



Uncovering Systemic Climate Risk in the Municipal Market

October 7, 2021



ICE Data Services ESG solutions



ESG Reference Data

Better understand the ESG risks and opportunities of listed companies with ICE ESG Reference Data, the data set provides detailed ESG attributes in a standardized format for comparing data points across industry sectors.



ESG Risk Data

Uncover the risks of listed companies with risk monitoring and controversy data. The data set is provided by RepRisk, an ESG data science company, and is offered as part of the ICE ESG Reference Data service.



Climate Risk

Quantify climate risk exposure and make strategic decisions across municipal bond portfolios by maturity, obligor or geographical boundary with ICE Climate Risk.



Sustainability Indices¹

Gain exposure to ESG and carbon footprint factors through a range of sustainable benchmarks.



Sustainable Bond Data

Get greater clarity on green and social bonds sourced from authoritative agencies and issuer documentation from our terms and conditions data service.



ESG Derivatives Data

Access content on a range of ESG derivatives markets including ICE Environmental Markets with ICE Data Services ESG Derivatives Data.

¹ ICE Data Indices in providing these Sustainability Indices is not intending to interpret or give guidelines on the EU Taxonomy disclosures nor the EU criteria for environmentally sustainable investments. Please refer to the methodology for each of the ICE Sustainability Indices for additional information: [ESG indices](#), [Green Bond indices](#) and [Carbon Reduction indices](#).

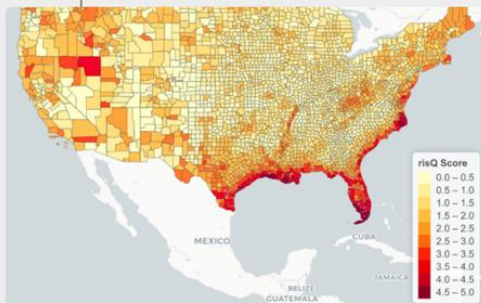
Leading climate risk and ESG analytics for U.S. fixed income



Physical Climate Risk

Hurricane, flood, wildfire, heat stress, drought, sea level rise

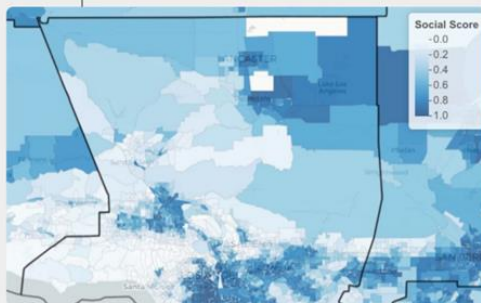
Measurable relationships to key pillars of the U.S. economy — property value, mortgage delinquency and default, credit impairment, and population loss



Social Impact & ESG Data

Social impact scoring based on affluence, poverty, health, education, race, employment, and housing indices to identify needs of communities

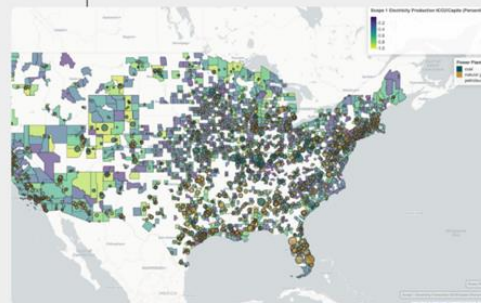
Governance scoring driven by a policy database covering an array of key issues that drive municipal and social health



Carbon Transition Risk

Energy, transportation, industry, residential and commercial emissions

Scope 1 and scope 2 views on socioeconomic carbon dependence risk and opportunity

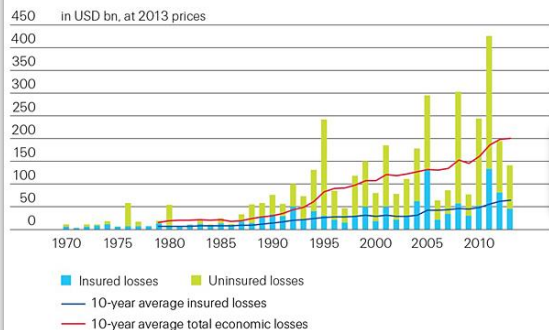


Climate Change is a Growing Public Burden in the U.S.

The insurance industry has managed to shift the burden off itself and onto the public -- from FEMA, to cities, and most importantly under resourced and disenfranchised communities and small, resource-stressed municipalities and people.

Widening Insurance Gap

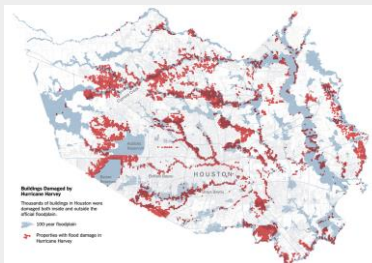
Figure 1: Insured losses vs uninsured losses, 1970–2013



Economic loss = insured + uninsured losses
Source: Swiss Re Economic Research & Consulting

Risk

Municipal Level Burden



B Bloomberg.com

[Everybody Is Going to End Up Paying for Texas' Climate Crisis](#)

Americans already share the collective financial burden of climate change, even if they don't realize it (113 kB) ▾

'The NFIP "now pays about \$1 million in interest per day, according to a [recent federal report](#), and won't be able to repay its existing debts in the next decade as warmer oceans bring more flooding."'

Federal Burden

THE BOND BUYER

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RATINGS

Near-certain default spurs downgrade of debt linked to fire-ravaged town

By Kenley Webster January 26, 2019, 3:57 p.m. EST 2 Min Read

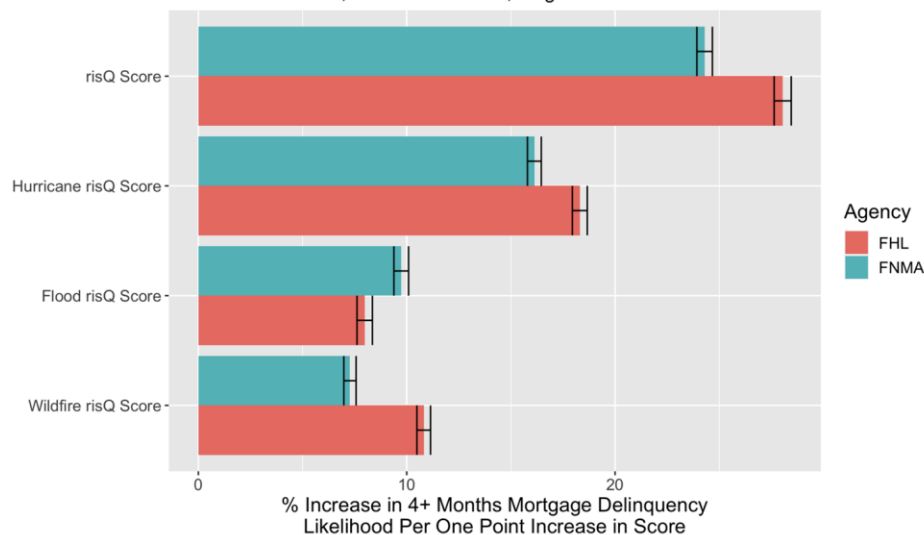
Taxpayer/Community Burden

risQ estimates that at least 80% of homeowners don't have (access to) government-subsidized flood insurance.

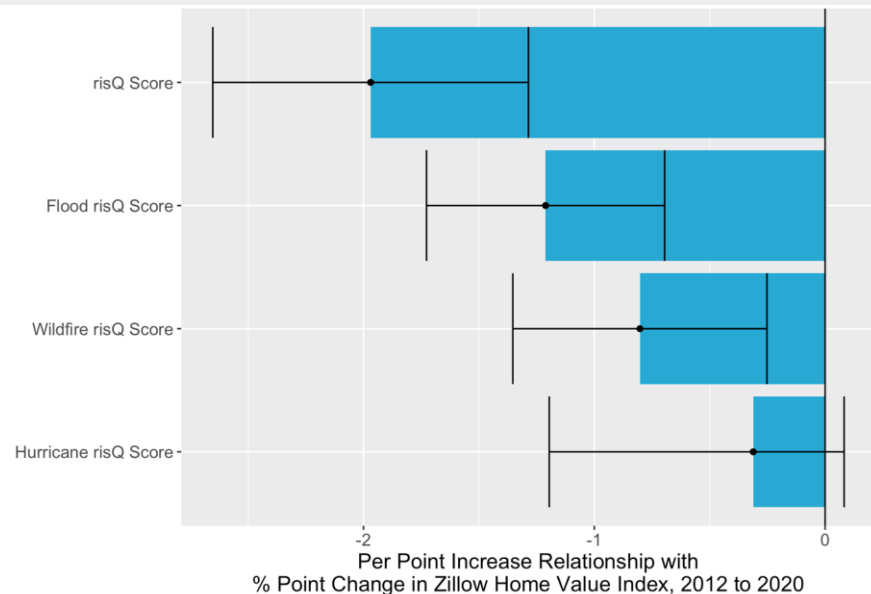
<https://www.nytimes.com/interactive/2017/11/11/climate/houston-flooding-climate.html>

Climate Risk is Already Impacting US Fixed Income Fundamentals

Climate Risk is a Significant Correlate to Mortgage Delinquency
~15M FNMA Loans, ~12M FHL Loans, Originated 2006 to 2018



Increasing the **risQ Score** by one point holding all else increases the odds of severe (4+ month) mortgage delinquency by ~24-28%.



Increasing the **risQ Score** by one integer holding all else constant implies a -2% discount for home price appreciation, and a -10% impact across the full 0 to 5 scale.

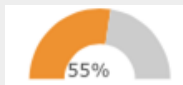
Physical climate risk analytics for all use cases

risQ's comprehensive climate risk data is used by larger client teams, while all clients can use to the **risQ Score** to compare securities, evaluate portfolios and benchmark to indices

**Property
Value at Risk**

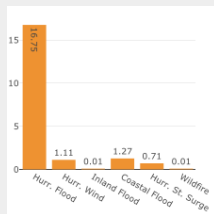
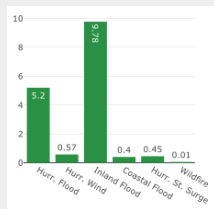


**GDP
Impairment
Risk**



Percentiles

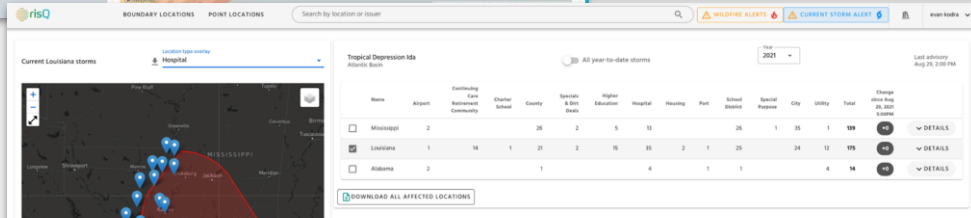
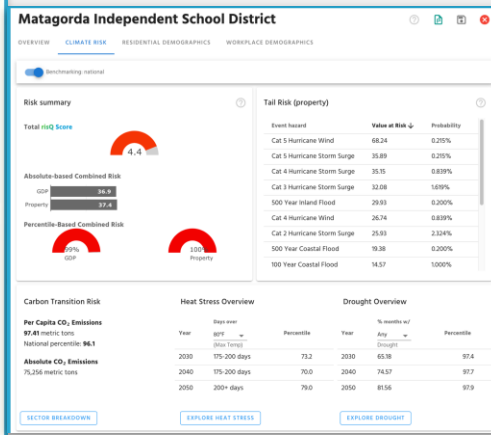
Perils and VaRs



 **risQ Score**

- ✓ Unified metric on a 0-5 scale that maps to total financial risk from acute physical climate risk
- ✓ Applicable at CUSIP and portfolio levels
- ✓ Built on accessible, underlying data outputs from climate conditioned catastrophe models
- ✓ Relationships to key pillars of U.S. fixed income - property value, credit impairment, mortgage risk, and population loss

High granularity data, but not as easily absorbed

[illegible]

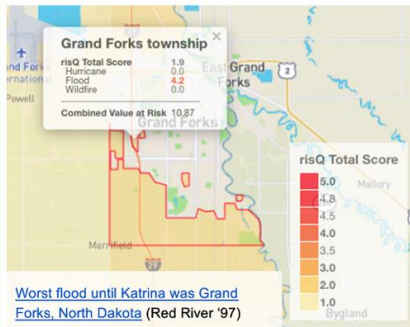
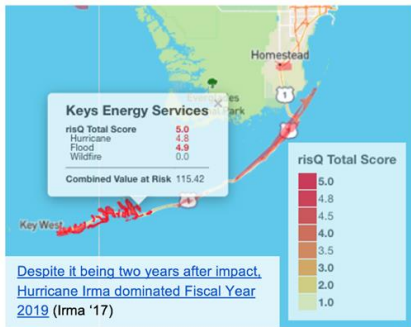
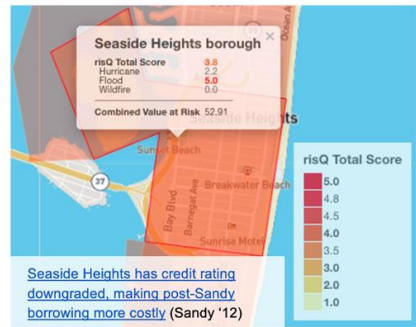
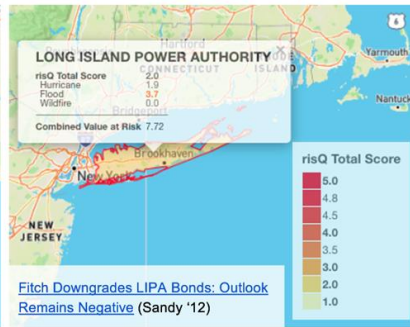
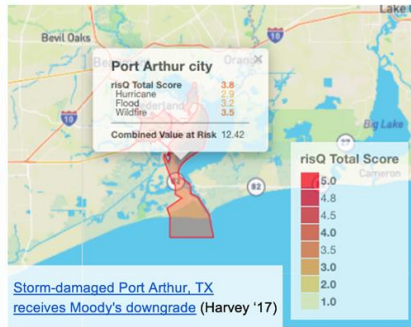
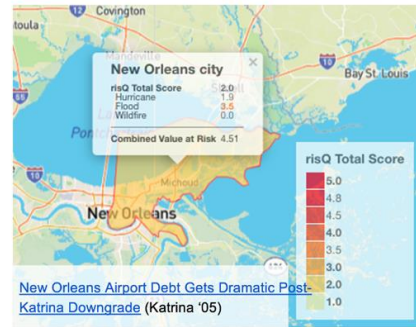
- Explore the U.S. climate risk and socioeconomic landscape
- Drill down into any location or debt obligor
- Export data and reports
- Upload, benchmark, and manage portfolios
- Monitor portfolios for real time climate event risk
- Weekly, in-depth commentary on competitive sales, negotiated sales, new issuances
- In-depth, monthly market-centric research
- < 1 day turnaround on new-to-market coverage requests

Issuer and CUSIP-Linked Climate Risk

CUSIP9	ISSUER	ISSUE DATE	COUPON	MATURITY DATE	STATE	ORIGINAL PRINCIPAL AMOUNT	EVAL DATE AS OF	EVAL PRICE	EVAL YIELD	EVAL PRICE TO DATE	RisQ Score	Flood Score	Hurricane Score	Wildfire Score
69578PGJ4	PAINTSVILLE KY INDPT SCH DIST FIN CORP SCH BLDG REV	3/1/2018	3.25	3/1/2034	KY	\$735,000	2/20/2020	107.95	2.164	3/1/2028	4.8	4.8	0	2.5
935005AN8	WARREN CNTY KY SCH DIST FIN CORP ENERGY CONSV REV	5/1/2018	3.25	3/1/2031	KY	\$1,850,000	2/20/2020	107.94	2.167	3/1/2028	0.04	1.4	0	0
834562GW4	SOMERS POINT N J	10/2/2019	2	10/1/2031	NJ	\$1,145,000	2/20/2020	99.224	2.076	10/1/2031	2.6	4.7	1.6	2
9273963U3	VINELAND N J	10/1/2019	2	10/1/2031	NJ	\$770,000	2/20/2020	99.122	2.086	10/1/2031	0.06	0.4	1.4	1.2
41423EFC1	HARRIS CNTY TEX MUN UTIL DIST NO 449	9/1/2019	2.625	9/1/2044	TX	\$2,325,000	2/20/2020	99.737	2.64	9/1/2044	2.5	1.5	2.2	1
34679VJY7	FORT BEND CNTY TEX MUN UTIL DIST NO 24	9/1/2019	2.625	9/1/2044	TX	\$300,000	2/20/2020	99.737	2.64	9/1/2044	2	2.5	2	1.4
640023DR5	NEEDLES CALIF UNI SCH DIST	8/9/2011	0	8/1/2027	CA	\$25,268	2/20/2020	88.969	1.578	8/1/2027	2.4	4.3	0	2.6
669096MY2	NORWALK LA MIRADA CALIF UNI SCH DIST	5/5/2005	0	8/1/2027	CA	\$3,906,249	2/20/2020	88.969	1.578	8/1/2027	0.03	1	0	0
533067HP2	LINCOLN CALIF UNI SCH DIST SAN JOAQUIN CNTY	8/28/2007	0	8/1/2027	CA	\$133,403	2/20/2020	88.445	1.658	8/1/2027	2.1	4.5	0	0
763507BS8	RICHLAND CALIF SCH DIST	12/3/2004	0	8/1/2027	CA	\$265,000	2/20/2020	88.445	1.658	8/1/2027	1.6	3.7	0	1.4
499214JQ8	KNOTT CNTY KY SCH DIST FIN CORP SCH BLDG REV	2/5/2020	2.5	2/1/2039	KY	\$240,000	2/20/2020	99.425	2.538	2/1/2039	1.9	3	0	2.5
782561KQ6	RUSSELL KY INDPT SCH DIST FIN CORP SCH BLDG REV	2/18/2020	2.5	2/1/2039	KY	\$305,000	2/20/2020	99.425	2.538	2/1/2039	0.08	1.7	0	1.4

~98% of all outstanding municipal debt covered (~3.8T) at a CUSIP9 level, delivered as data flat file product

Climate & Credit Impacts



Climate Helped Turn These 5 Places into Ghost Towns

Sea level rise, river floods and wildfires have destroyed some settlements and forced others to relocate

By Daniel Cusick, E&E News on October 30, 2020

Source: <https://www.scientificamerican.com/article/climate-helped-turn-these-5-places-into-ghost-towns/>

Climate Change Is Bankrupting America's Small Towns

Repeated shocks from hurricanes, fires and floods are pushing some rural communities, already struggling economically, to the brink of financial collapse.

Source: <https://www.nytimes.com/2021/09/02/climate/climate-towns-bankruptcy.html>

Devastated by Disasters, Lake Charles Is Still Waiting for Help

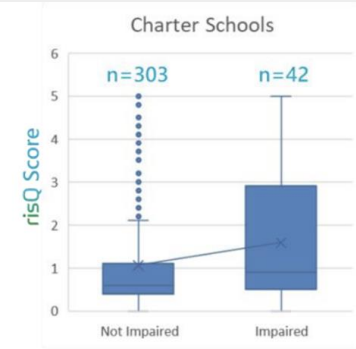
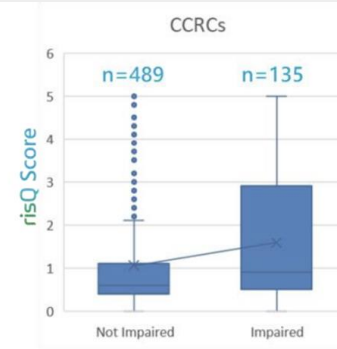
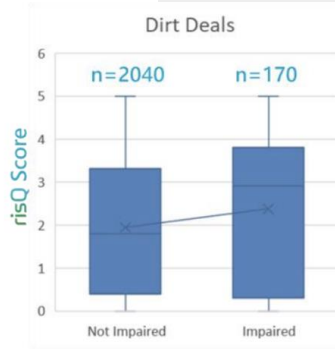
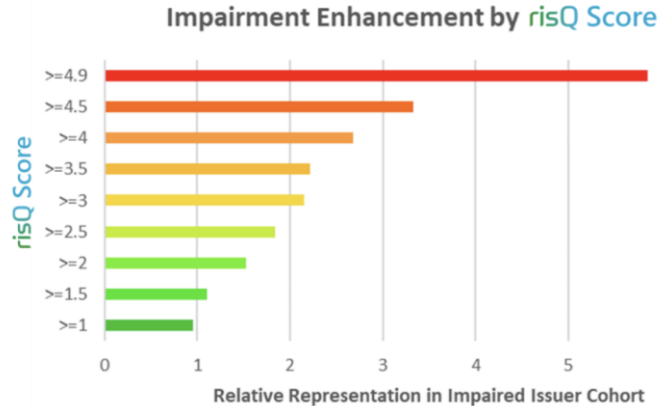
The Louisiana city, hobbled by two hurricanes, a winter storm and a flood, has struggled to translate sympathy into financial support. It is a challenge other cities could soon face.

Source: <https://www.nytimes.com/2021/07/26/us/hurricanes-lake-charles-louisiana.html>

Material impacts on issuer health and credit are growing - especially for the munis that don't make the news regularly

Physical Climate Risk and Issuer Impairment

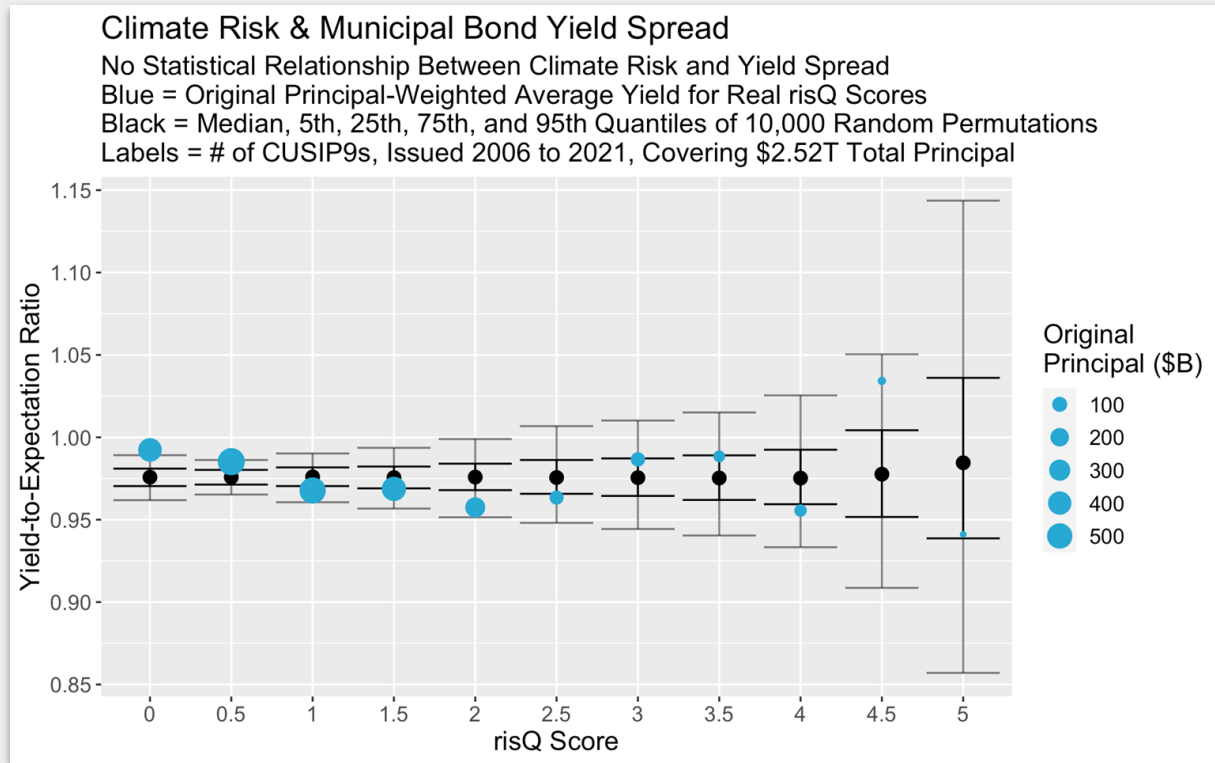
Climate change imperils the municipal borrowers already most prone to credit impairment, suggesting an amplified credit downside to national and some state-specific bond portfolios.



MMA Independent and Data Driven

Physical climate risk is not priced into municipal bonds

After accounting for bond duration, issue year, original principal amount, security type, obligor type and multiple socioeconomic impact factors through the Social Impact Scores, **no significant relationship between the risQ Score and municipal bond yields emerges.**



Helping Issuers Adapt: Illustrative Climate Investment Benefit Analysis

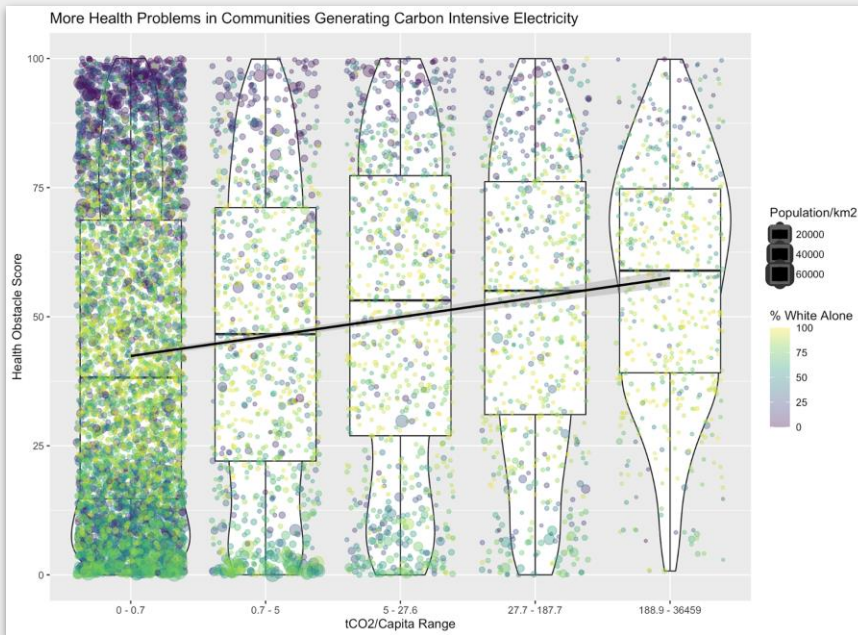
	Expected Property Damage % of Total, 2021 USD			Expected GDP Impairment % of Total, 2021 USD			Population % Below Poverty Line Impacted		
	<i>No action</i>	<i>Project A</i>	<i>Project B</i>	<i>No action</i>	<i>Project A</i>	<i>Project B</i>	<i>No action</i>	<i>Project A</i>	<i>Project B</i>
<i>BWSC Service Area</i>	5%	1%	2%	13%	6%	2%	10%	9%	4%
<i>MBTA Service Area</i>	4%	2%	1%	10%	5%	1%	20%	12%	7%
<i>City of Boston</i>	6%	0.3%	3%	6%	2%	3%	16%	12%	12%
<i>City of Cambridge</i>	4%	1%	0.2%	9%	6%	2%	20%	19%	11%

- Climate resilience investments are a cost-benefit question; the benefit has been elusive
- Consider 2 proposed flood adaptation projects, A and B, with costs \$A and \$B.
- Benefits can be cast in real \$ terms and compared to estimated capital costs of project A and B (and C, D...) using standard financial (e.g., Net Present Value) approaches.
- The social impact of the same investment options can also be clearly quantified.
- Ongoing pilot project with *Boston Water & Sewer Commission* with *Hazen & Sawyer*

Carbon Transition Risk

Objective measurement of issuer exposure to transition away from carbon-intensive assets and practices

Issuer (County)	Bexar, TX (All)	Williamson, TX (All)
Population	1,892,004	508,313
Scope 1 tCO2, Transportation per Capita	1.18	1.12
Scope 1 tCO2, Electricity Production per Capita	2.15	0.00
Scope 1 tCO2, Residential + Commercial per Capita	0.25	0.24
Scope 1 tCO2, Industry per Capita	0.46	0.06
Scope 1 tCO2, Total per Capita	4.04	1.42
Debt Outstanding -- All	\$2,967,865,000	\$1,286,209,956
2019 Debt Servicing Budget	\$121,799,321	\$107,911,342
2019 Revenue	\$481,382,562	\$184,914,936
OS Source	OS Link	OS Link
2019 (or 2018) Revenue / Outstanding Debt (All)	16.22%	14.38%
2019 (or 2018) Revenue / 2019 Debt Service	3.95	1.71
Average Maturity Date (Outstanding Debt)	12/12/2029	8/13/2028
Average Yield (Outstanding Debt)	2.49	2.42
Recent Issuance Rating/s	AAA	AAA
	(Fitch, S&P, Moody's)	(Fitch, S&P)
\$ Per tCO2 Assumption	\$51	\$51
Annual Total tCO2 Liability	\$389,616,234	\$36,740,113
Annual Total tCO2 Cost Per Capita	\$205.93	\$72.28

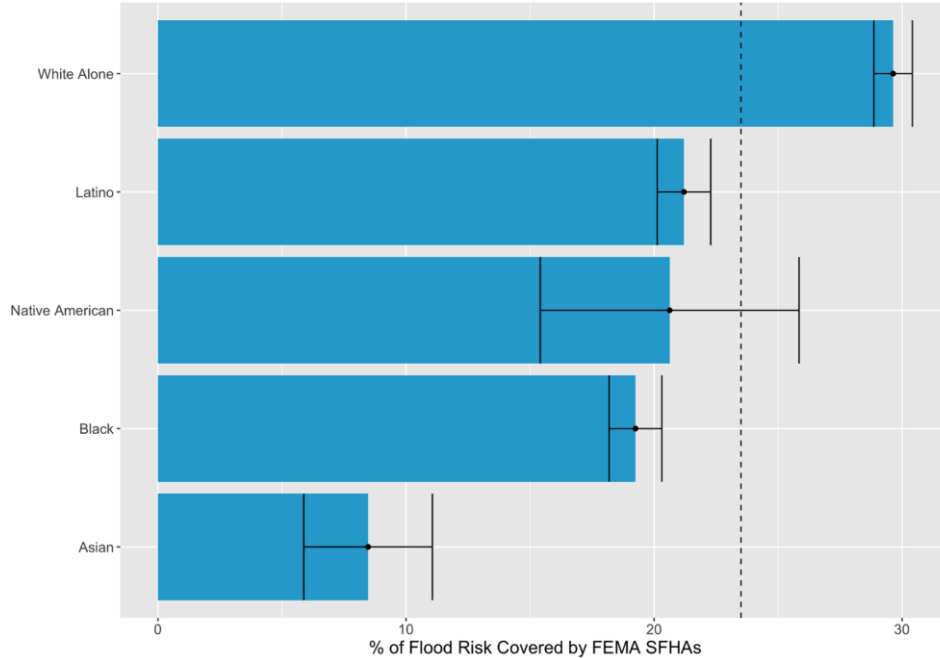


Using the Biden administration's Social Cost of Carbon (SCC) of \$51 per metric ton of CO2 applied to Scope 1 emissions in the contiguous US, there is ~\$294B in annual carbon transition risk liability. This is a liability that disproportionately burdens socioeconomically vulnerable communities.

Climate & Environmental Justice

Flood Risk Covered by FEMA SFHAs Per Racial Group

After Controlling for State, Total Flood Risk, Coastal or Not, and Discretionary Income-Based Affluence



Statistic	risQ Wildfire Score	Asian	Black	Latinx	Native American	White, Non-Hispanic
[1a] 2019 Percent of All Population in Wildfire Category	3 – High Risk	7.1% (+1.0)	4.0% (+0.4)	21.1% (+2.4)	2.2% (+0%)	69.2% (-3.7)
	4 – Extreme	9.9% (+1.4)	3.9% (+0.1)	26.7% (+3.5)	1.4% (-0.1)	62.9% (-4.9)
[1b] (Change from 2010-2019 in % points)	5 – Most Extreme Risk	8.2% (+1.1)	4.2% (+0.6)	37.1% (+4.8)	1.4% (+0.3)	55.8% (-6.7)
[2] Ratio of Wildfire Category Percent Relative to Percent of US Total	3 – High Risk	1.30	0.31	1.15	2.62	1.05
	4 – Extreme Risk	1.81	0.30	1.45	1.72	0.93
	5 – Most Extreme Risk	1.50	0.32	2.00	1.64	0.79

Communities of color are disproportionately underinsured for flood (left) and exposed to extreme wildfire (above)

The mark of a successful response to the current climate and environmental crises can only be one that directly addresses inequalities in the process.

[Politico: "Wildfires threaten all of the West — and one group more than others"](#)

[NBC News Video: "Climate Challenge: Latinos disproportionately impacted by wildfires"](#)

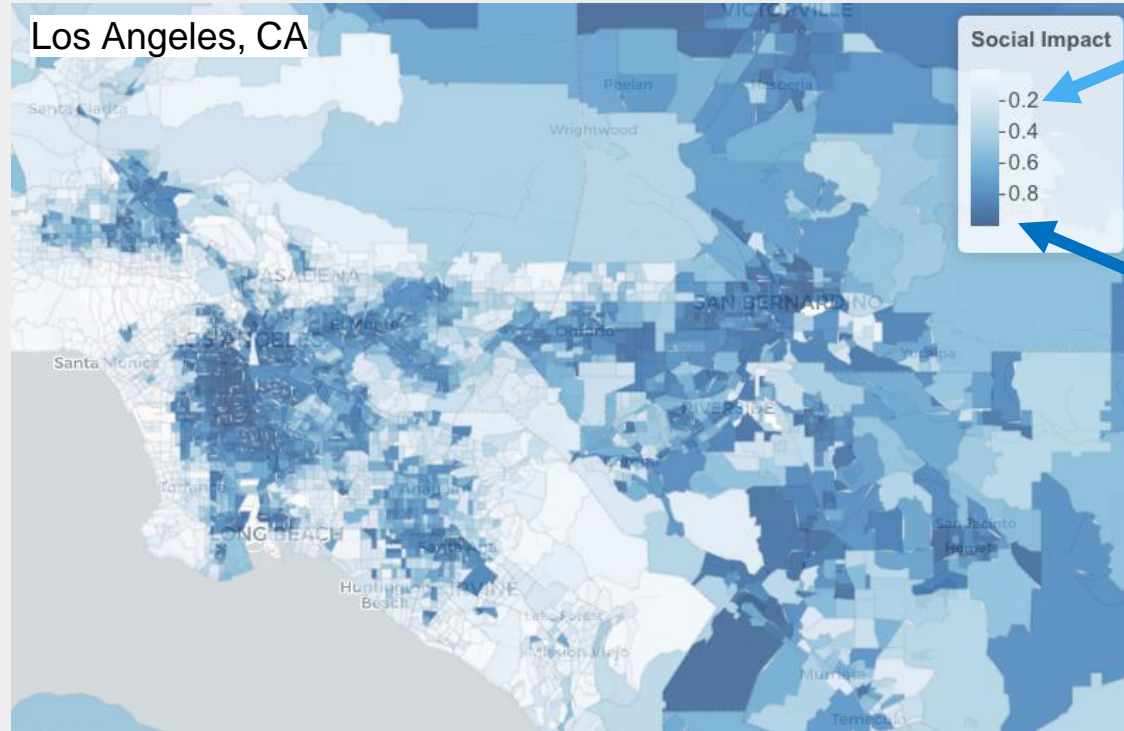
[MarketWatch: "National Flood Insurance Program leaves out communities of color, lower-income Americans, report finds"](#)

[Slate: "Raising Flood Insurance Premiums Sounds Fair. It isn't."](#)

Targeted Investment for Social Good

Combination of 7 different metrics derived from census data that capture:

- employment
- education
- poverty level
- affluence
- health
- housing costs
- race



less likely
an investment
will have a
positive social
impact

more likely
an investment
will have a
positive
social impact

The **Social Impact Score** captures the structural challenges that people face so that targeted investments can bring resources to these communities.