easy to use tool overall if the jurisdiction is fiscally healthy |
| Disadvantages | As long as the jurisdiction balances its long term debt obligations relative to revenues, the disadvantages are small (which is why GO bonds are so popular) |

Source: ASU Smart City Investment Guide

How Can Other Actors Facilitate Private Finance?

- Banks: Adapt financial **instruments** to channel investment to resilient infrastructure (*and away from maladaptation*)
- Non profits: Compile **data** on return of resilience projects
- Associations: Create **consortium** of operators, developers & investors
- Advocates: Encourage sustainability criteria in **procurement**
- Governments: Establish a **priority** pipeline of resilience projects
- Foundations: Invest in project **preparation** & pipeline development



Source: Moody's 2018

What Investors Want: Vision

- City vision
 - Vision strategic objectives, priorities and programs
 - Vision collaboration for shared goals
 - Vision, priorities and program with STAKEHOLDERS
 - Vision budget strategy
 - Vision governance, vehicles and FOCAL POINT
 - Vision mechanisms for CONTRACTING at each project stage
- Legislative, regulatory and licensing regime to inspire investor confidence

Stress Test & Create Project Case for Investor Package

1. Fully investigate project needs and solution options
2. Describe 1 in 100/200/500 year event impact with and without project
3. Clearly define project scope, delivery program and budget requirements
4. Consider commercial viability, possible funding options and applicable laws
5. Identify path to meet regulatory, permit and land rights

Finance Sector Adaptation Leadership '17 '18

opinion & comment

COMMENTARY:
How insurance can support climate resilience
Svenja Surmiski, Laurens M. Bouwer and Joanne Linerooth-Bayer
Insurance is gaining importance in and beyond the climate negotiations and offers many opportunities to improve climate risk management in developing countries. However, some caution is needed, if current momentum is to lead to genuine progress in making the most vulnerable more resilient to climate change.

Was 2015 'the year of climate insurance'? Statements emerging from the G7 leaders and COP21 in Paris certainly suggest so. Article 8 of the Paris Agreement includes "Risk insurance facilities, climate risk pooling and other insurance solutions" as areas of action. Earlier in the year, at their summit in Germany, the leaders of the G7 launched a new initiative on Climate Risk Insurance (ClimateResilience), pledging to bring climate insurance to 400 million currently uninsured individuals in poor countries by 2020. In many ways the G7 initiative and the Paris Agreement are the culmination of a long process to establish insurance as an accepted climate adaptation instrument".

High hopes and expectations ...
The supporters of climate insurance point to increasing losses from weather extremes – such as floods, droughts and tropical cyclones – where the absence of insurance can have negative implications for the scale and duration of the economic impact of disasters, the resilience of businesses, individuals and governments, and speed of recovery". Insurance can shift the mobilisation of financial resources away from ad hoc post-event payments, where funding is often unpredictable and delayed, towards more strategic and, in many cases, more efficient approaches that were set up in advance of disastrous events". Making these tools available to the most vulnerable areas is attractive. A number of pilot schemes, such as the African Risk Capacity, the Pacific Catastrophe Risk Assessment and Financing Initiative, and the Caribbean Catastrophe Risk Insurance Facility, as well as new pilot schemes, such as index-based agriculture micro-insurance, are offering financial protection to a growing number of governments and individuals across the world.

... but some scepticism remains
Any new insurance scheme in developing countries needs to overcome difficult challenges, including lack of risk data, limited financial literacy, and weak financial infrastructure. It also needs high levels of support to make it viable for people with very low income. Many of the new pilots and pools have been designed with this in mind. However, utilising insurance for adaptation and poverty reduction faces even more challenges: how can a scheme reach the most vulnerable, and how does it cope with and address changing risk levels? As the intensity and frequency of climate extremes increase, is it fair to shift responsibility on to those who are the least responsible for climate change, the least able to shoulder the premiums, and in many cases the least able to reduce their losses?

Without substantial external support, insurance could shift the burden of climate-related impacts to the most vulnerable in society, by requiring them to pay insurance premiums rather than offering them direct help and support. Subsidised premiums are one answer to this, other solutions include publicly funded reinsurance arrangements and technical support – each of which indirectly reduce premiums. For this purpose, discussions on the G7 initiative include the potential of global and regional facilities financed by wealthy countries to absorb a high layer of risk and support local insurance arrangements in the most vulnerable countries, as suggested early on by the Alliance of Small Island States. However, external support, especially direct subsidies, raises the question of value for money. Some critics point out that traditional insurance is an expensive mechanism with high transaction and capital costs, making premiums far higher than expected losses. This suggests that adaptation funds might be better spent on other types of safety net rather than on buying insurance cover from international insurance markets".

Critics further caution that subsidised insurance can dampen incentives to reduce risks. A recent study for the Climate Investment Fund" suggests that climate insurance can play an important role in climate adaptation, but it also warns that inappropriately set up insurance schemes can have unwanted consequences and may neither benefit the poor nor foster climate resilience. This echoes the IPCC report on managing the risk of extreme events". This report concludes that insurance can be a tool for risk reduction and for recovering livelihoods, particularly in the face of extreme weather events, but it also warns that insurance could provide disincentives for risk reduction, if not correctly structured.

There are no one size fits all solutions for climate insurance, and insurance is not suitable for certain risks, such as slow onset events like sea level rise. However, this tool does offer many benefits, particularly compared with reliance on post-disaster aid. We therefore believe that there is a role for carefully designed and supported insurance instruments, such as index-based micro-insurance where pay-outs are based on triggering of certain weather parameters like rainfall, and coverage insurance pools in which national governments are covered against the impacts of natural hazards on their annual budget. But their success will depend on making them fair and

NATURE CLIMATE CHANGE | VOL 6 | APRIL 2016 | www.nature.com/natureclimatechange
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Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures

TCFD | TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES | June 2017

Financing urban adaptation to climate change

ISSN 1937-8449

European Environment Agency

BLACKROCK

Adapting portfolios to climate change

Implications and strategies for all investors

BLACKROCK INVESTMENT INSTITUTE

GLOBAL INSIGHTS SEPTEMBER 2016

LENDERS' GUIDE FOR CONSIDERING CLIMATE RISK IN INFRASTRUCTURE INVESTMENTS

U.S. PUBLIC FINANCE

Moody's INVESTORS SERVICE

SECTOR IN-DEPTH 28 November 2017

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Environmental risks

Evaluating the impact of climate change on US state and local issuers

In coming years, climate change is forecast to result in a higher frequency and severity of extreme weather events, in turn heightening US exposure and vulnerability to economic loss across industries and geographic regions. This piece discusses how we assess the credit impact of these risks on US state and local issues.

- Global climate change is forecast to increase the US' exposure and vulnerability to a range of factors such as severe heat, changes in precipitation patterns and rising sea levels. These changes are projected to drive an increased frequency of extreme weather occurrences, or climate shocks, including heat waves, droughts, hurricanes, flooding, wildfire and more damaging coastal storm surges. If federal, state and local governments do not adapt, these risks are forecast to become more frequent and severe over time. However, we anticipate that some level of adaptation and mitigation strategies will be adopted to lessen these impacts.
- The negative economic effects of climate change vary by region. Although climate change is certain to have economic impacts in the future, projections of costs are imprecise. The primary quantifiable impacts are damage to coastal property as a result of floods and rising sea levels, changes in agricultural production, lower labor productivity, health impacts and increased energy use. Changes in environmental policy and adaptive mitigation strategies will likely reduce these costs.
- Credit risks resulting from climate change are embedded in our existing approach to analyzing the key credit factors in our methodologies. Our analysis of economic strength and diversity, which signals the speed with which an economy may recover, captures climate-driven credit risks such as economic disruption, physical damage, health and public safety, and population displacement. Fiscal strength, access to liquidity and levers to raise additional revenue are also key to our assessment of climate risks as is evaluating asset management and governance. This provides the basis for our view of state credit resiliency to climate change, and is the framework for evaluating the credit risk to local government issuers.
- Local, state and federal tools for both immediate response and long-term recovery enhance resilience to the physical and economic impact of extreme weather events. US municipal issuers benefit from local, state and federal programs to help areas affected by climate shock manage the immediate physical impacts of extreme weather. Issuers also benefit from a variety of resources to expedite the long-term recovery of their economic base.

PENSIONS AND LIFETIME SAVINGS ASSOCIATION

IN ASSOCIATION WITH ClientEarth

MORE LIGHT, LESS HEAT: A FRAMEWORK FOR PENSION FUND ACTION ON CLIMATE CHANGE
DECEMBER 2017

AN INVESTOR GUIDE TO PHYSICAL CLIMATE RISKS & RESILIENCE: AN INTRODUCTION

GARI

An Investor Guide to Physical Climate Risk & Resilience
An Introduction

An Investor Guide of the
Global Adaptation & Resilience Investment Working Group
December 2017

UNEP Federal Ministry for Economic Cooperation and Development FINANCE UNEP INITIATIVE giz

DEMISTIFYING ADAPTATION FINANCE FOR THE PRIVATE SECTOR

November 2016

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A GUIDE FOR PUBLIC-SECTOR RESILIENCE BOND SPONSORSHIP

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