

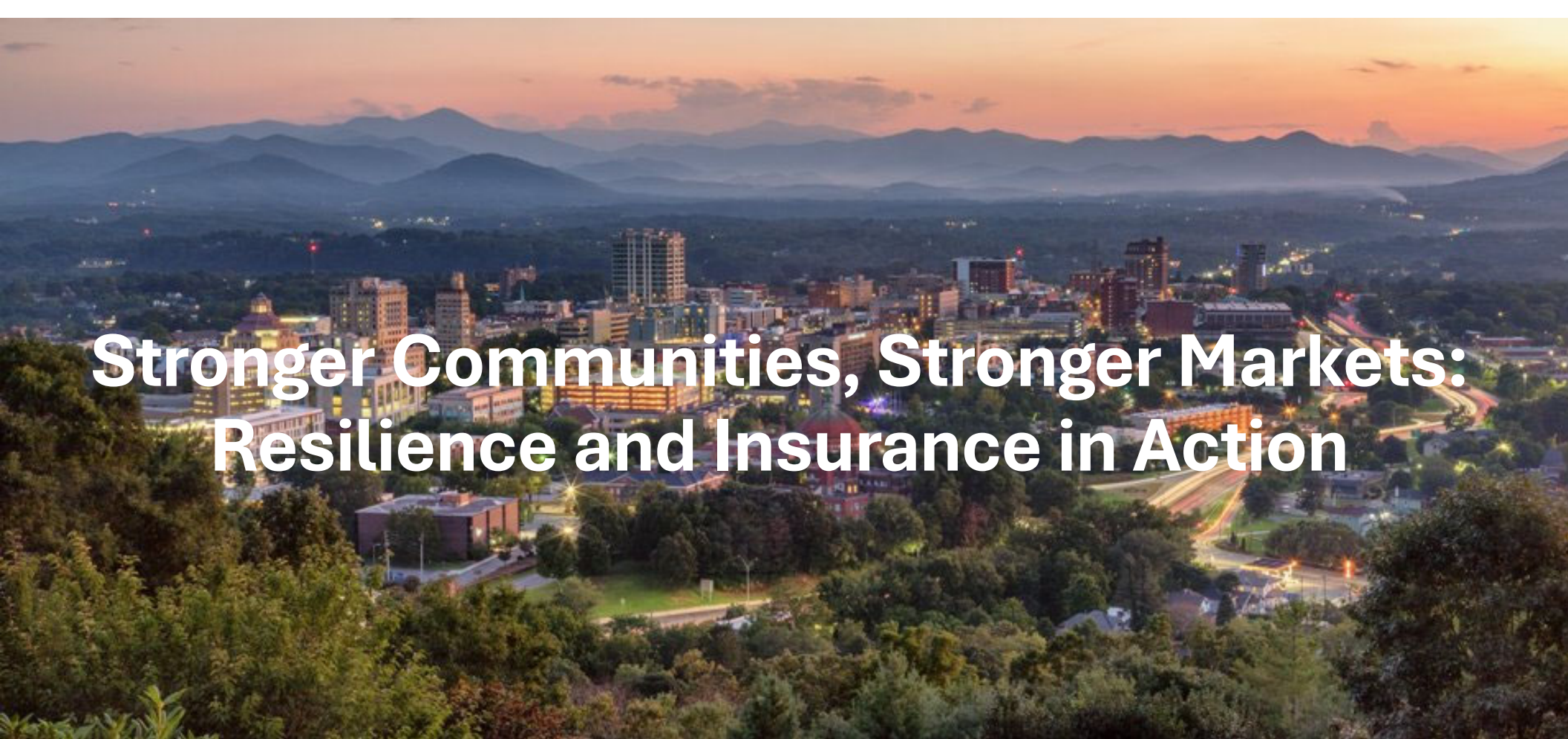
Southern Municipal Finance Society



Disaster Recovery, Rebuilding, and Resilience Conference

September 23 – 25, 2026

**Stronger Communities,
Stronger Markets:
Resilience and Insurance
in Action**

An aerial photograph of a city at dusk, with mountains in the background. The city lights are visible, and the sky is a mix of orange and blue. The text is overlaid on the image.

Stronger Communities, Stronger Markets: Resilience and Insurance in Action

Moderator:

Patricia Healy, Director of Fixed Income Research, Cumberland Advisors

Speakers:

Guillermo Franco, Founder & Director of Parametric Factory

Sara Kane, Sustainability and Resilience Manager, Sarasota County, FL

Muhammad Nawaz, Associate Professor, University of North Carolina at Asheville

Adapting to Change

Sarasota County Resilience Planning

Southern Municipal Finance Society
Disaster Recovery, Rebuilding, and Resilience Conference
September 24, 2026





Overview

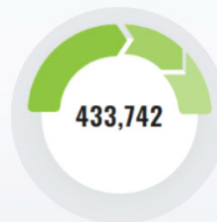
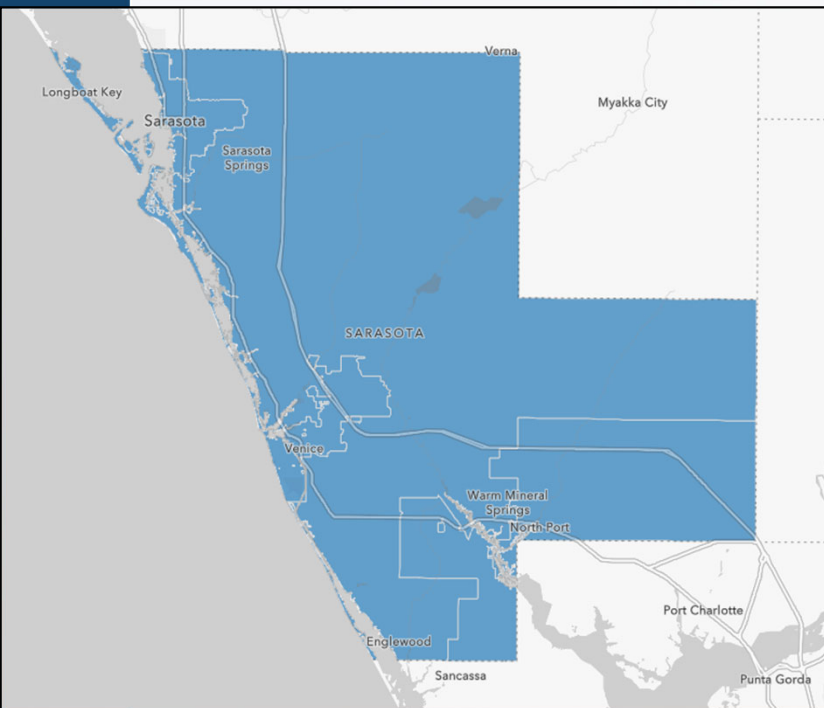
- Sarasota County
 - Hurricane Seasons
- Sarasota County Sustainability & Resilience
 - Resilience Planning Overview
- Resilient Florida
- Vulnerability Assessment
- Adaptation Plan
- Nature-Based Solutions
- Projects
- Funding
- Next steps



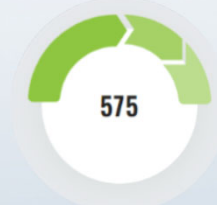
Sarasota County



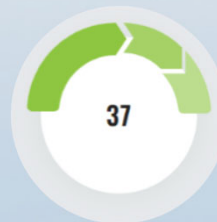
Snapshot



**Permanent
Residents
(2020 Census)**



**Square Miles
of Land**



**Miles of Open
Shoreline**

Quick Facts

Four Municipalities:

- City of Sarasota
- City of Venice
- City of North Port
- Town of Longboat Key

**Over 50,000 acres of
natural area**

Shaped and influenced by water, including:

- Gulf, Myakka River
- Numerous Bays, Creeks, Canals – Sarasota Bay, Lemon Bay, Roberts Bay, Philippi Creek, Venetian Waterway



UF/IFAS Extension & Sustainability

- Partnership between Sarasota County & University of Florida
 - One of 18 departments in the County
 - Education, outreach & consulting services
- Mitigation – Reducing Pollution
 - Energy Efficiency, Green Building, Renewable Energy, Sustainable Transportation, Waste Reduction, Green Living
- Adaptation – Becoming More Resilient
 - Reducing flooding, sea level rise, making assets less vulnerable to what we are already experiencing



Photo credit: Brilliant Harvest, LLC



Storms in Sarasota County

A Need to Adapt



Hurricane Irma, 2017



Hurricane Irma, 2017



Hurricane Irma, 2017



Hurricane Ian, 2022



Hurricane Ian, 2022

Hurricane Ian, 2022



Hurricane Idalia, 2023

Hurricane Idalia, 2023



Hurricane Idalia, 2023

2024 Hurricane Season

2024 Hurricane Costs and Damages*

Debby

\$58M Residential / 1,047 Properties
No significant reporting on commercial damage
\$49.7M Public Assistance

Helene

\$788M Residential / 7,644 Properties
\$317M Commercial / 5,066 Properties
\$43.8M Public Assistance

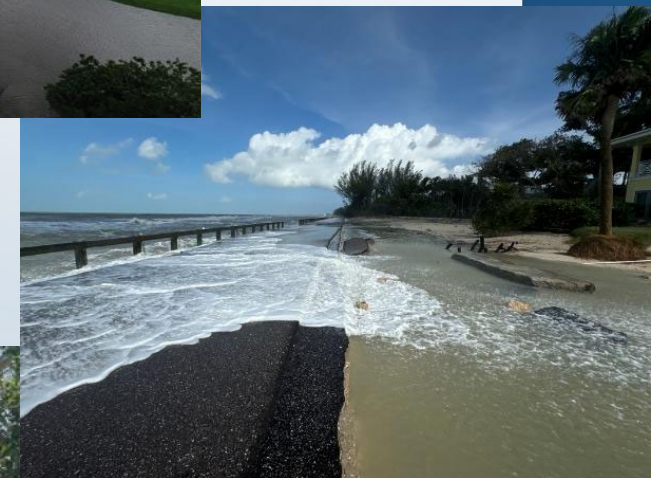
Milton

\$446M Residential / 9,649 Properties
\$164M Commercial / 1,120 Properties
\$227.9M Public Assistance

Total for the Season

\$1.29B Residential/ 18,340 Properties
\$481M Commercial/ 6,186 Properties
\$321M Public Assistance

**The data was collected from unincorporated Sarasota County, City of North Port, Town of Long Boat Key, and City of Venice. City of Sarasota provided residential data only.*



2024 Hurricane Season

The Reality: Record Breaking Events

"A record daily rainfall of 11.06 inches was set in Sarasota in August 2024 from the impacts of Hurricane Debby (NWS, 2024)."



Hurricane Debby, 2024



Hurricane Debby, 2024



Hurricane Debby, 2024



Hurricane Helene, 2024

Hurricane Milton by the Numbers



Cars
Assisted at
the County's
NPOD
Locations



Cubic Yards
of
Cumulative
Debris
Recovered



Calls to 311
Contact
Center



Hurricane
Helene/Milton, 2024



Hurricane Milton, 2024

"One month prior, the Sarasota-Bradenton Airport reported an all-time record of 3.93 inches for a one-hour event from a summer rainstorm (Bachmeier, 2024)."

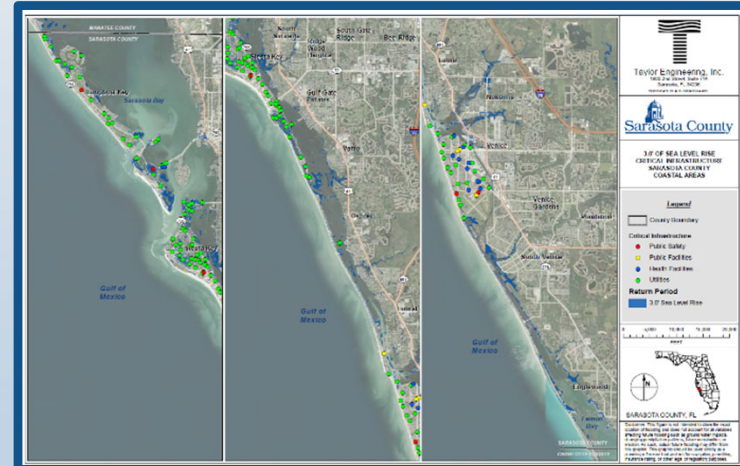
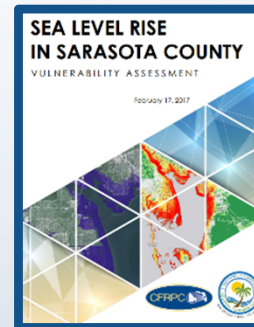
Resilience Planning

Sarasota County has been proactive in resilience planning for years.

To enhance the County's Climate Resilience, applied for and awarded a **Resilient Florida Grant** in 2022 to conduct a Vulnerability Assessment and develop and an Adaptation/ Resilience Plan.

Builds on past efforts:

- 2017 – Sea Level Rise in Sarasota County Vulnerability Assessment
- 2020 - Sarasota County Sea Level Rise Working Group Report & Vulnerability Assessment and joined the Tampa Bay Regional Resiliency Coalition
- 2021 - Sarasota County Coastal Resilience – Baseline Coastal Analysis
- 2023 – Sarasota/Manatee MPO Resiliency Vulnerability Assessment Study

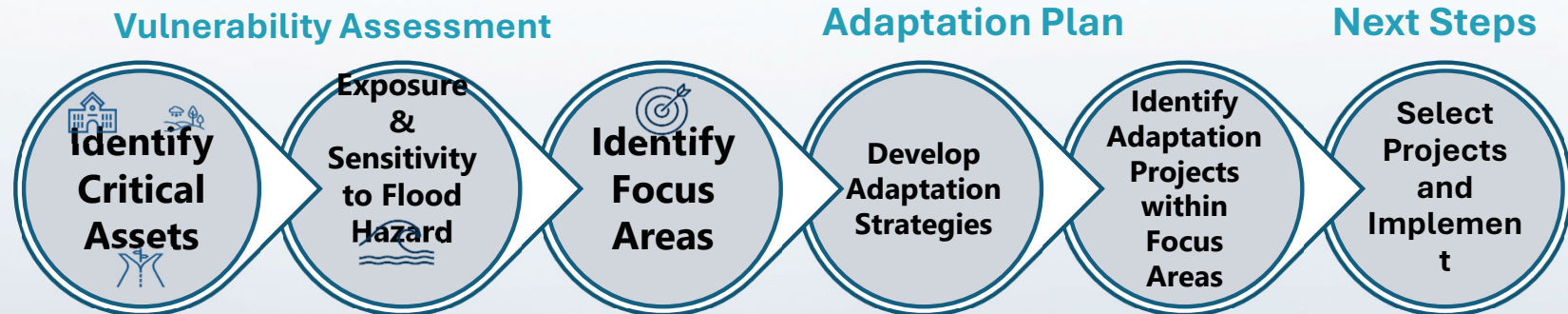


Resilient Florida

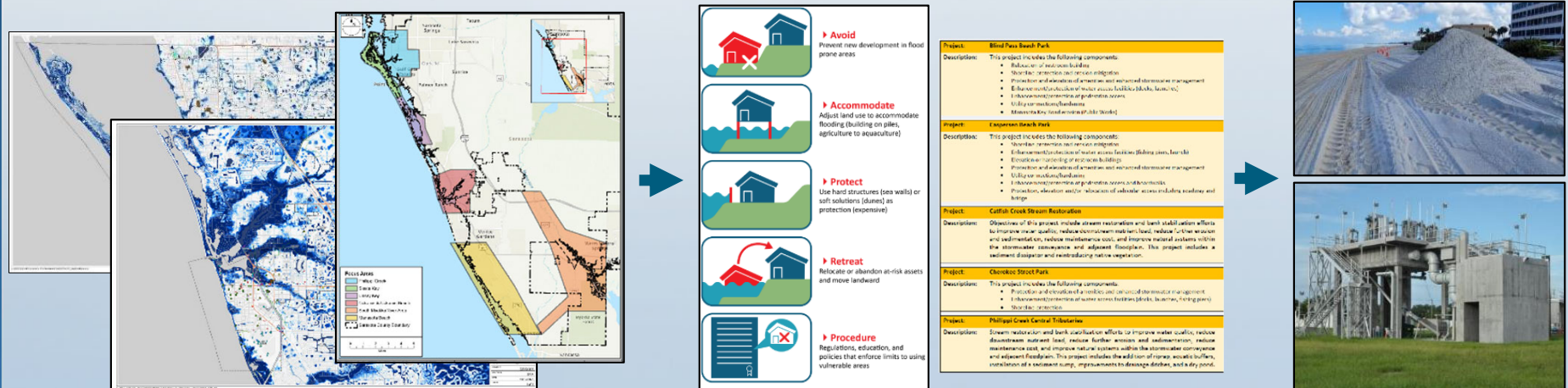
- May 2021 – Senate Bill 1954 signed, establishing the Resilient Florida grant program
 - Requires all municipalities in the state to develop vulnerability assessments and resilience plans in accordance with [State Statute \(380.093, FS\)](#)
- Coordinated the approach to Florida's coastal and inland resilience for the state, counties and cities
- Goal: To prepare communities for the impacts of sea level rise, intensified storms and flooding
- Grants are available for planning and implementation



Vulnerability Assessment and Adaptation Plan



The first steps of a multi-phased effort to increase the County's resilience to flooding and storm events



Vulnerability Assessment Overview



Critical and Regionally Significant Asset Inventory



Critical Infrastructure (3,610)

Stormwater Utilities, Water/Wastewater Utilities, Drinking Water Facilities, Electric Production and Supply, Solid and Hazardous Waste Facilities, Communications Facilities



Critical Community and Emergency Facilities (522)

Schools, Colleges/Universities, Community Centers, Libraries, Correctional Facilities, Disaster Recovery Centers, Fire Stations, Health Care Facilities, Hospitals, Law Enforcement, Local Government, Affordable Housing, State Government Facilities, EMS, Risk Shelters



Natural, Cultural, and Historical Resources (180)

Cemetery, Conservation Lands, Parks, Shoreline, Wetlands, Historical and Cultural Resources



Transportation Assets and Evacuation Routes (595)

Major Roadways, Evacuation Routes, Marinas, Airports, Bridges

(d) “Regionally significant assets” means critical assets that support the needs of communities spanning multiple geopolitical jurisdictions, including, but not limited to, water resource facilities, regional medical centers, emergency operations centers, regional utilities, major transportation hubs and corridors. airports. and seaports.

Funded by the FDEP's Resilient Florida Program

Section 380.093, Florida Statutes



Requirements for FDEP-Funded Vulnerability Assessments:

- Use most recent LiDAR digital elevation model (DEM)
- Flooding: high tide, storm surge, rainfall
- Sea Level Rise projections for years 2040 and 2070

These requirements had to be met to pursue additional grant funding from FDEP for implementing projects.



High Tides – Mean Higher High Water (MHHW)

Storm Surge – 25-year (4% annual chance) and 100-year (1% annual chance) events

Rainfall – 25-year (4% annual chance), 100-year (1% annual chance) & 500-year (0.2% annual chance) events

Exposure Analysis

What is the County's exposure to floodwaters?

**Asset &
Countywide
Elevations**



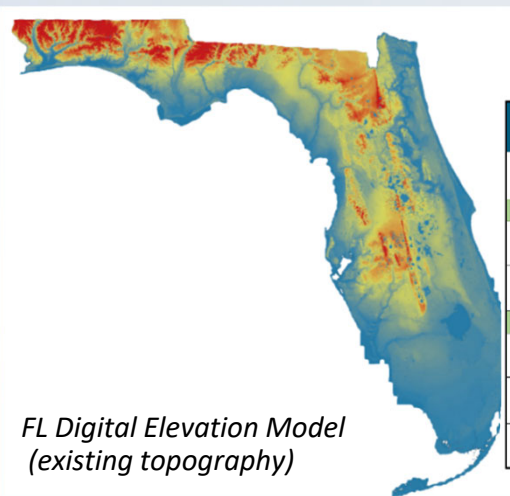
Current and Future Flood Hazards

Sea Level Rise Projections

Tidal Flooding

Storm Surge

Rainfall Induced

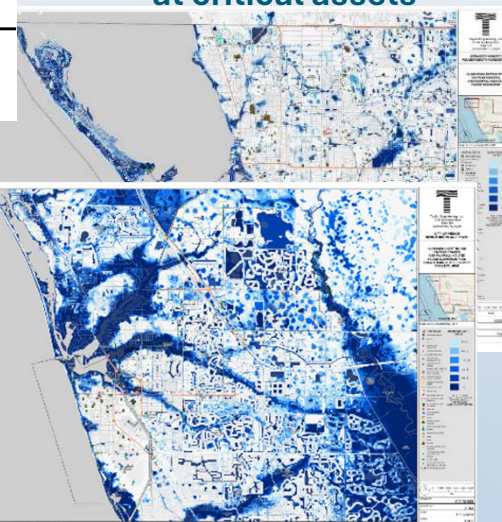


*FL Digital Elevation Model
(existing topography)*

Flood Scenario Type	Current Conditions	2040 Int-Low	2040 Int-High	2070 Int-Low	2070 Int-High
Tidal Flooding (MHHW)	X	X	X	X	X
25-Year Storm Surge Flooding	X	X	X	X	X
100-Year Storm Surge Flooding	X	X	X	X	X
25-Year Rainfall Induced Flooding	X	X	X	X	X
100-Year Rainfall Induced Flooding	X	X	X	X	X
500-Year Rainfall Induced Flooding	X	X	X	X	X

Flood Exposure Maps

Maps and Tables to illustrate the flood extents and flood depths at critical assets



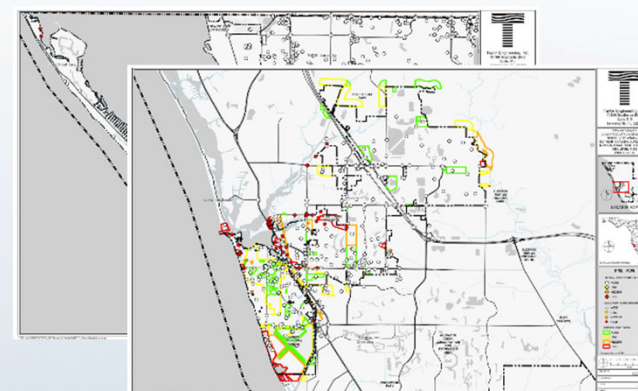
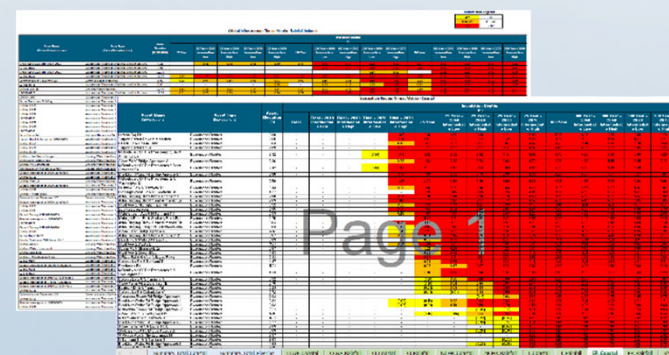
Example Exposure Analysis Maps

Sensitivity Analysis

How much flooding does how much damage?

Acceptable Flood Depths based on Asset Type

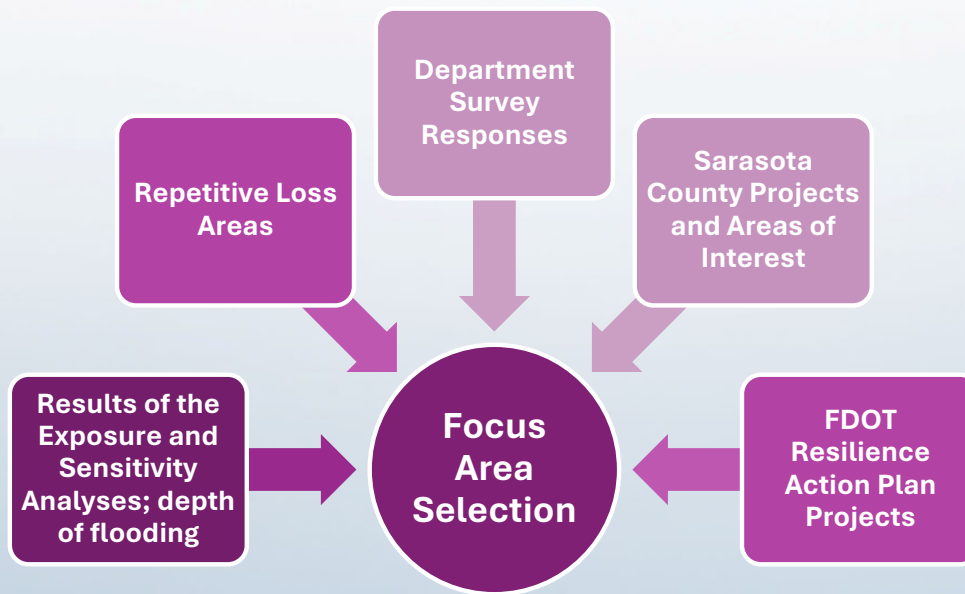
Critical Asset Group	Critical Community and Emergency Facilities	Critical Infrastructure	Natural, Cultural, and Historic Resources		Transportation and Evacuation Routes	
			Buildings	Parcels	Bus Terminals and Marinas	Roadway Intersections
Low	< 3"	< 3"	< 3"	< 25%	< 3"	0" - 3"
Medium	3" - 18"	3" - 18"	3" - 18"	25% - 50%	3" - 18"	3" - 6"
High	> 18"	> 18"	> 18"	> 50%	> 18"	> 6"

The screenshot shows a detailed table with multiple columns. The columns include asset names, locations, and various impact metrics. The table is color-coded to match the sensitivity levels: Low (yellow), Medium (orange), and High (red). The table is titled 'Page 1' and shows a large number of rows of data.

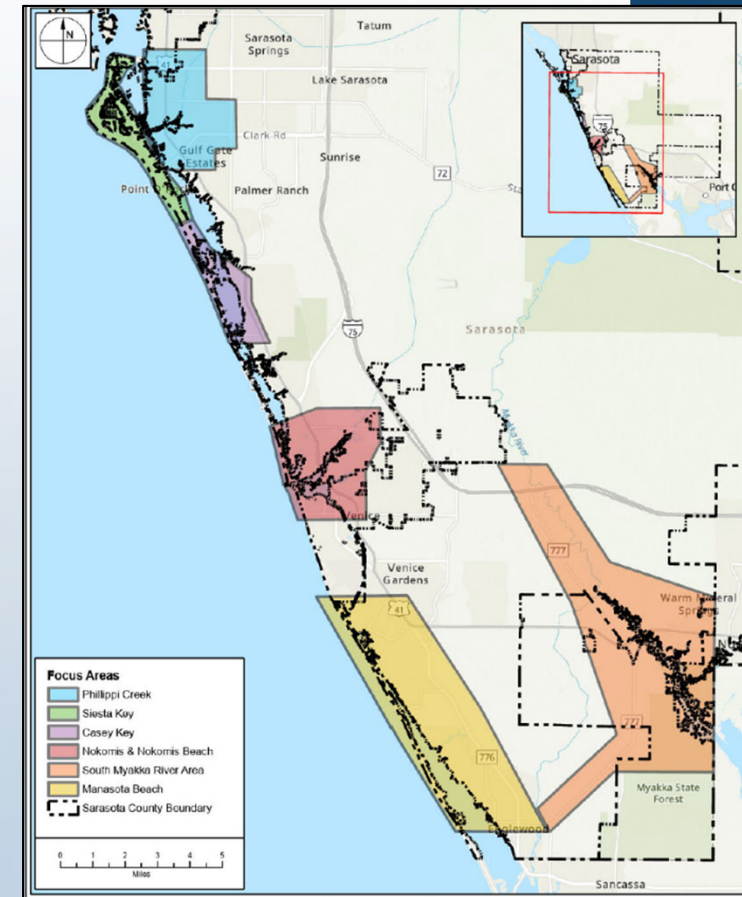
Example Sensitivity Analysis Maps & Tables

Focus Area Selection



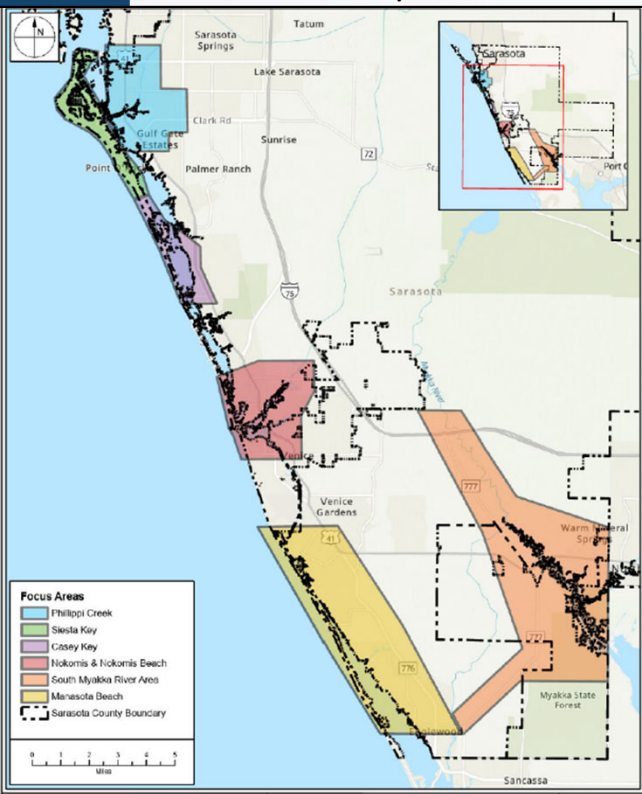
Focus Areas Selected:

Phillippi Creek Area, Siesta Key, Casey Key, Nokomis/Nokomis Beach, South Myakka River Area, Manasota Beach

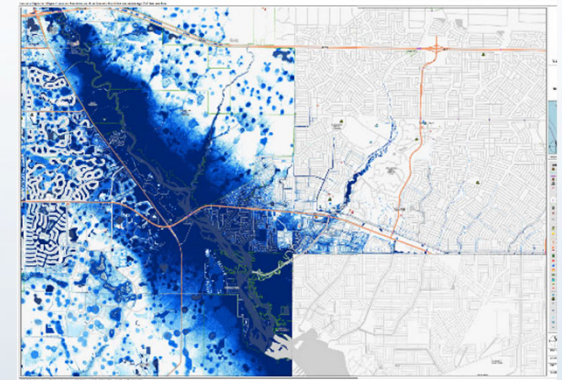


Vulnerability Assessment Results

Focus Area Maps and Critical Assets:



Flood Exposure and Sensitivity Maps:



Lists of Flood Depths at the Critical Assets for all flood scenarios and sensitivity rating:

Asset Name (Critical Infrastructure)	Asset Unique ID	Asset Type (Critical Infrastructure)	Asset Elevation (ft)	Flood Scenario Depth (ft)																				
				25 Year		25 Year + 2040 Intermediate Low		25 Year + 2040 Intermediate High		25 Year + 2070 Intermediate Low		25 Year + 2070 Intermediate High		100 Year		100 Year + 2040 Intermediate Low		100 Year + 2040 Intermediate High		100 Year + 2070 Intermediate Low		100 Year + 2070 Intermediate High		
				Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	
US-447-0823	1324	Wastewater Treatment Facilities and LRI Stations	8.79	-	-	-	-	-	-	-	-	-	-	-	-	0.42	0.42	0.40	0.40	0.35	2.34	2.34	2.46	2.47
US-447-0826	1317	Wastewater Treatment Facilities and LRI Stations	9.65	-	-	-	-	-	-	0.19	0.20	0.27	3.22	3.22	3.28	3.28	3.31	3.65	3.65	3.65	3.65	3.65	3.65	3.65
US-447-0831	1338	Wastewater Treatment Facilities and LRI Stations	10.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.32	0.32	0.42	0.42
US-447-0836	1320	Wastewater Treatment Facilities and LRI Stations	8.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.73	1.73	1.85	1.86
US-447-0849	1629	Wastewater Treatment Facilities and LRI Stations	13.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	0.08	0.14	0.14
US-447-0852	1365	Wastewater Treatment Facilities and LRI Stations	14.36	-	-	-	-	-	-	-	-	-	0.07	0.07	0.11	0.11	0.06	0.17	0.17	0.37	0.45	0.45	0.45	0.45
US-447-0856	1319	Wastewater Treatment Facilities and LRI Stations	14.08	-	-	-	-	-	-	-	-	-	0.05	0.05	0.08	0.08	0.01	0.12	0.12	0.17	0.17	0.17	0.17	0.17
US-756-0887	1058	Wastewater Treatment Facilities and LRI Stations	14.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.26	0.26	0.40	0.40
US-757-0814	1057	Wastewater Treatment Facilities and LRI Stations	9.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.47	0.47	0.64	0.64
Manatee County 0881-0001	1001	Wastewater Treatment Facilities and LRI Stations	26.75	-	-	-	-	-	-	-	-	-	0.20	0.20	0.18	0.18	0.23	0.92	0.92	1.04	1.04	1.04	1.04	1.04
Manatee County 0887-0008	1448	Wastewater Treatment Facilities and LRI Stations	27.37	-	0.39	0.39	0.45	0.45	0.46	0.81	0.81	0.87	0.87	0.87	0.79	1.29	1.29	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Manatee County 0889-0001	1406	Wastewater Treatment Facilities and LRI Stations	27.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19	0.19	0.28	0.28	0.28	0.28	0.28
Master Campus	2255	Wastewater Treatment Facilities and LRI Stations	11.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.64	0.64	0.69	0.69	0.69	0.69	0.69
Midwood WRF 0033-0001	1057	Wastewater Treatment Facilities and LRI Stations	24.23	-	0.76	0.76	0.84	0.84	0.86	1.58	1.58	1.75	1.75	1.75	1.51	3.12	3.12	3.42	3.42	3.42	3.42	3.42	3.42	3.42
Midwood WRF 0034-0012	1029	Wastewater Treatment Facilities and LRI Stations	24.61	-	0.21	0.21	0.28	0.28	0.30	1.07	1.07	1.15	1.15	1.15	0.96	2.49	2.49	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Midwood WRF 0034-0021	1057	Wastewater Treatment Facilities and LRI Stations	25.18	-	-	-	-	-	-	-	-	-	0.44	0.44	0.60	0.60	0.40	1.74	1.74	1.95	1.95	1.95	1.95	1.95
Midwood WRF 0035-0012	1052	Wastewater Treatment Facilities and LRI Stations	24.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.25	0.25	0.25	0.25
Midwood WRF 0039-0002	1052	Wastewater Treatment Facilities and LRI Stations	21.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.41	0.41	0.70	0.70	0.70	0.70	0.70
Midwood WRF 0040-0021	1060	Wastewater Treatment Facilities and LRI Stations	19.57	-	-	-	-	-	-	-	-	-	0.44	0.44	0.68	0.68	0.38	1.84	1.84	2.14	2.14	2.14	2.14	2.14
Midwood WRF 0040-0021	1059	Wastewater Treatment Facilities and LRI Stations	20.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06	0.06	-	1.22	1.22	1.52	1.52
Midwood WRF 0040-0023	1061	Wastewater Treatment Facilities and LRI Stations	20.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.66	0.66	0.96	0.96	0.96	0.96	0.96

Adaptation Plan Overview



The **Adaptation Plan** will take the risks presented by the Vulnerability Assessments and provide Adaptation Strategies, including structural and non-structural efforts, for community response to specific hazards.

- **Phase 1** – Recommendations by Focus Areas and Asset Groups
Focus Areas are geographic which allows prioritization to be given to specific vulnerable areas and regions.
- **Phase 2** – Project Prioritization by common themes and goals to align County Departments
This phase encourages collaboration between the departments and making projects multifunctional and multi-beneficial.



High Level Adaptation Projects and Examples



- **Avoid**
Prevent new development in flood-prone areas



- **Accommodate**
Adjust land use to accommodate flooding (building on piles, agriculture to aquaculture)



- **Protect**
Use hard structures (sea walls) or soft solutions (dunes) as protection (expensive)



- **Retreat**
Relocate or abandon at-risk assets and move landward



- **Procedure**
Regulations, education, and policies that enforce limits to using vulnerable areas

STORMWATER MANAGEMENT

Joint-Use Stormwater Storage and Recreational Areas	Enhanced Drainage Infrastructure
Drainage System Maintenance	Natural Flood Management
Permeable Pavement	On-Site Storage
Redundant Pump Systems	Backflow Prevention

NATURE-BASED SOLUTIONS

Green Infrastructure – Bioswales, Rain Gardens, etc.	Preserve Wetlands
Monitor Environmental and Water Quality	Increase Tree Canopy
Artificial Reefs and Living Shorelines	Green Spaces and Pocket Parks
Sponge Park Design	Floodplain Restoration
Restore Mangroves and Native Vegetation	

WATERFRONT

Beach/Dune Nourishment	Boat Storage Plans
Seawalls, Revetments, Retaining Walls	Secure Mooring Systems
Elevate Marine Structures	Elevate Canal Banks
Floating Docks	Levees and Floodwalls

TEMPORARY STRATEGIES

Sandbags
Temporary Flood Barriers

ASSET SPECIFIC

Elevate Critical Components	Elevate Access Routes
Asset/Facility Relocation	Wet and Dry Flood Proof Assets
Backup Power Systems and Generators	Elevate Structures and Components
Flood and Corrosion Resistant Materials	Lift and Pump Station Solutions

NON-PHYSICAL

Redundant Communication Channels	Alternate Evacuation Routes
Proper Safety Protocols	Stock Emergency Supplies
Information and Education	Early Warning Systems
Debris Monitoring Programs	Land Use Planning and Zoning
Buyout Programs	Relocation plans
Cost Share Programs & Incentives for Property Owners	Post Disaster Redevelopment Plan

Types of Adaptation Strategies

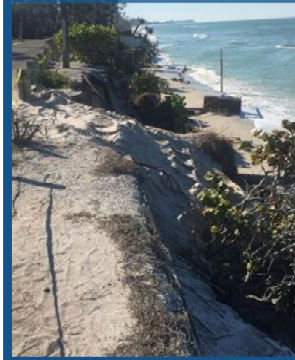
Mangroves Living Shoreline



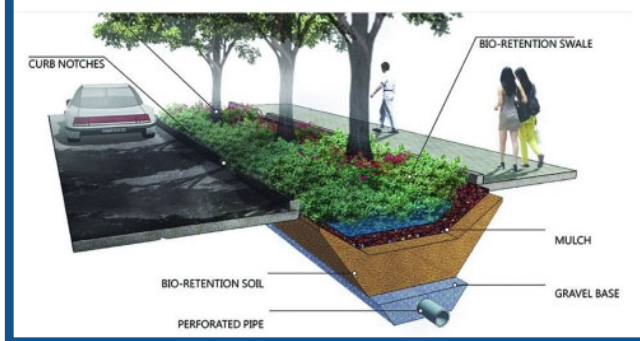
Flood Vents on a Park Restroom



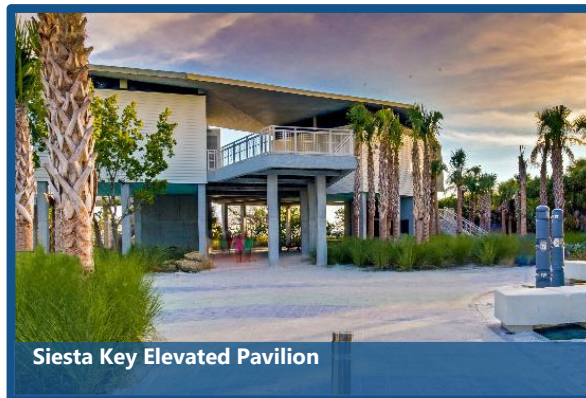
Before (left) and After (right) the Casey Key Shoreline Stabilization



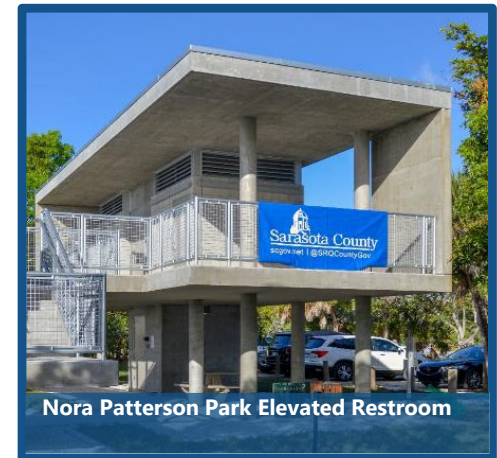
Bioswale



Siesta Key Elevated Pavilion



Nora Patterson Park Elevated Restroom



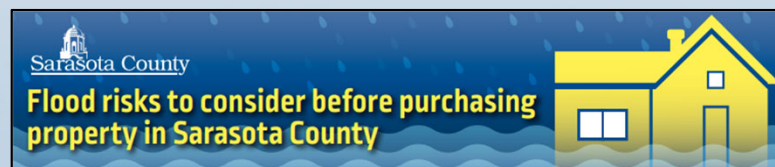
Types of Adaptation Strategies



Sarasota County continues commitment to environment with new land acquisition

Sarasota County's Land Acquisition and Management Program, which encompasses the Environmentally Sensitive Lands Protection Program (ESLPP) and the Neighborhood Parkland Acquisition Program (NPP), continues to preserve natural lands.

Post Date: 07/18/2024 10:21 AM



Nature-Based Solutions Focus

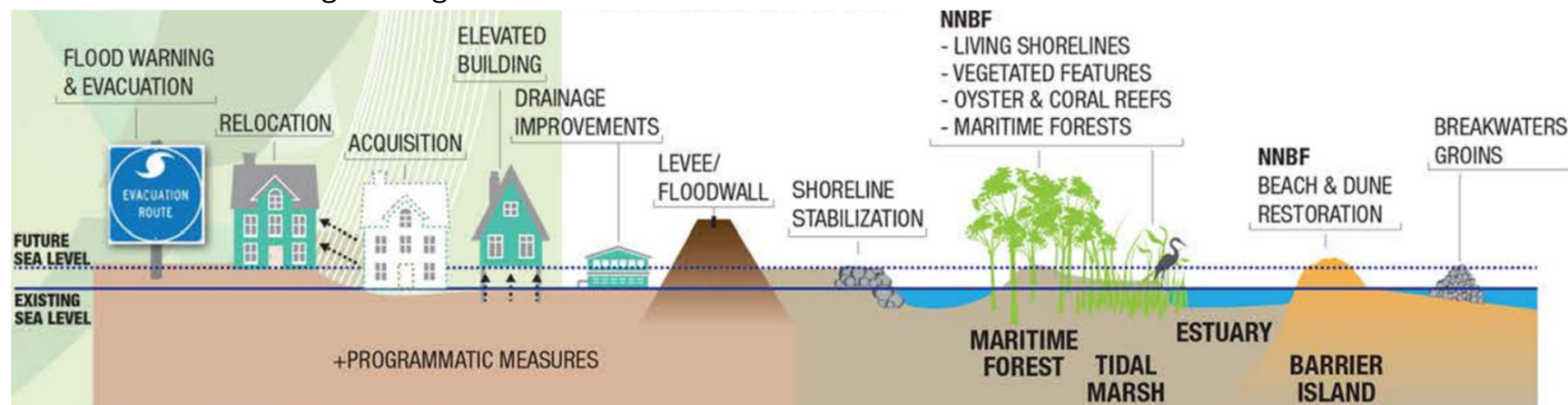
Prepare • Resist • Recover • Adapt



Benefits of NBS

- Reduces erosion
- Improves water quality
- Acts as a natural barrier
- Enhances habitats for marine life
- Can provide additional stormwater retention

Source: USACE Engineering with Nature



Multiple lines of defense in the face of coastal storms and sea level change



Adaptation Planning

A great investment!

The U.S. experiences a multitude of disasters each year. The cost of cleaning up and rebuilding destroyed homes, businesses, equipment, and infrastructure is immense and growing. In 2022 alone, the **cost of natural disasters exceeded \$360 billion** across the globe, including more than **40 weather events causing over \$1 billion in damage.**

[US Chamber Full Report](#) – The Preparedness Payoff: The Economic Benefits of Investing in Climate Resilience

Every \$1 invested in resilience and preparedness saves \$13



\$6

in damage and
cleanup costs

+



\$7

in economic
savings



U.S. Chamber of Commerce



Allstate.



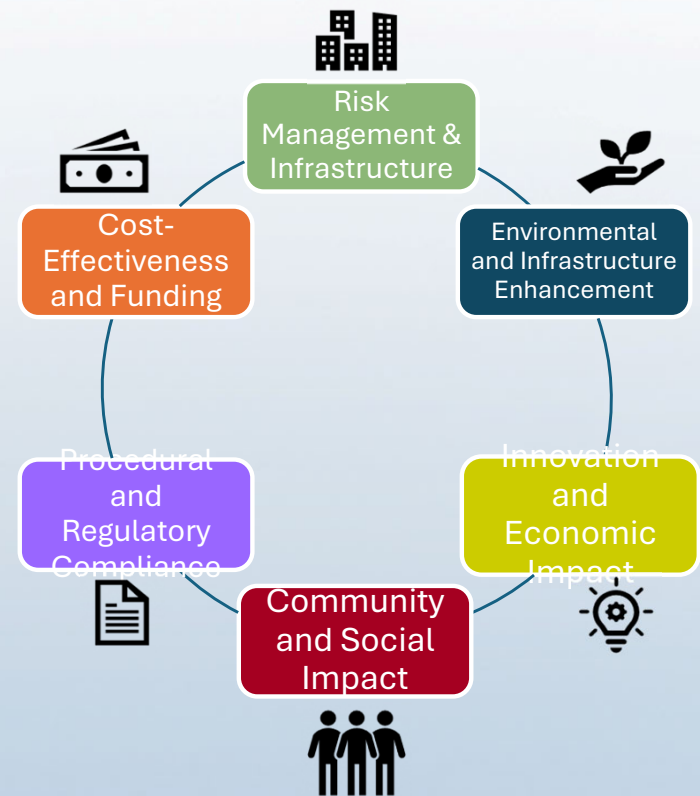
U.S. Chamber of Commerce
Foundation

The logo for the Sarasota County Unified Local Mitigation Strategy. It features the Sarasota County seal at the top, which includes a sun, a palm tree, and a building. Below the seal, the text "Sarasota County" is written in a serif font. Underneath that, "Unified Local Mitigation Strategy" is written in a larger, bold, sans-serif font. At the bottom of the logo, there are five smaller circular and rectangular seals: the Florida state seal, the City of Sarasota seal, the Sarasota County seal, the City of Venice seal, and the City of Bradenton seal.

**625-8 Resilient Florida Program
Guidance for Applicants**

**Office of Resilience and Coastal Protection
Florida Department of Environmental Protection**

October 2023

[illegible]

Project Prioritization Examples

- **Phillippi Creek Focus Area**
 - Vacuum Sewer Rehabilitation
 - Phillippi Creek NW Tributaries
- **Siesta Key Focus Area**
 - SK Force Main and Flow Diversion Evaluation
 - Siesta Beach Access #7
- **Casey Key Focus Area**
 - Turtle Beach Park and Campground
 - Palmer Point Beach Park
- **Nokomis Focus Area**
 - Laurel Rd Force Main Upgrades
 - Nokomis Beach and Island Shoreline Restoration
- **South Myakka River Focus Area**
 - Englewood Sports Complex Generator
 - Snook Haven
- **Manasota Beach Focus Area**
 - Caspersen Beach Park
 - Blind Pass Beach Park

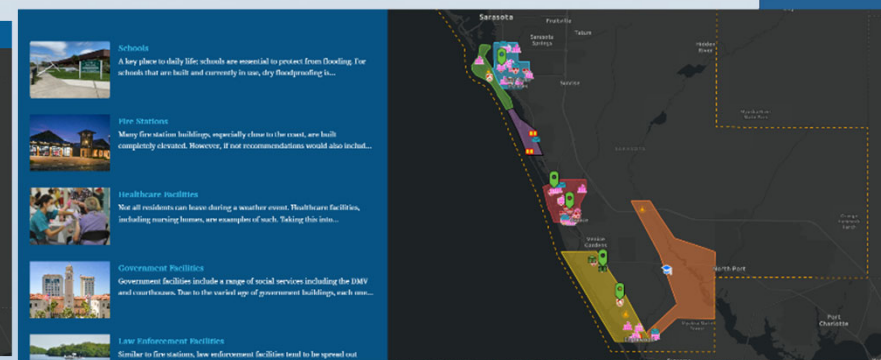
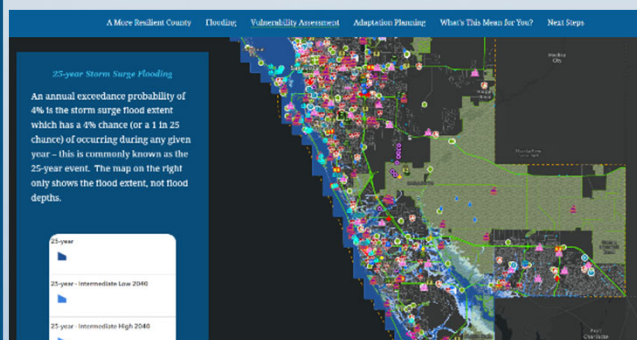
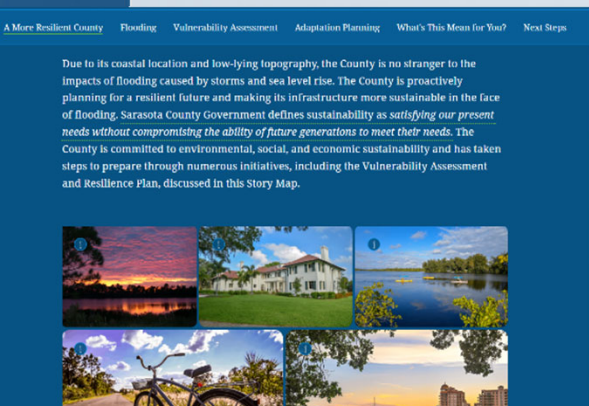
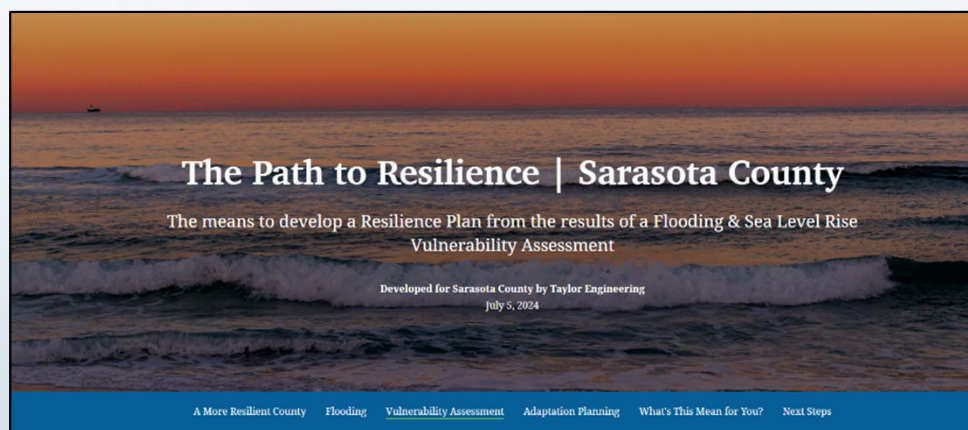


Next Steps – Communicate Results

Sarasota County Vulnerability Assessment Web-based Story Map



Resilience Planning Webpage and StoryMap



Next Steps – Seek Funding for Implementation



Resilience-Related Funding Applied For/Awarded:

- AmeriCorps Team
- FDEM Hurricane Loss Mitigation Program
- Flood Management Assistance
- Building Resilient Infrastructure and Communities (BRIC)
- Water Quality Implementation Grants
- Wetlands Restoration and Protection Grants
- Safe Streets and Roads for All
- Community Wildfire Defense Grant Program
- State and Local Cybersecurity Grant Program
- Community Development Block Grant – Disaster Recovery (Resilient SRQ)
- FEMA Hazard Mitigation Grant Program
- Coastal and Heartland National Estuary Partnership (CHNEP)

Next Steps – Seek Funding for Implementation



Future Opportunities for Resilience Related Funding:

- Resilient Florida implementation grants
- Flood Mitigation Assistance
- Water & Groundwater Storage and Conveyance
- Local Mitigation Strategy (LMS) ranked projects

Goals/Best Practices:

- Reduce duplication of effort across funding opportunities and apply for highly ranked, prioritized projects
- Enable planning for matching funds in budgets ahead of time
- Assist departments with applications and apply for comprehensive projects that affect regional areas and multiple departments
- Working committee and ongoing communication

- US Dept. of Housing and Urban Development (HUD) Community Development Block Grant – Disaster Recovery

ResilientSRQ.net

- 2022 – Hurricane Ian (\$201.5M)
- 2024 – Hurricanes Debby, Helene and Milton (\$210.1M)



Housing Recovery



Multifamily
Affordable
Housing



Infrastructure
and Public
Facilities



Workforce
Development
and Training



Voluntary Home
Buyout

500+ Homeowners projected funded:

- 159 Homeowners reimbursed for home repairs (\$2.3 million)
- 92 Repaired homes (\$5.0 million)
- 66 Replaced mobile homes (\$10.0 million)
- 4 Reconstructed homes (\$1.2 million)
- 3 Homes removed from repetitive loss areas (\$1.3 million)
- 125 Homes made more energy efficient
- 42 Homes elevated to mitigate future flooding
- 29 Homes made more accessible (lifts, grab bars)

- 616 New impact windows
- 206 New impact doors
- 83 New energy efficient roofs



Sarasota County
Resilient SRQ
Community Development Block Grant-Disaster Recovery

14

New Affordable Housing Projects (\$88.7 million)

845 new affordable units to be available

Land use restrictions to remain affordable for 511+ cumulative years



36

Infrastructure Projects (\$210.5 million)

- 15 Flood/water management projects
- 10 Emergency preparedness projects
- 5 Bridge and road projects
- 6 Nonprofit community projects

Emergency Roles

- Blue skies
- Gray skies
 - New employee commitment
 - Training



Next Steps

- Communicate Results
 - Story map, factsheets, workshops
- Continue working with departments on prioritizing projects and applying for funding opportunities
- Implement adaptation projects and strategies
- **Adaptation Action Area plans, Phase 2 Adaptation Planning – CHNEP funding**
- Partnerships and regional coordination
- Climate Adaptation Center
- Resilience Hubs

UF/IFAS Extension and Sustainability  

Resilience Planning

Sarasota County proactively plans for a resilient future.

Mitigation: Taking actions to reduce greenhouse gas emissions and slow the impacts of climate change.

Adaptation: Adjusting infrastructure to minimize increasing effects of flooding and sea level rise.

Resilience: Creating infrastructure able to withstand natural events the region is facing.

Adaptation strategy examples in Sarasota County's Adaptation

 Avoid  Accommodate  Protect  Retreat  Procedure

Questions and Discussion

Sara Kane

Sustainability and Resilience Manager, Sarasota County

skane@scgov.net



Financing Resilience:

Insurance, Parametric Solutions, and Disaster Hardening

Muhammad Nawaz Ph.D.

University of North Carolina Asheville

Outline

- ✓ Small Businesses and Municipal Fiscal Health
 - Small Businesses and Natural Disaster
 - SBA Disaster Loans: Does Climate Insurance Matter?
- ✓ Insurance and Resilience with Evidence
- ✓ Parametric Insurance as a Resilience Tool
 - Parametric Insurance and Financial Technology: How it evolves
- ✓ Disaster Hardening and Insurance Premium: Case Study-I
- ✓ Disaster Hardening and Insurance Premium: Case Study-II

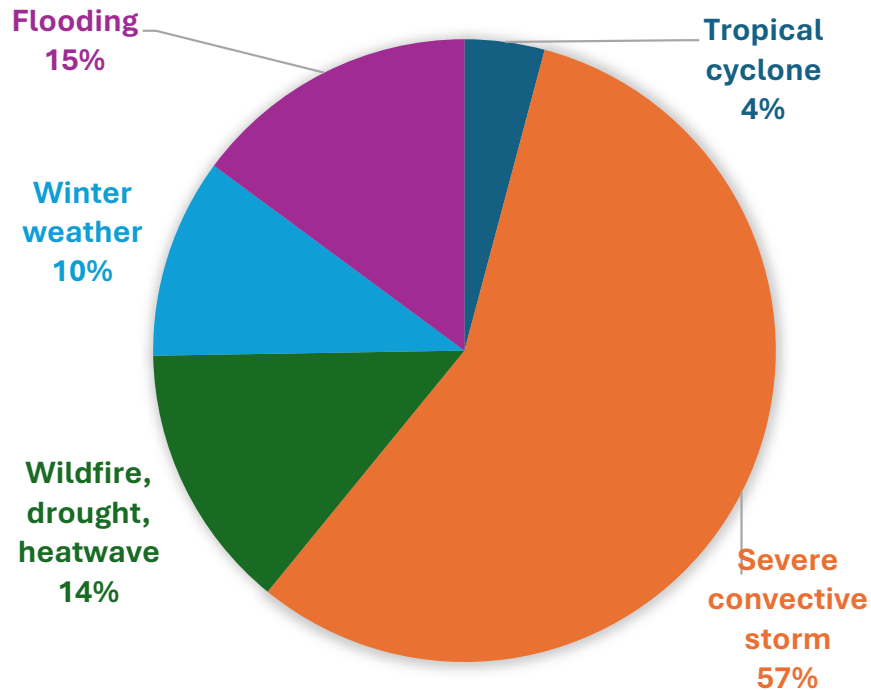
Small Businesses and Municipal Fiscal Health

Why Small Businesses Matter: Key Lessons

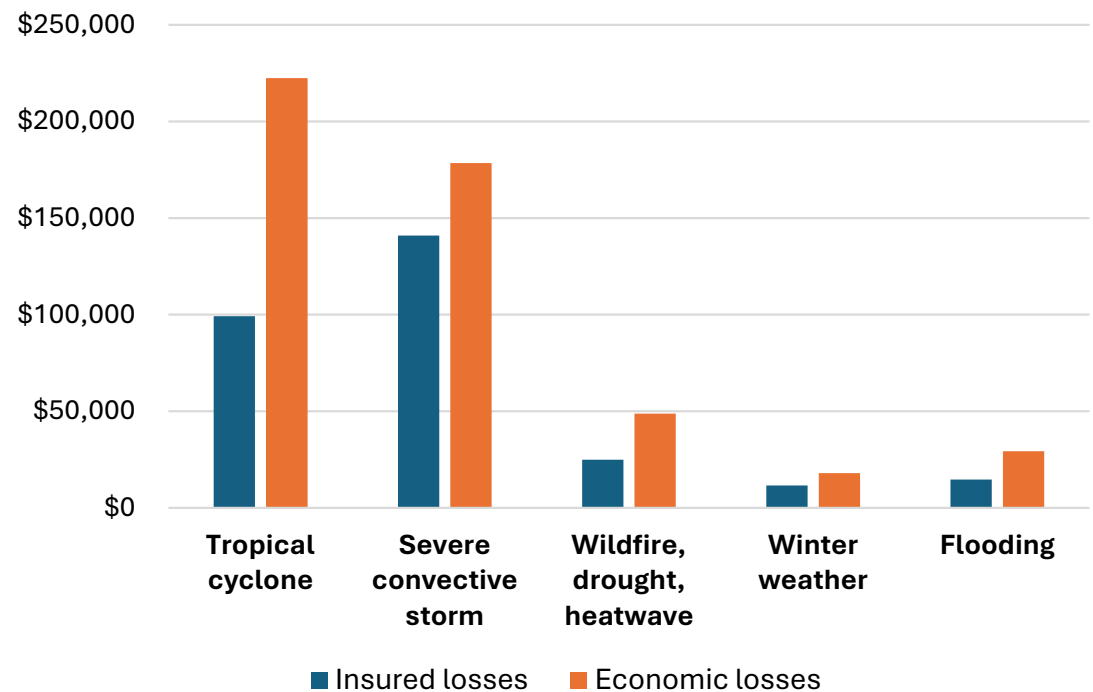
- ✓ **Employment** (created net 12.9 million new jobs: 66% of all)
- ✓ **Tax base** (sales & business property taxes, other local revenues)
- ✓ **Economic activities** (nationwide 44%)
- ✓ **Community Resilience:**
better able to recover from disruptions
- ✓ **Local Economic and Municipal Fiscal Stability** (\$107 billion to local that is 5% of local general revenue)

Natural Catastrophe Losses in the United States By Peril, 2022-2024

NATURAL DISASTER EVENTS IN THE UNITED STATES: 2022-2024

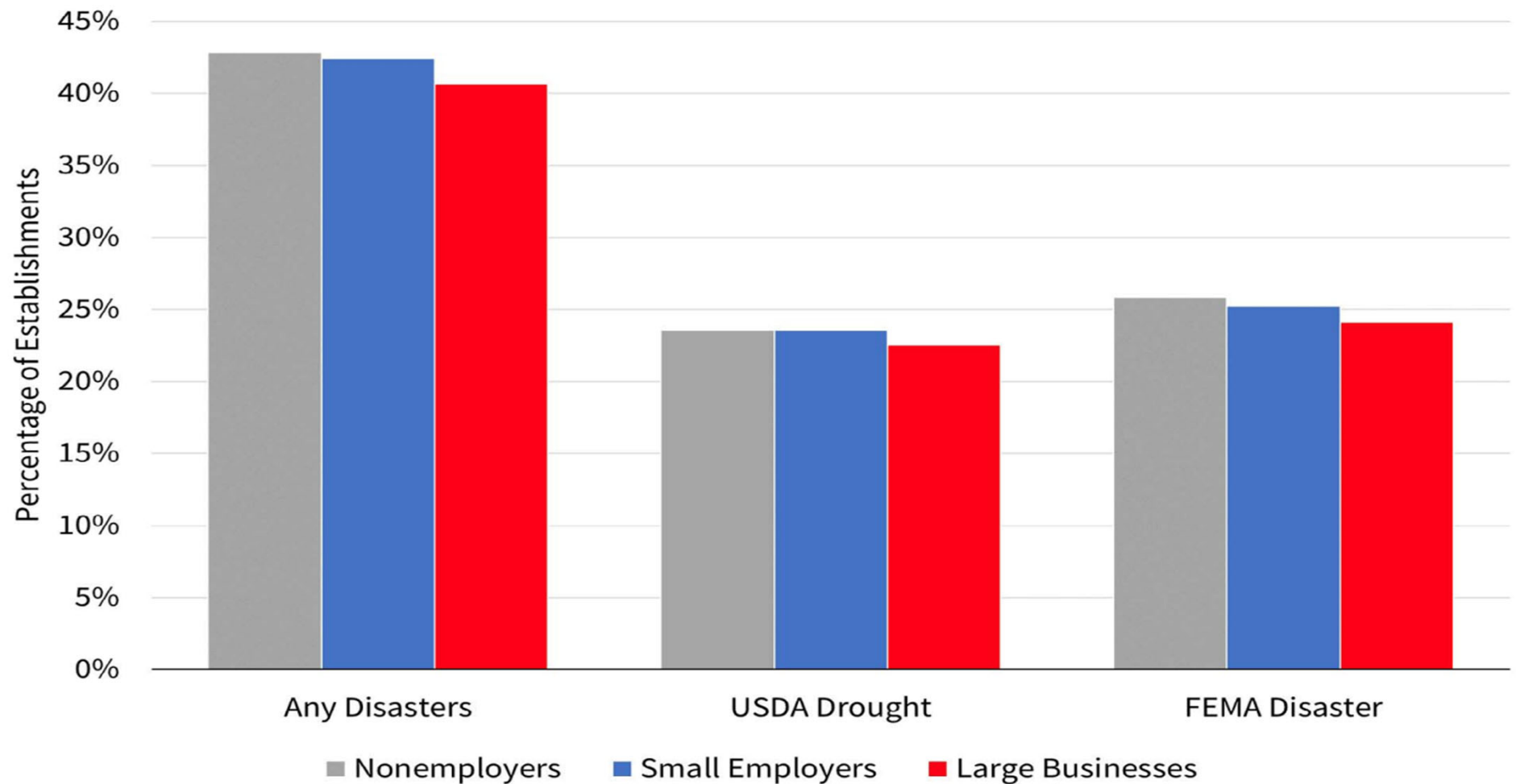


Economic and Insured Losses from Natural Disasters in the U.S. (2022-2024) \$million



Small Businesses in the U.S. and Natural Disasters

Figure 1: Business Establishments in Disaster Areas by Firm Size, 2017–2021

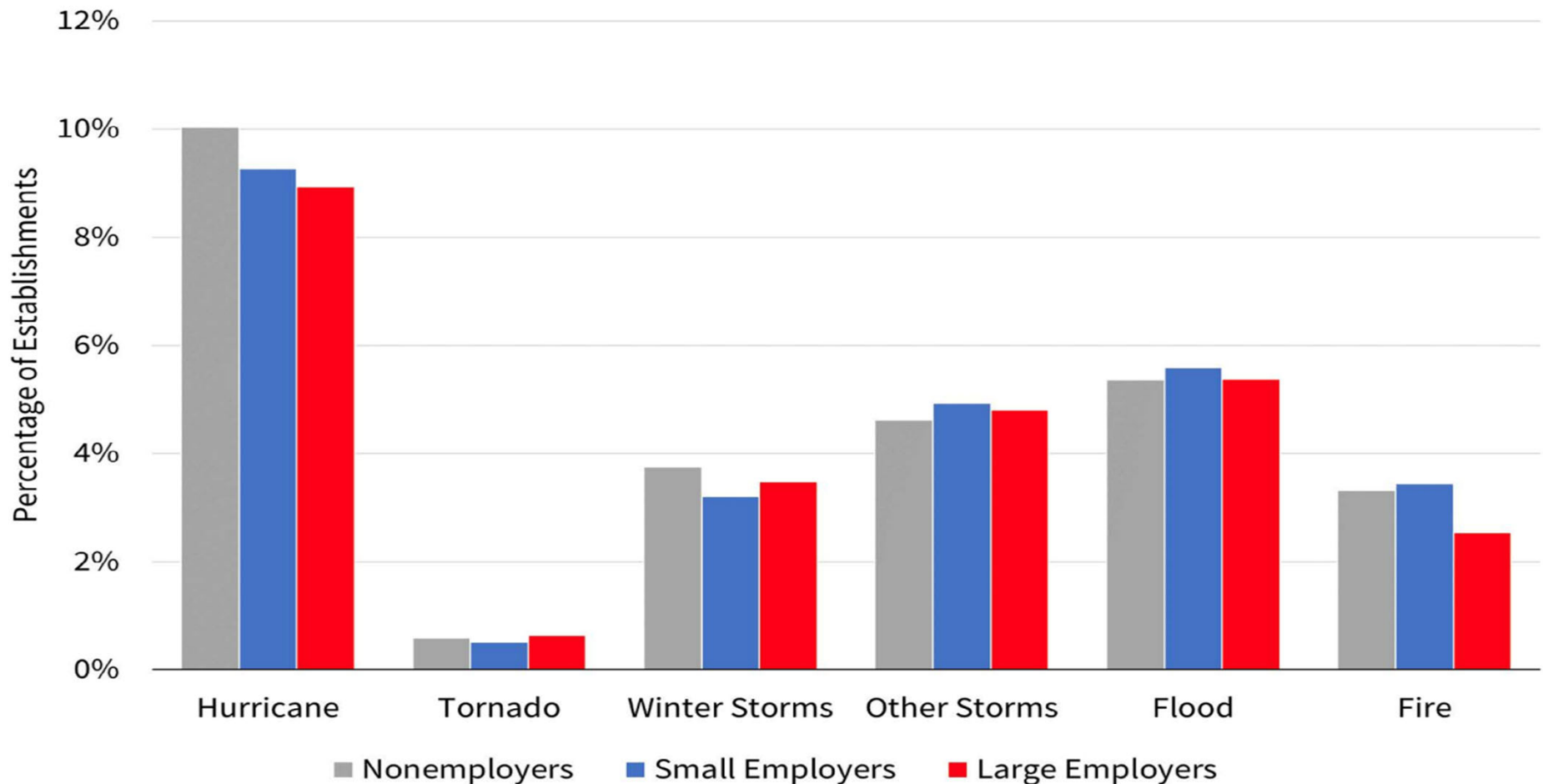


Source: FEMA, USDA, SUSB, NES 2017-2021, author's calculations

Source: SBA Office of Advocacy (Press, 2024)

Small Businesses in the U.S. and Natural Disasters

Figure 2: Business Establishments in FEMA Disaster Areas by Firm Size, 2017–2021



Source: FEMA, SUSB, NES 2017-2021, author's calculations

Source: SBA Office of Advocacy (Press, 2024)

SBA Disaster Loans :

Does Climate Insurance Matter?

1. Physical damage loans (Business physical disaster loan)
 - ✓ Up to \$2 million: if not fully covered by insurance
2. Economic Injury Disaster Loans (EIDL)
 - ✓ If unable to obtain credit elsewhere
 - ✓ maximum loan amount = \$2 million
3. Mitigation assistance
 - ✓ physical property damage loan up to 20% of the verified loss
 - ✓ **Covers:** wind, flood, wildfire, earthquake, and hail mitigations

Insurance and Resilience

- **Insurance** as a major tool of
 - (i) **risk transfer**
 - (ii) **risk reduction**
- provides financial resilience
- a key tool in adapting to climate change.

Two Main Insights

1. Capital for Recovery

Provides funding to recover from disasters

2. Protection Through Resilience

Promotes measures against climate-driven disasters

Traditional Insurance

Traditional insurance is becoming faster because of new digital technologies

- 1) **Satellites** to quickly observe damaged buildings, crops, roads, etc.
- 2) **Synthetic Aperture Radar (SAR)** to detect changes or damage even through clouds or at night.
- 3) **Drones** to photograph and measure damage from above.

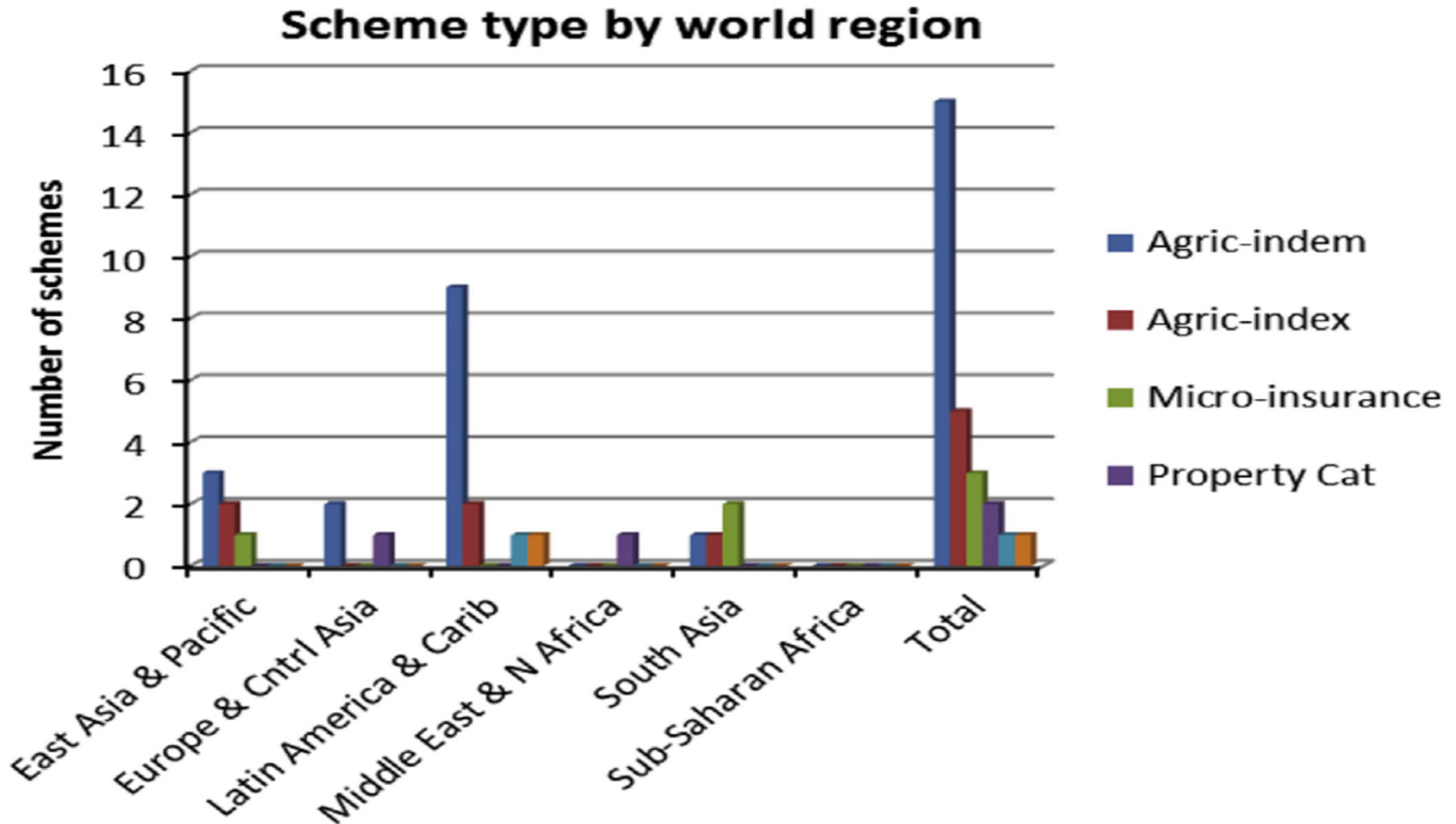
Evidence: Traditional Insurance

Key Findings from the Analysis: Traditional Climate Insurance

27 flood-risk insurance schemes across
20 countries

Evidence: Traditional Insurance

- 27 flood-risk insurance schemes across 20 countries



Source: Surminski and Oramas-Dorta (2014)

Evidence: Traditional Insurance

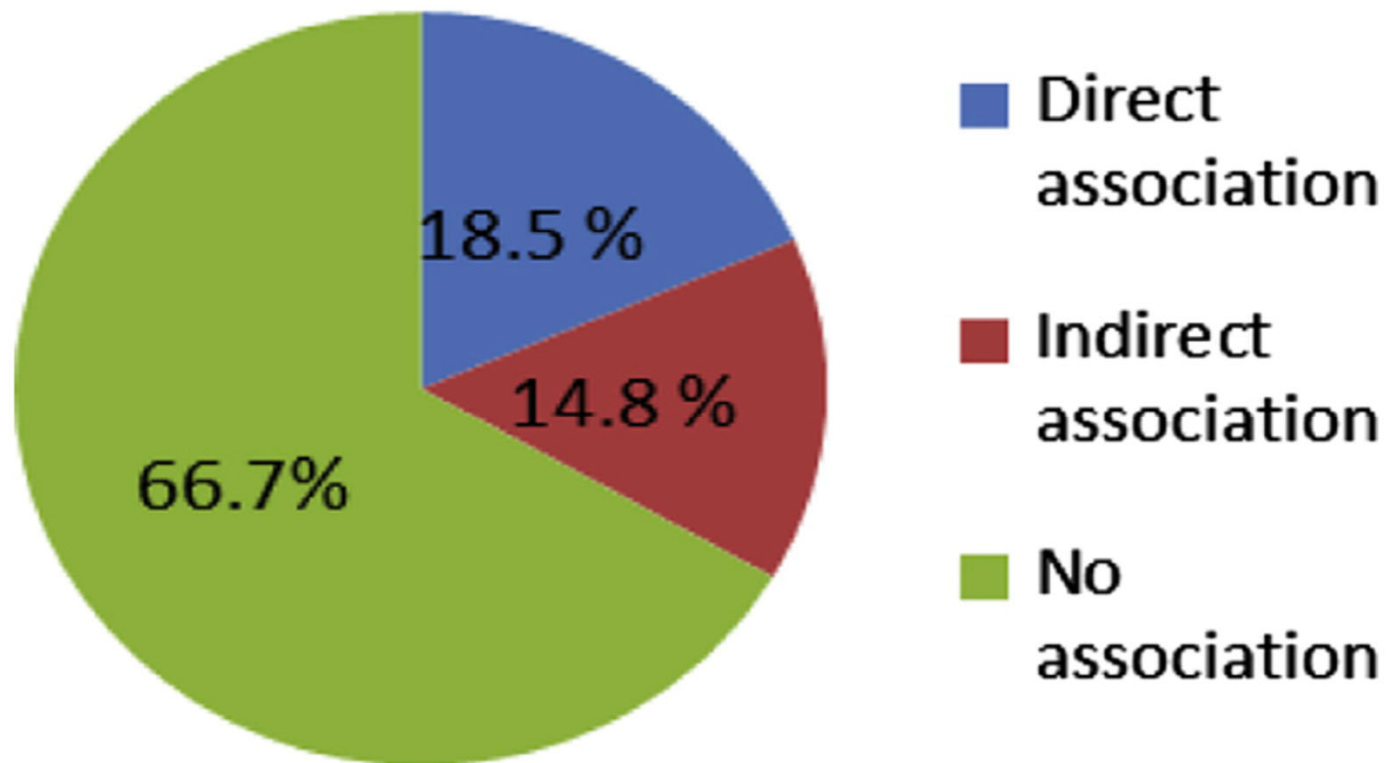
Exploring

Three different degrees of linkages between risk transfer and risk reduction

- **No Association:** No risk reduction
- **Indirect Association:** Risk transfer is one element for disaster risk reduction or adaptation
- **Direct Association:** where a risk transfer scheme explicitly supports risk reduction efforts

Evidence: Traditional Insurance

Risk transfer and disaster risk reduction linkages



Source: Surminski and Oramas-Dorta (2014)

Traditional Insurance

Factors hampering uptake of flood insurance

- 1) high transaction costs
- 2) lack of financial literacy and
- 3) lack of access to affordable products in remote rural area
- 4) insurer and insured might disagree

Insurance-Resilience Solution

Can **Parametric Insurance** Support Risk Reduction and Build Resilience?

- “parametric trigger”
 - ✓ pays the insured a set amount based on an objective measure of the severity of a specific event
 - ✓ No dispute

First-generation triggers
“cat-in-a circle”

vs.

Second-generation triggers

Parametric Insurance

What Makes Parametric Insurance Valuable?

- ✓ verifiable triggers
- ✓ rules-based post-event finance
- ✓ Ex ante transparency
- ✓ auditability
- ✓ rapid payment
- ✓ **fiscal smoothing**
- ✓ payout timeliness, and trust
- ✓ **low-coverage, low-premium insurance**

Parametric Insurance: Possible Triggers

- Crop Insurance
- Weather Insurance
- Earthquake Insurance
- Wildfire Insurance

CROP INSURANCE
Farmers are paid when rainfall is below a certain threshold.



Trigger: Rainfall < 50mm
Payout: Instant to farmer

EARTHQUAKE INSURANCE
Payouts are triggered by earthquake magnitude and location.



Trigger: Magnitude > 6.0 within defined zone
Payout: Instant payout

WEATHER INSURANCE
Compensation for extreme weather events like storms, hurricanes, or heatwaves.



Trigger: Wind speed > 120km/h
Payout: Automatic payout

WILDFIRE INSURANCE
Compensation for property owners when wildfires are detected nearby.

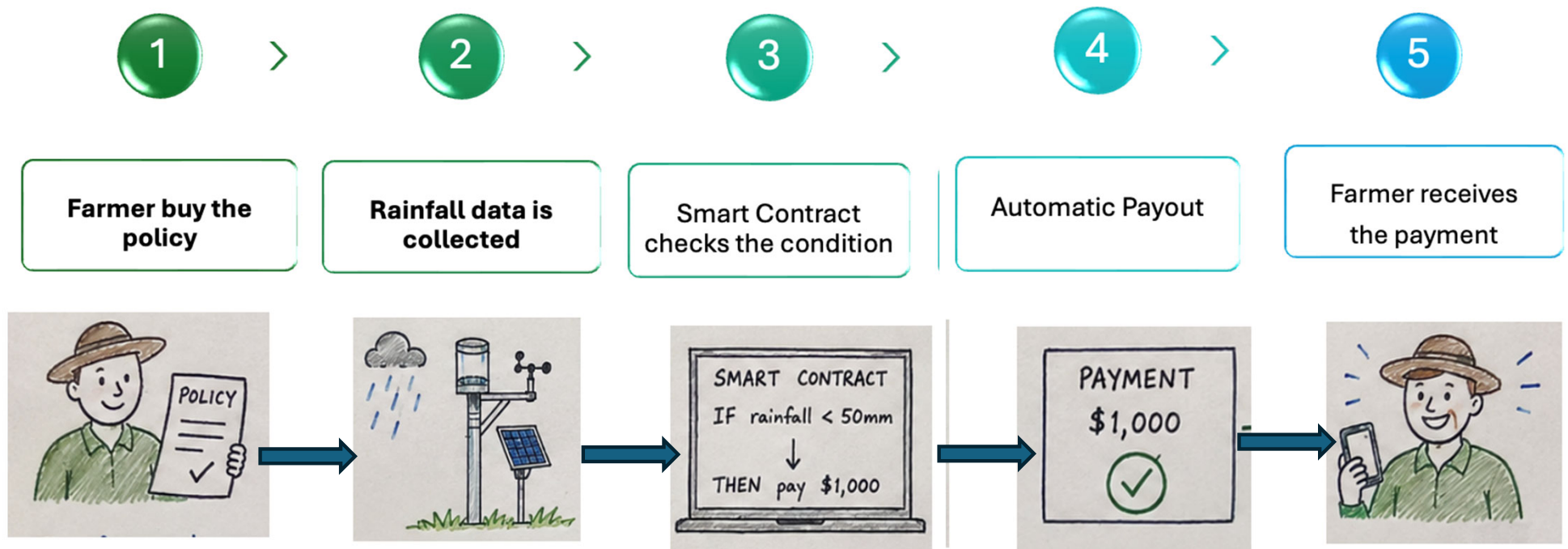


Trigger: Fire detected within 10km by satellite
Payout: Automatic payout

How Parametric Insurance work?

Smart Contracts in Parametric Insurance

Example: Rainfall insurance for a farmer



Benefits:

- ❑ Fast: Quick payout
- ❑ Reliable: No human intervention
- ❑ Transparent: Everyone can see the data and rules
- ❑ Lower cost: no paperwork or survey

Financial Technology and Parametric Insurance Industry



1. Big Data

**2. Machine Learning
Methods**

3. An objective Index

4. Blockchain

5. Smart Contract

1. Big Data and Parametric Insurance Industry

Big data

- ✓ Include Large amounts of information (Everywhere, Every Day)

Big data and “5Vs”

“5 Vs” in parametric insurance

Volume

- Weather records, Satellite images, Historical losses

Velocity

- Real-time weather stations and IoT sensors

Variety

- Satellite + weather stations + IoT sensors + historical losses + climate models

Value

- Better risk pricing and reliable/fast parametric payouts

Veracity

- Cross-checking satellite, weather-station, and sensor measurements

1. Big Data and Parametric Insurance Industry

Case study: 2017 Hurricane Harvey in Harris County, Texas

- Smart Flood Resilience Framework that leverages
 - (i) heterogeneous community-scale big data and
 - (ii) infrastructure sensor data
- ✓ Help to enhance predictive risk monitoring and situational awareness

1. Big Data and Parametric Insurance Industry

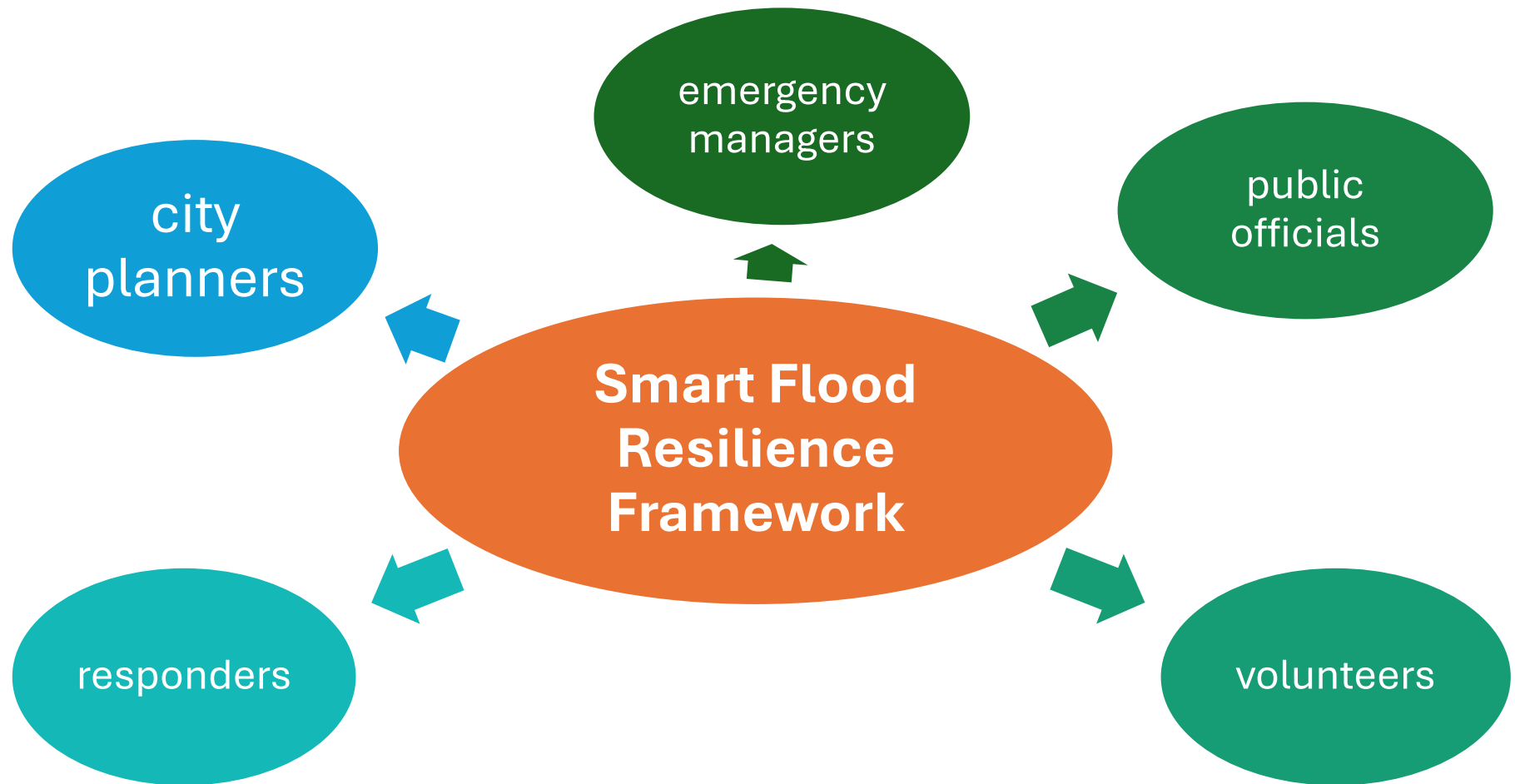
Case study: 2017 Hurricane Harvey in Harris County, Texas.

Big Data Applications for Disaster Resilience:

- (1) predictive flood risk mapping
- (2) automated rapid impact assessment
- (3) predictive infrastructure failure prediction and monitoring, and
- (4) smart situational awareness capabilities

1. Big Data and Parametric Insurance Industry

Case study: 2017 Hurricane Harvey in Harris County, Texas.



✓ They better cope with the impacts of catastrophic flooding events.

2. Machine Learning Method: Is it Resilience tool?

Why Machine Learning Methods (MLM) ?

process and extract information from big data with limited human intervention

- ✓ Allow computers to learn patterns from data and use those patterns to
 - make predictions/forecast extreme weather events
 - predict drought indices, floods, and tropical cyclones
 - forecast wind gusts and excessive rainfall, and many more

3. Index in Parametric Insurance

An objective index reported quickly and effectively to enable prompt payments

Examples:

- U.S. Geological Survey's earthquake magnitude index
- NOAA Regional Snowfall Index

4. Blockchain in Parametric Insurance

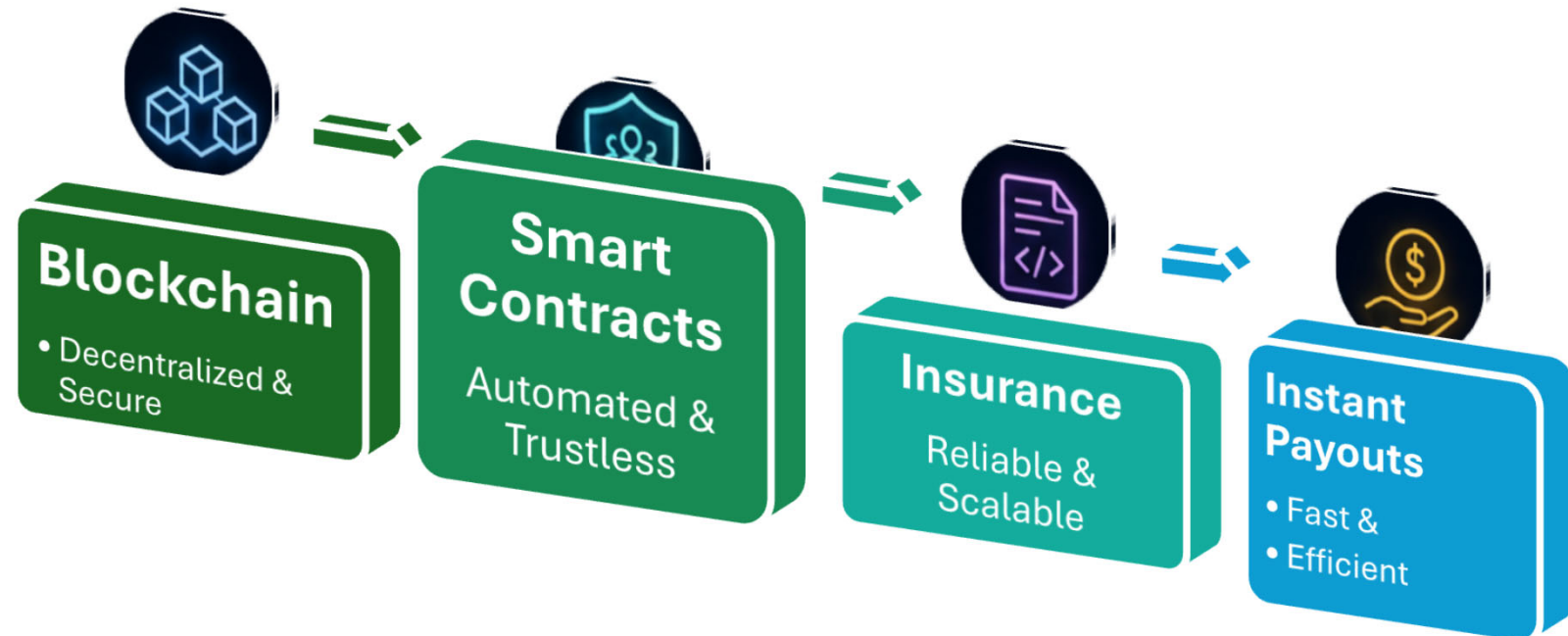
-digital ledger that permits digital information to be distributed but not copied.

5. Smart Contract in Parametric Insurance Industry

- Blockchain technology cost savings and efficient

How it works? Smart contracts

- ✓ enforced by virtual parties
- ✓ computer protocol digitally facilitate
- ✓ verify or enforce the performance of a contract



5. Smart Contract in Parametric Insurance Industry

Advantage

- Automated execution
- Secure and transparent information
- Automated payouts - no human interaction
- Faster and more cost-efficient claims
 - **3 times faster and 5 times cheaper**

Disadvantage:

- Novelty
- Basis Risk

Disaster Hardening and Insurance Premium: Case Study-I

FORTIFIED Home™ (“Fortified”) program: Insurance
Institute for Business and Home Safety (IBHS)

- ✓ promote construction of homes that are resilient to natural disasters
- ✓ mitigate wind and wind-driven water damage from hurricanes

Disaster Hardening and Insurance Premium: Case Study-I

✓ Alabama State law requires insurance companies in Alabama to give discounts for houses that earn the Fortified designation

Table: 1 Fortified mitigation levels and benchmark discounts

	Existing home	New and existing home
Mitigation category	Roof > 5 years old	Roof ≤ 5 years old
FORTIFIED™ Gold	40%	50%
FORTIFIED™ Silver	35%	45%
FORTIFIED™ Bronze	20%	35%

Source: Alabama Department of Insurance Bulletin Number 2016-7.

Disaster Hardening and Insurance Premium:

Case Study-II

“Fortified” program by Awondo and Powell's (2017)

- **Survey Results:** 2016 homeowners in coastal areas of Alabama

✓ Average premium: **\$2,287**

Fortified designation

- ✓ save the average homeowner \$366 to \$915 per year
- ✓ Fortified designation to increase the value of a house.

Disaster Hardening and Insurance Premium: How Parametric Insurance work?

Disaster hardening reduces physical damage

- trigger is based on an external index → **premium does not automatically fall.**
- Any pricing benefit depends on how the parametric contract is designed.
- ✓ **Reduce the coverage limit** - insure only the amount needed to cover critical losses.

Thank You !



Protecting Infrastructure Investments

Risk transfer tools to increase resilience
and support financial performance

Disaster Recovery, Rebuilding, and
Resilience Conference

Renaissance Asheville Downtown Hotel
Asheville, North Carolina
September 23-25, 2026

Guillermo Franco, Ph.D.
Founder & Director, Parametric Factory LLC
Guillermo.E.Franco@parametricfactory.com; +1(917)836-6856

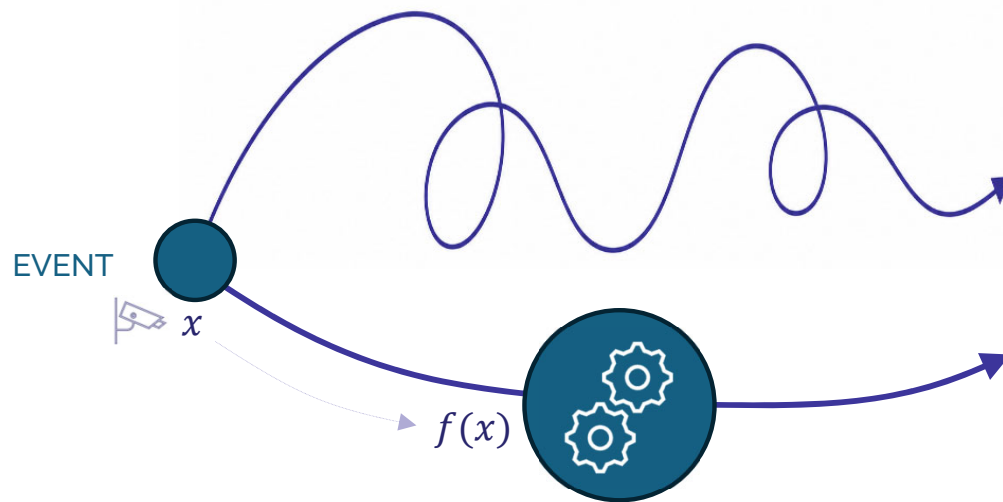


Guillermo Franco

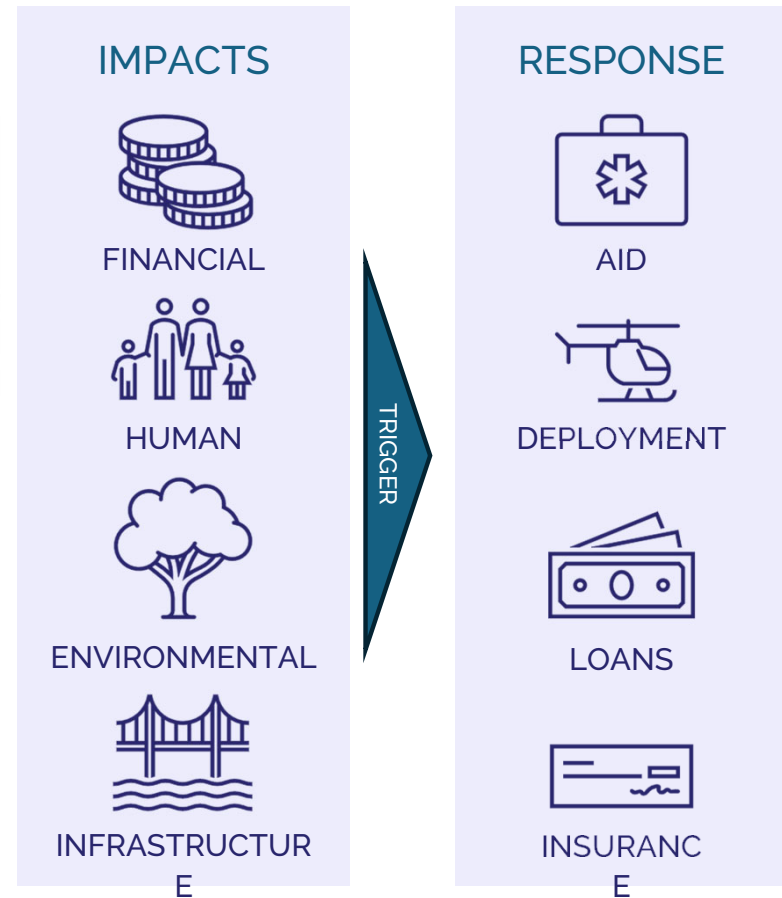
- 20 Years of experience in the reinsurance industry
- Structured and supported the placement of about \$6B of parametric insurance
- Former Managing Director & Head of Cat Risk Research at Guy Carpenter (now Marsh Re)
- Now Founder & Director of Parametric Factory
- Focused on innovation and applications of parametric risk transfer
- Ph.D. in Civil Engineering

Parametrics Are Models that Enable a Fast Response

Traditional approaches to assess impacts, like claims adjustment processes in insurance, can take a long time

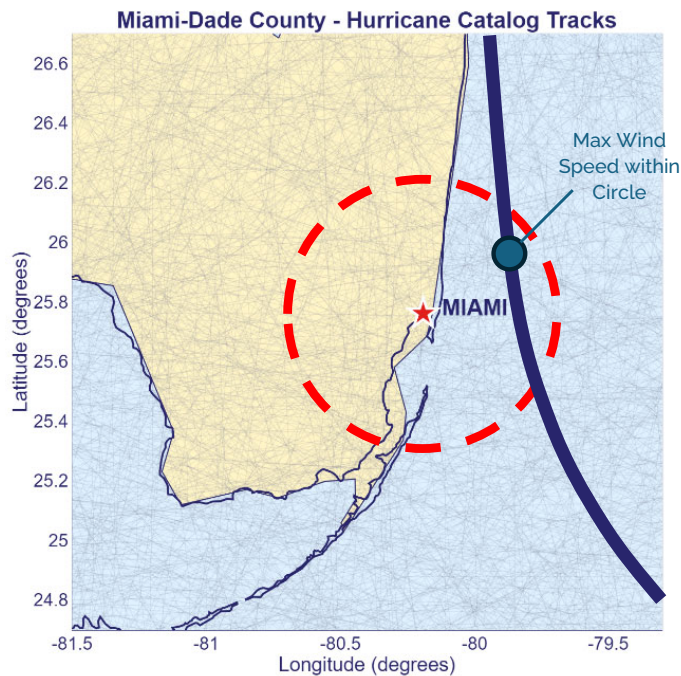


Parametric models can be very fast at providing estimates of impacts as a function of a few event observations



A Typical Parametric Underwriting Illustration

OBJECTIVE: We have a client in Miami. They desire protection through a parametric mechanism. The broker suggests a “Cat-in-a-Circle” structure. This consists of defining a circle and assigning a payout for hurricanes with tracks that intersect the circle.



USUAL PROTOCOL

Center a Circle in Miami
Assume a radius of about 50 km
Assume a payout table as a function of the maximum wind speed within the circle

Category	Payout (% of Limit)
<3	0
3	10%
4	50%
≥5	100%

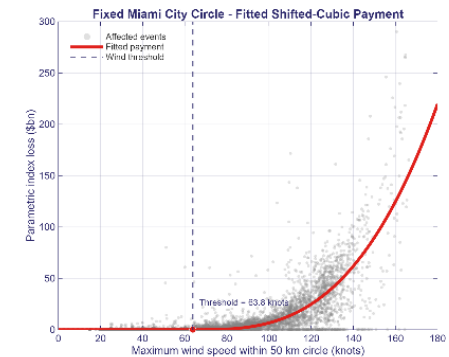
For illustration – payout tables vary based on budget and coverage needs

OUR PROTOCOL

Define a Circle or Circles

Define radii

Calculate event loss based on a cubic function of the maximum wind speed



Event data provided by a model

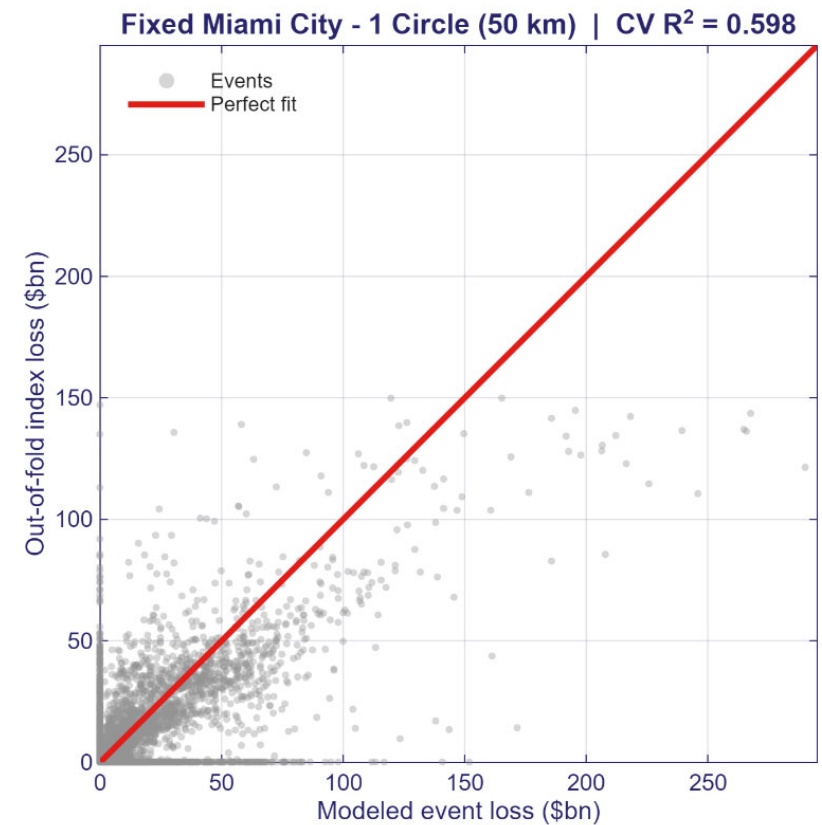
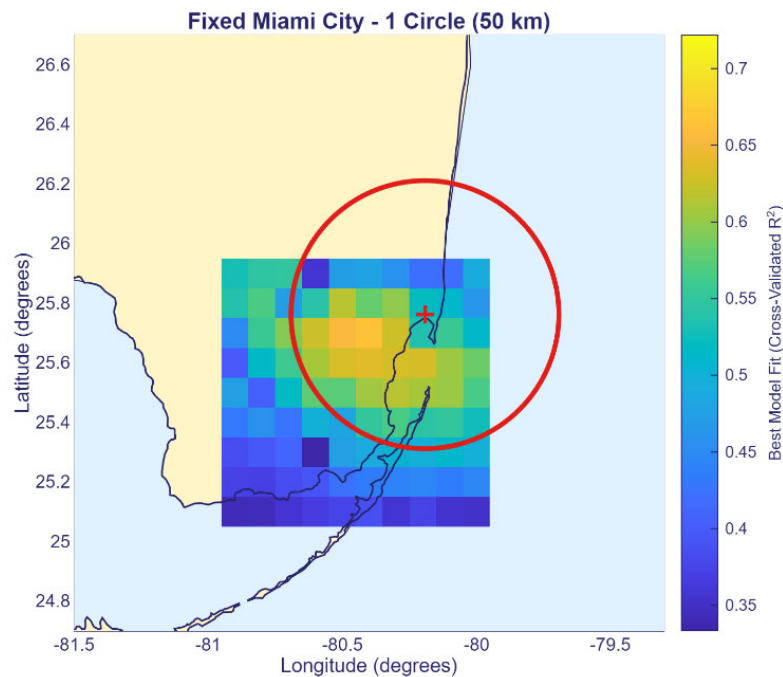
BASELINE: The “Usual” Approach

Number of circles: 1

Center: Arbitrarily fixed in Miami (intuitive)

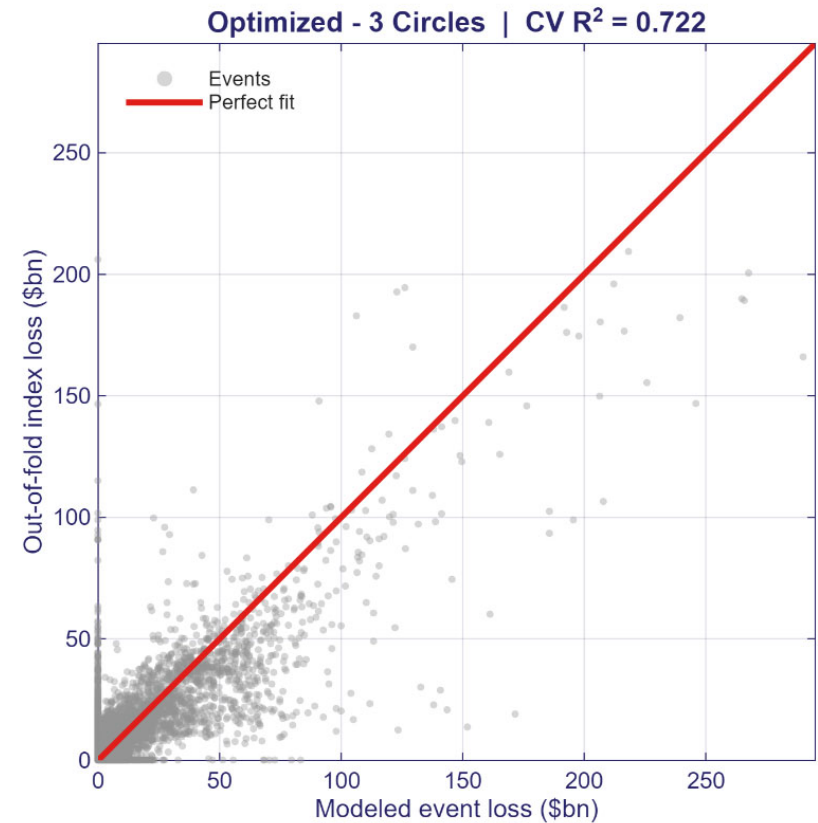
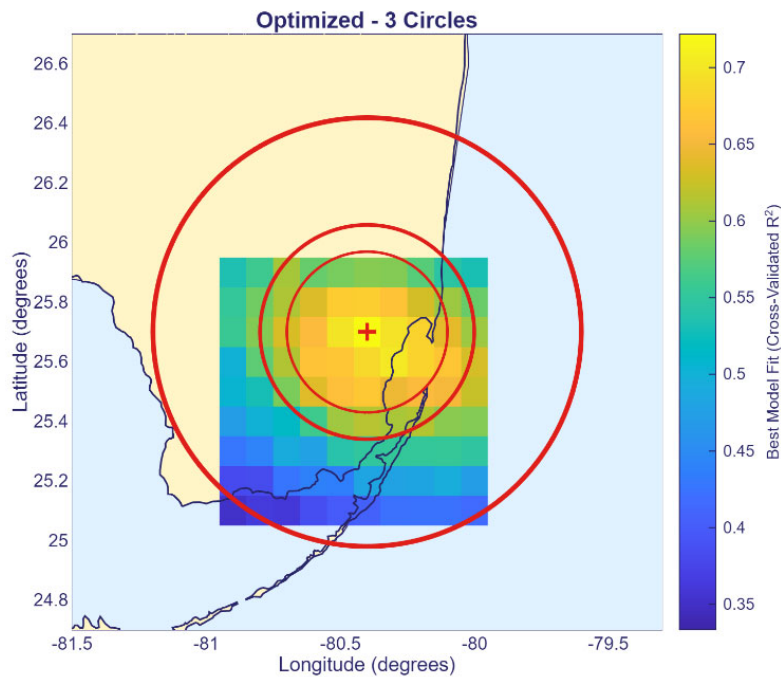
Radius: Arbitrarily fixed at 50km (from experience, budget)

Payments: Optimized with a cubic function to modeled events



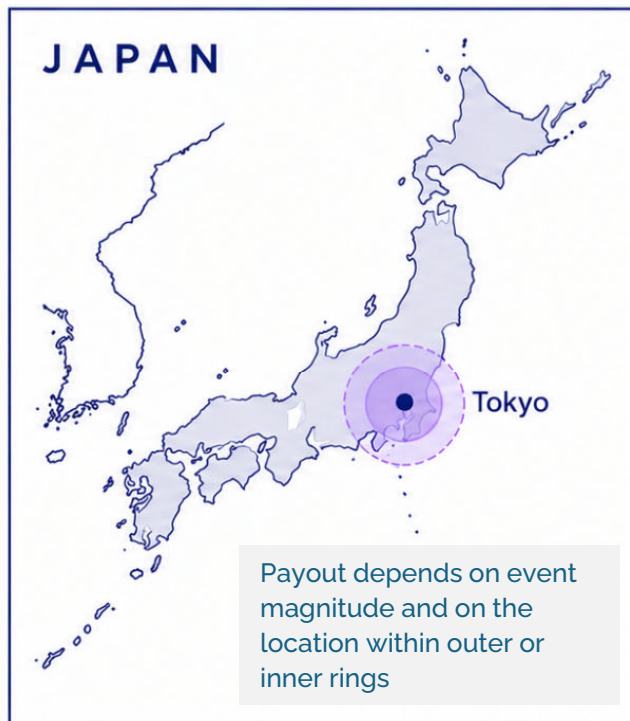
A Better Solution, from 59.8% to 72.2% Accuracy

Number of circles: 3
Center: Optimized (to modeled events)
Radii: Optimized (to modeled events)
Payments: Optimized with 3 cubic functions to modeled events

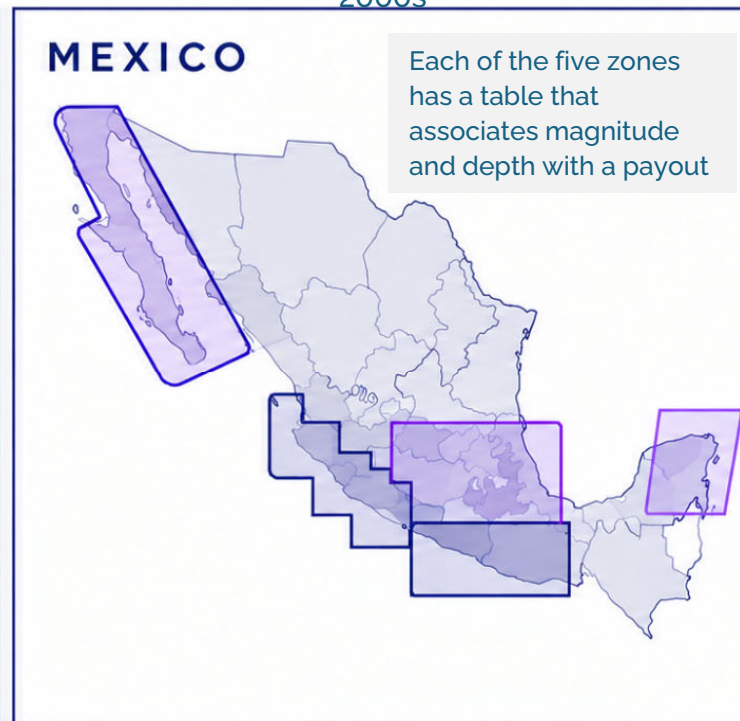


Earthquake Parametric Cat Bond Evolution

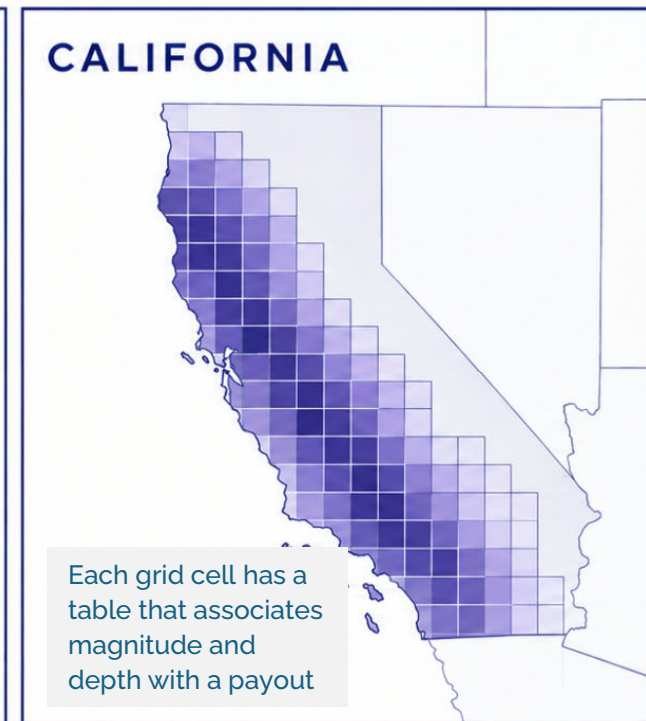
The starting point in the late 1990s



Early
2000s



From 2015 onward

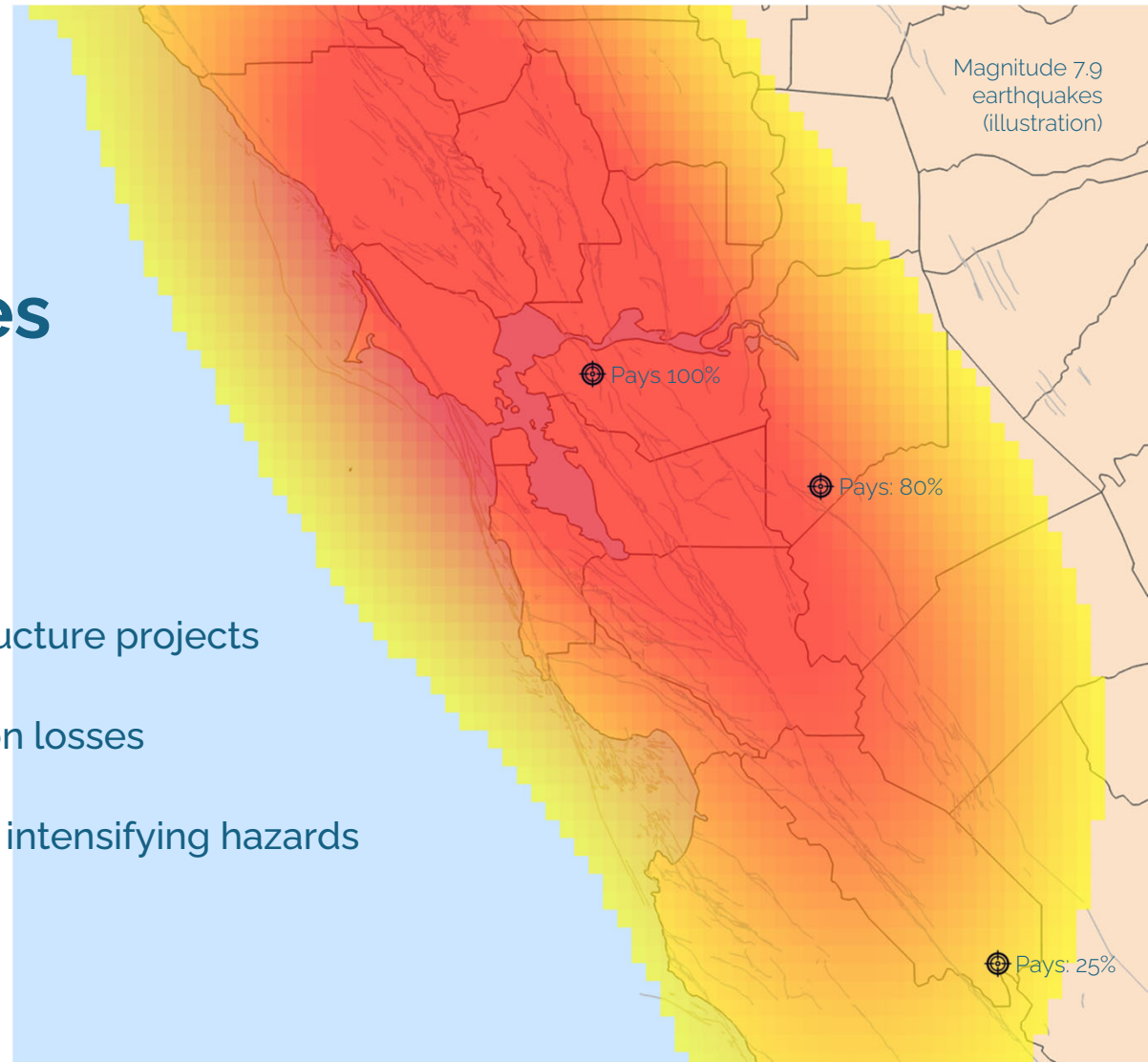


NOTE: These graphs are AI-Generated for illustration only. These maps do not depict actual transactions.

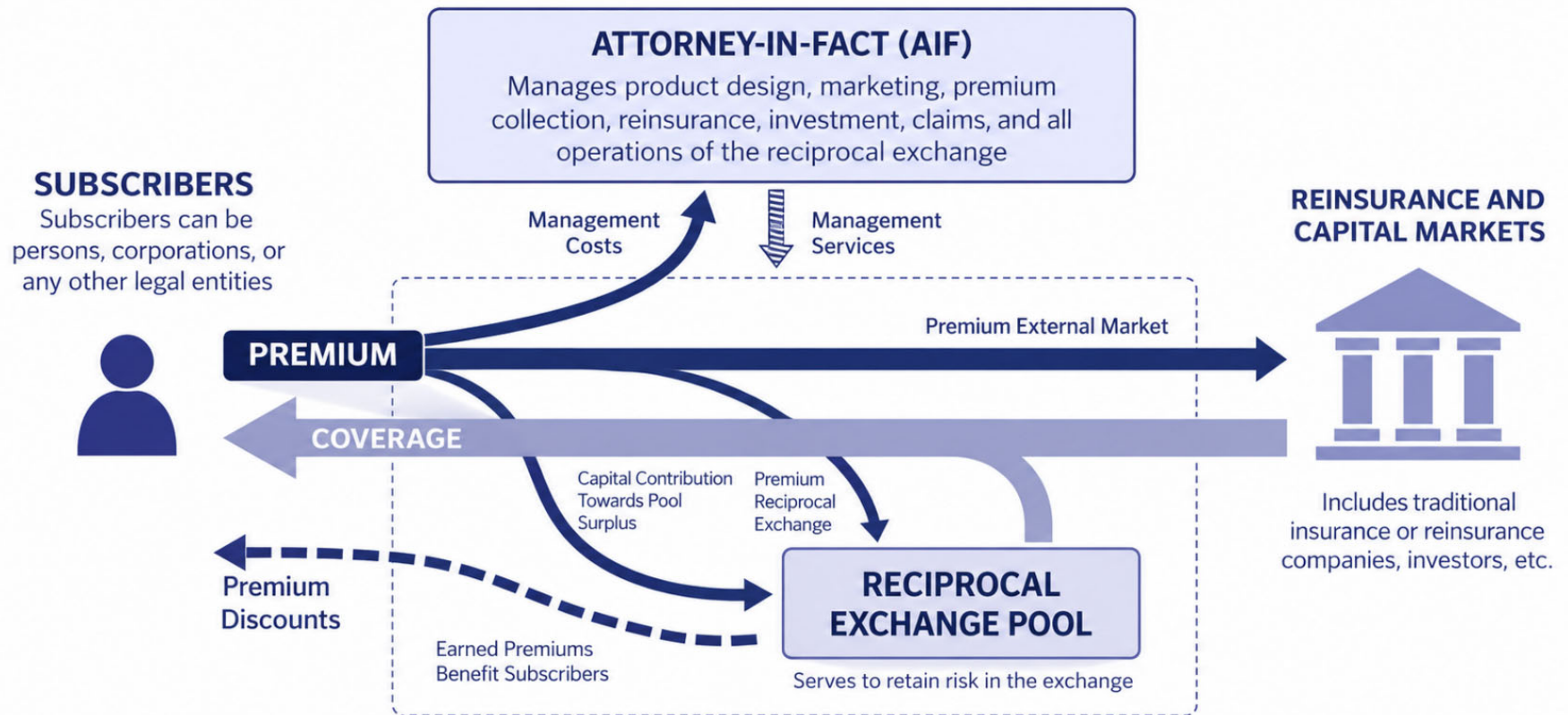
Parametric Cat-in-a-Grid Earthquake Structures

These solutions can be tailored to:

- ✓ Protect financial revenues from infrastructure projects
- ✓ Secure stronger credit evaluations
- ✓ Insure physical and business interruption losses
- ✓ Provide liability protection
- ✓ Support maintenance operations under intensifying hazards

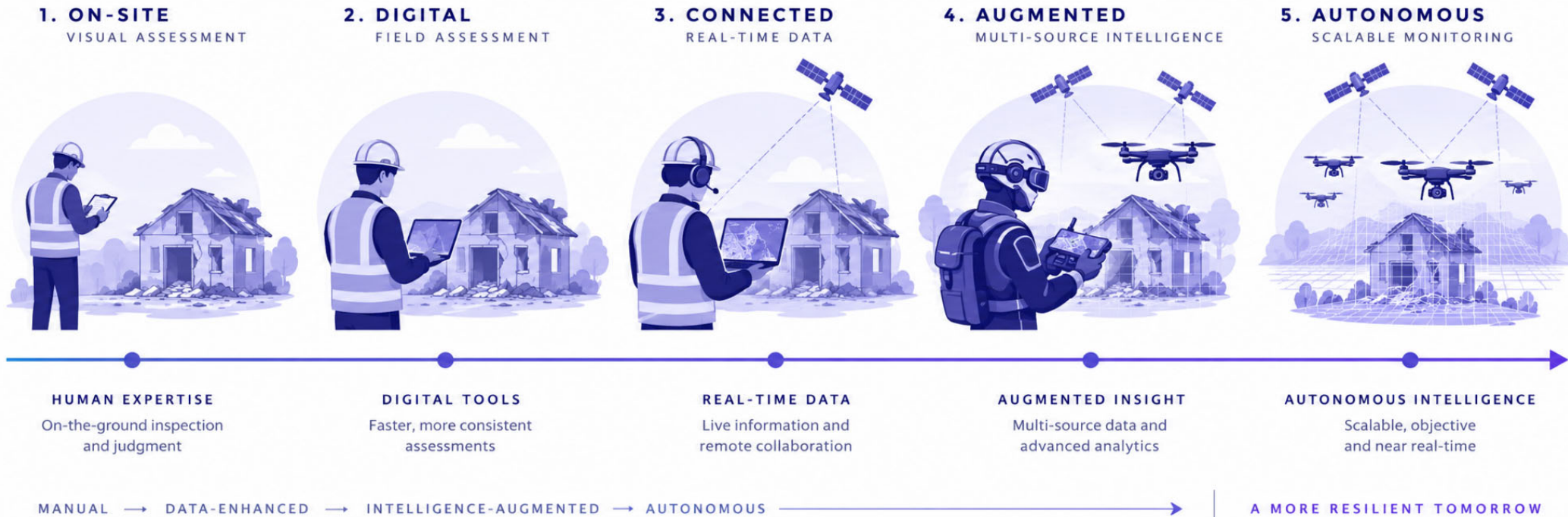


Pooling & Parametrics



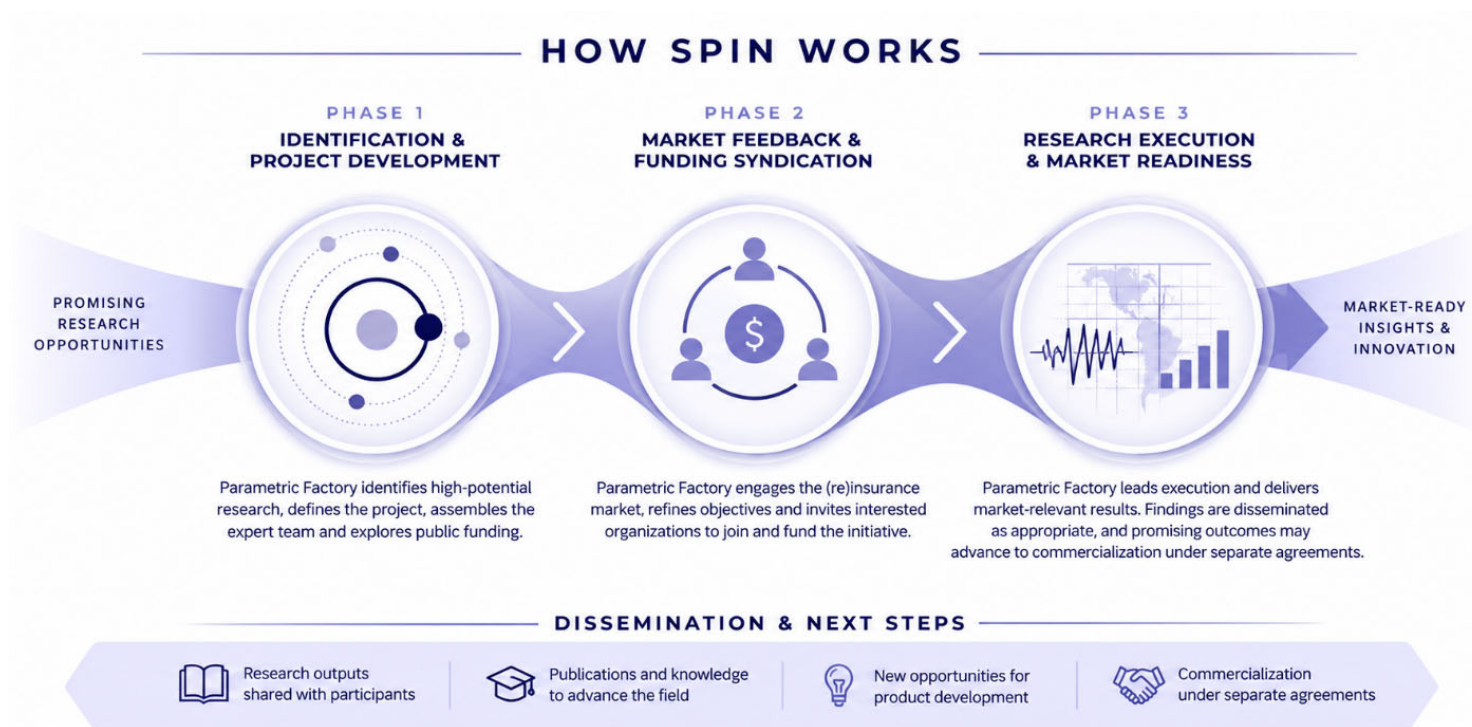
Parametrics & Traditional Indemnity

Parametric solutions and traditional indemnity are on a path to hybridize and simply yield a better insurance and risk response experience

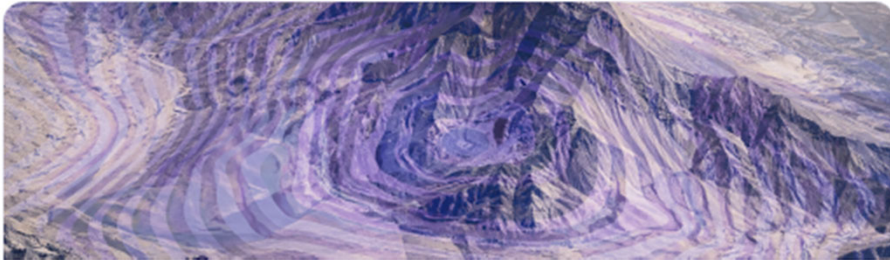


Parametric Factory SPIN Initiative

SPIN (Syndicated Parametric Innovation Network) provides a platform to jointly advance the boundaries of parametric risk transfer and emergency response



Launch in October 2026



Subsidence

With Universitat Oberta de Catalunya

InSAR (Interferometric Synthetic Aperture Radar) technology offers promising opportunities to develop parametric risk transfer products for subsidence, landslide, earthquake, and sinkhole risks. Through this 1-year collaboration, we aim to establish the foundations for commercialization by evaluating reporting agents, risk modeling methodologies for quoting, and policy payment mechanisms.

Flood Parametric Research
and other projects in
preparation for Q1-Q2 2027



For questions, please contact:

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QUESTIONS?



Disaster Recovery, Rebuilding, and Resilience Conference

September 23 – 25, 2026

Southern Municipal Finance Society