PRESENTED BY TEXAS TECH UNIVERSITY

TAMEST NATURAL HAZARDS SUMMIT

Responding to and Mitigating the Impacts

PART II: LUBBOCK
05.16.2022

#NATURALHAZARDSSUMMIT

Plenary:

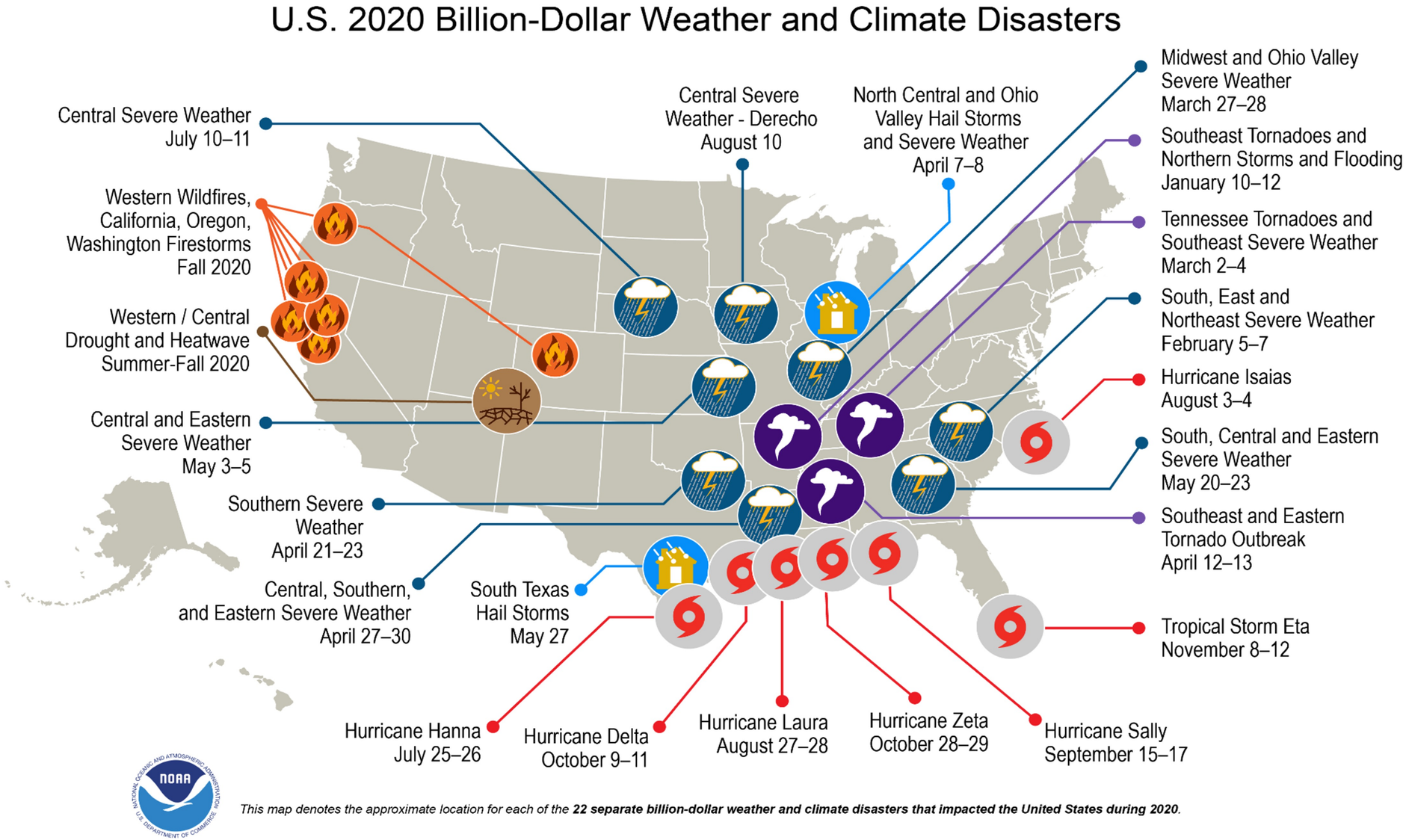
Emergency Response and Recovery

TRACY KIJEWSKI-CORREA, PH.D.

Linbeck Chair and Associate Professor, College of Engineering & Keough School of Global Affairs

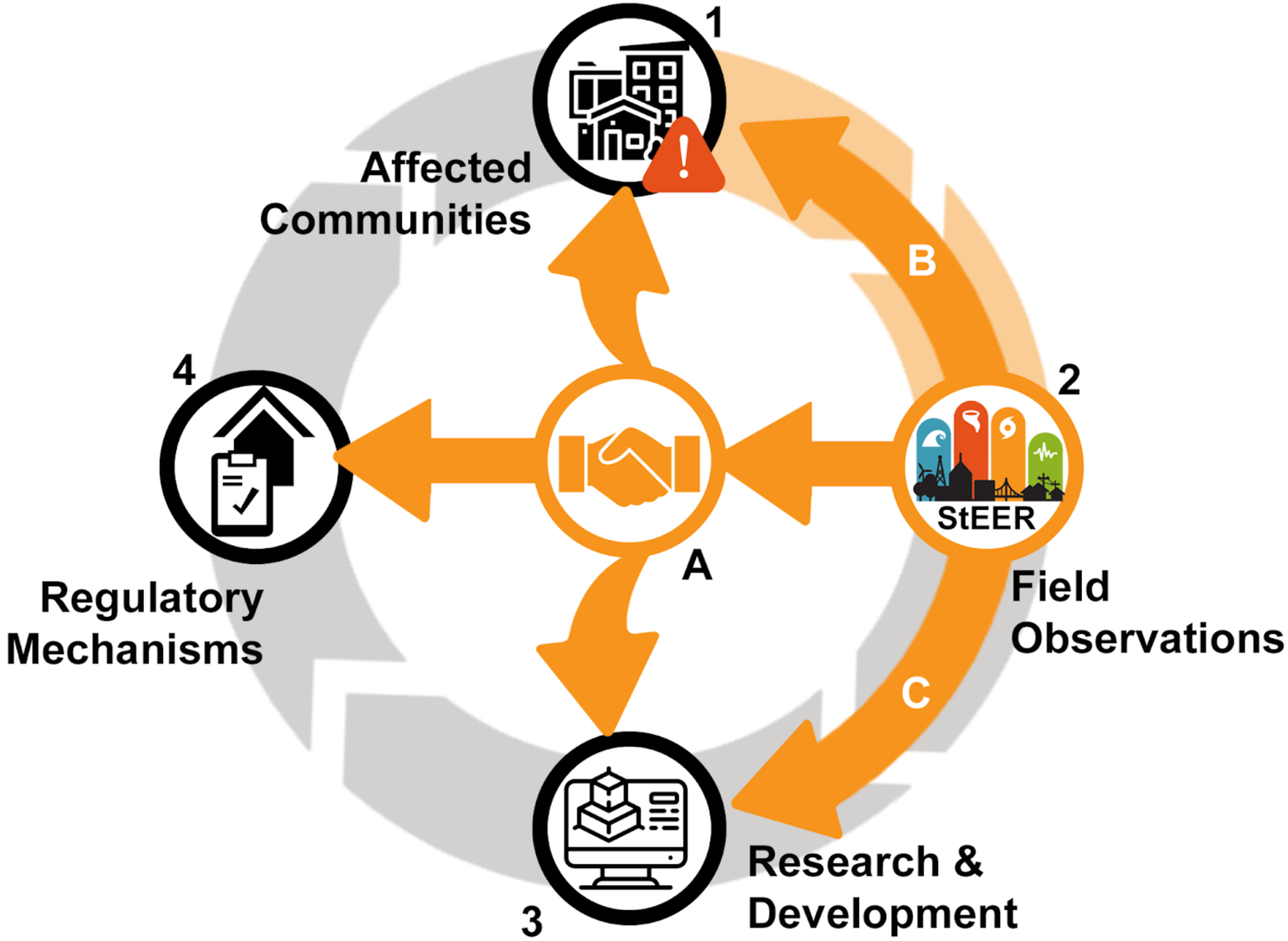
University of Notre Dame

MOTIVATION



POTENTIAL DRIVERS	
☑	Hazard Exposure
☑	Inventory Vulnerability
☑	Regulatory Context
☑	Information Channels
☑	Incentive Structures

DATA-TO-KNOWLEDGE LIFE CYCLE



APPROACH

StEER

STRUCTURAL EXTREME EVENTS RECONNAISSANCE

CAPACITY	COORDINATION	COLLABORATION
promoting **community-driven standards**, best practices, and training for field reconnaissance	facilitating **early, efficient and impactful** event responses	broadly engaging communities of **research, practice and policy** to accelerate learning from natural hazard events

PRIMARY OUTCOMES:

- ❑ High-quality communal datasets documenting performance of built environment, intended for broad re-uses
- ❑ Synthesis of collective knowledge, spur ongoing research, uptake into policy and practice
- ❑ Requires **TIMLEY** capture of **RELIABLE** data that is **ACCESSIBLE**

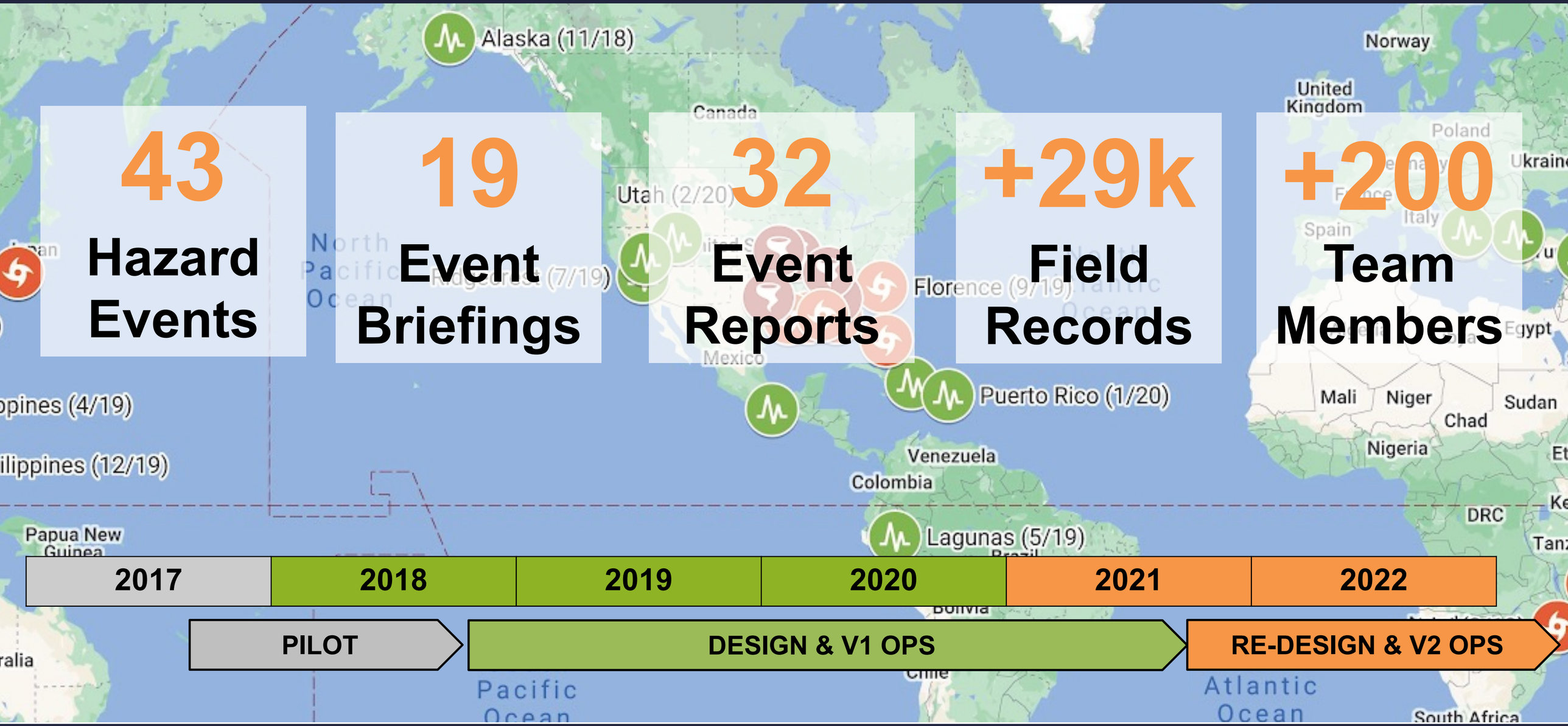
Hurricanes

Tornadoes & Other Windstorms

Earthquakes

Storm Surge and Tsunami

CHRONOLOGY AND GEOGRAPHIC COVERAGE



43 Hazard Events

19 Event Briefings

32 Event Reports

+29k Field Records

+200 Team Members

2017	2018	2019	2020	2021	2022

PILOT → DESIGN & V1 OPS → RE-DESIGN & V2 OPS

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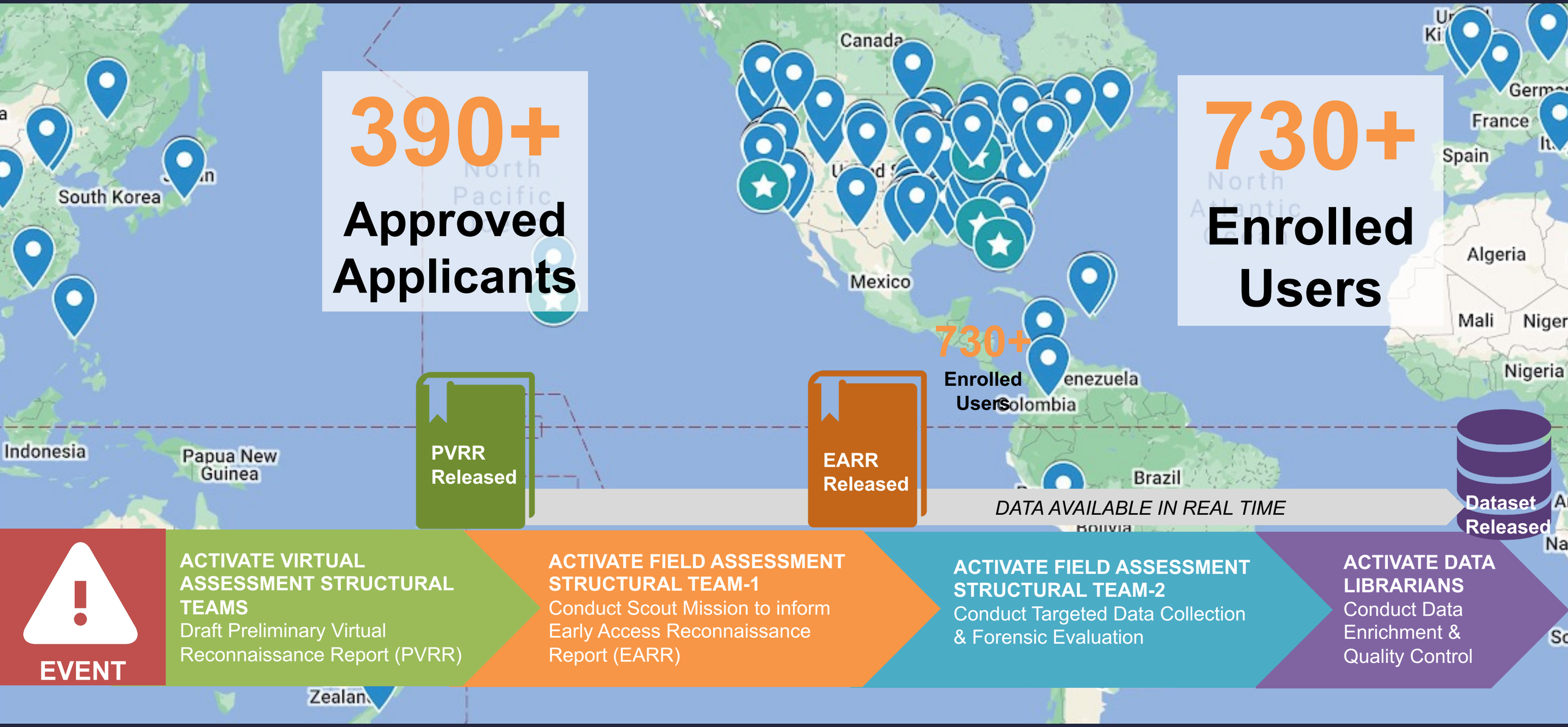
TIERED EVENT REPONSE MODEL



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MISSION DESIGNS

Hazard Gradient Survey: Hurricane Michael

Hazard Gradient Survey: Nashville Tornadoes

Representative Performance Study: Palu Tsunami

Targeted Case Studies: Puerto Rico Earthquakes

Phased Multi-Hazard Investigation: H. Dorian

Rapid Survey + Virtual Assessment: H. Laura

TYPICAL ASSESSMENT TECHNOLOGIES

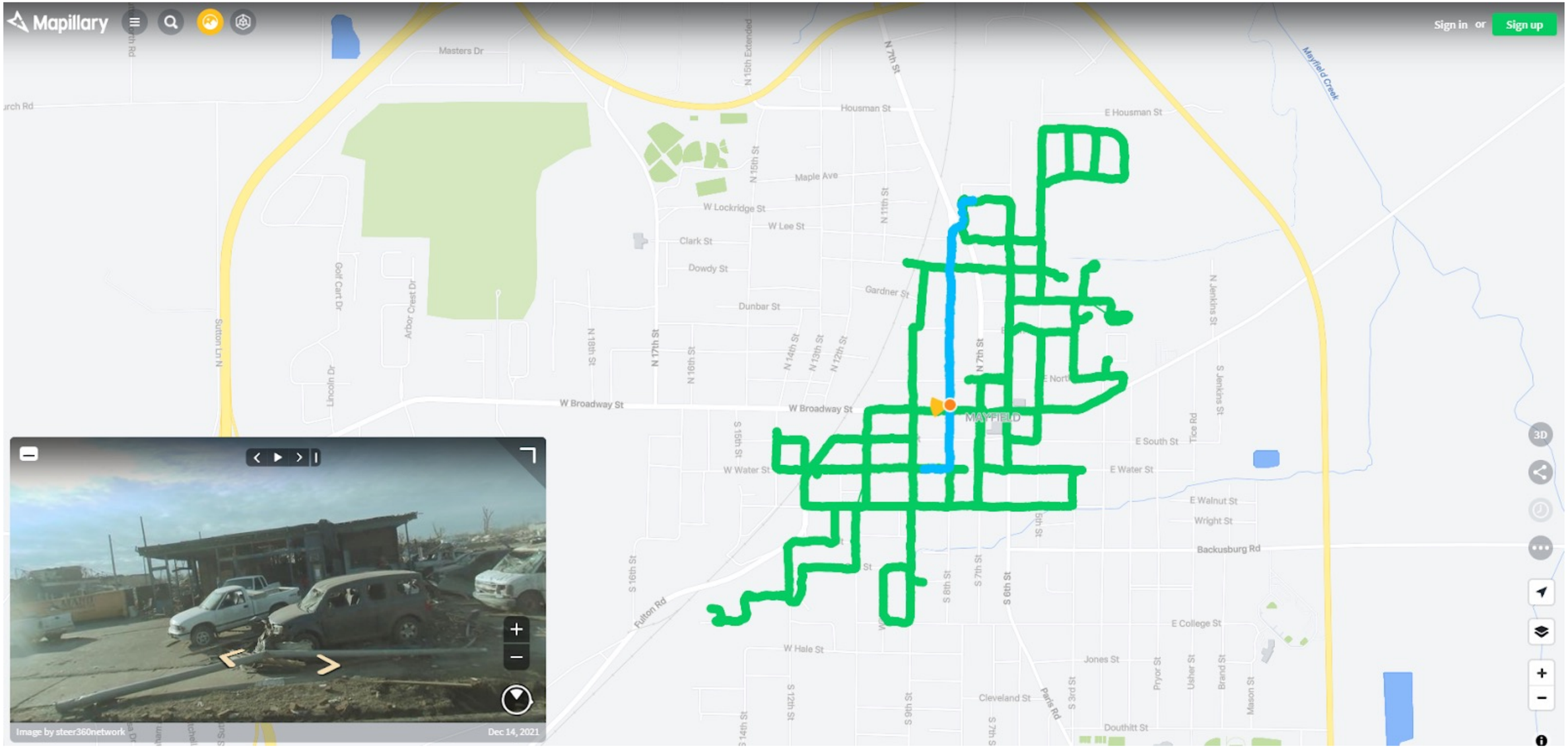
Performance Assessments

Unmanned Aerial Systems

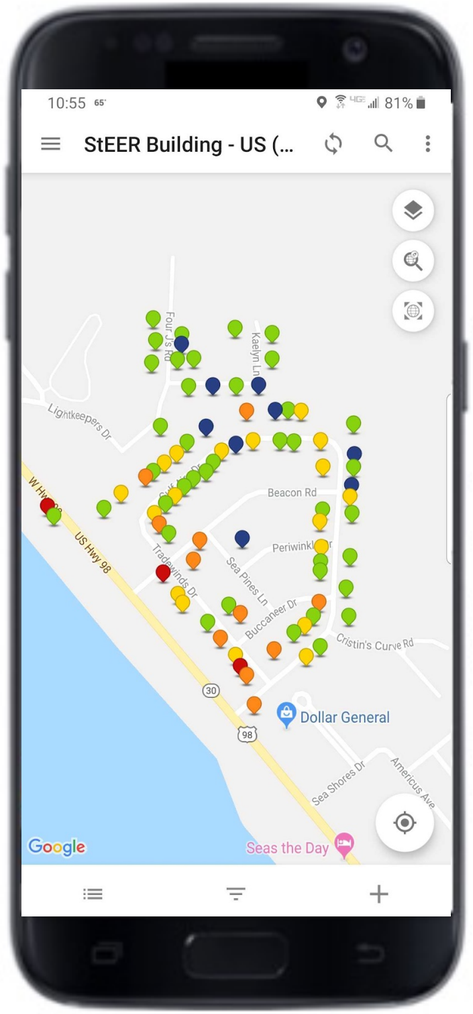
Street-level 360 imaging platforms

Terrestrial Scanning Technologies

EXAMPLE: QUAD-STATE TORNADO OUTBREAK (MAYFIELD, KY)

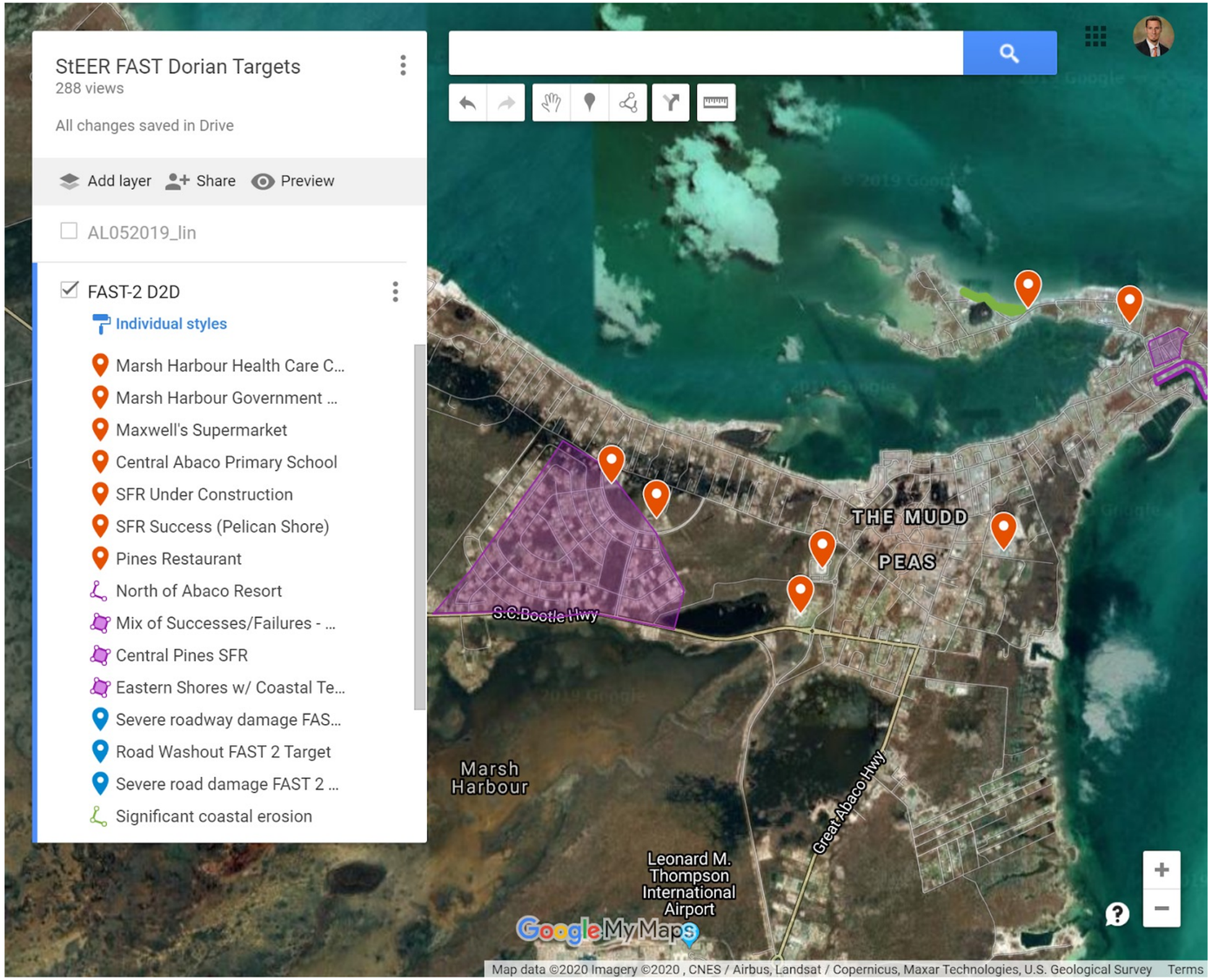


LEVERAGING MOBILE APPS IN PERFORMANCE ASSESSMENT

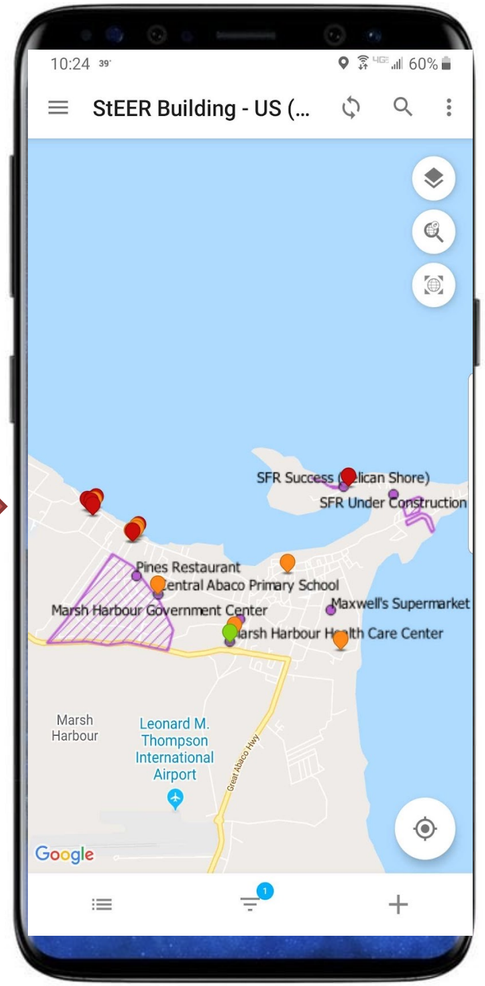


Single geolocated record with rich multi-media content, exportable to common formats: Excel, ESRI Shapefile, GeoJSON, etc.

TARGETEDED FOLLOW-UP DATA COLLECTION



Targets synced to Fulcrum for offline access by FAST

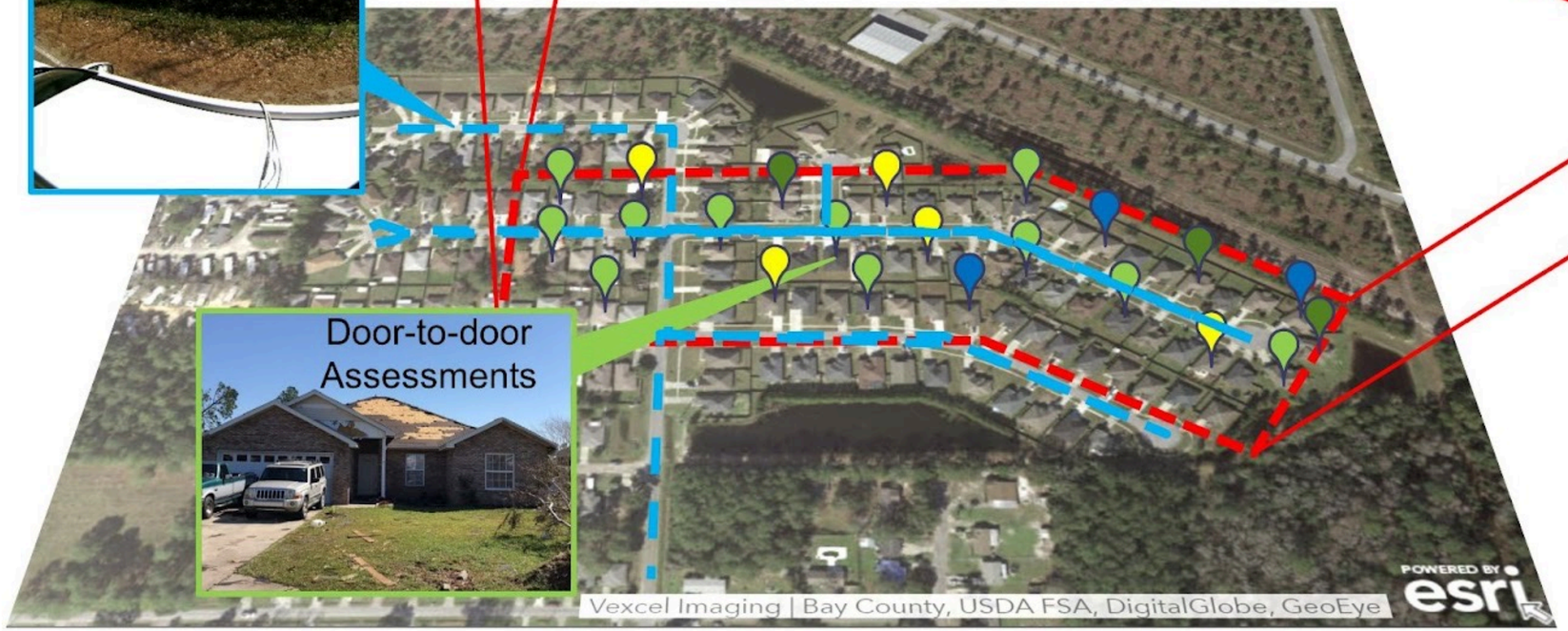


MIXED-METHODOLOGICAL STRATEGY

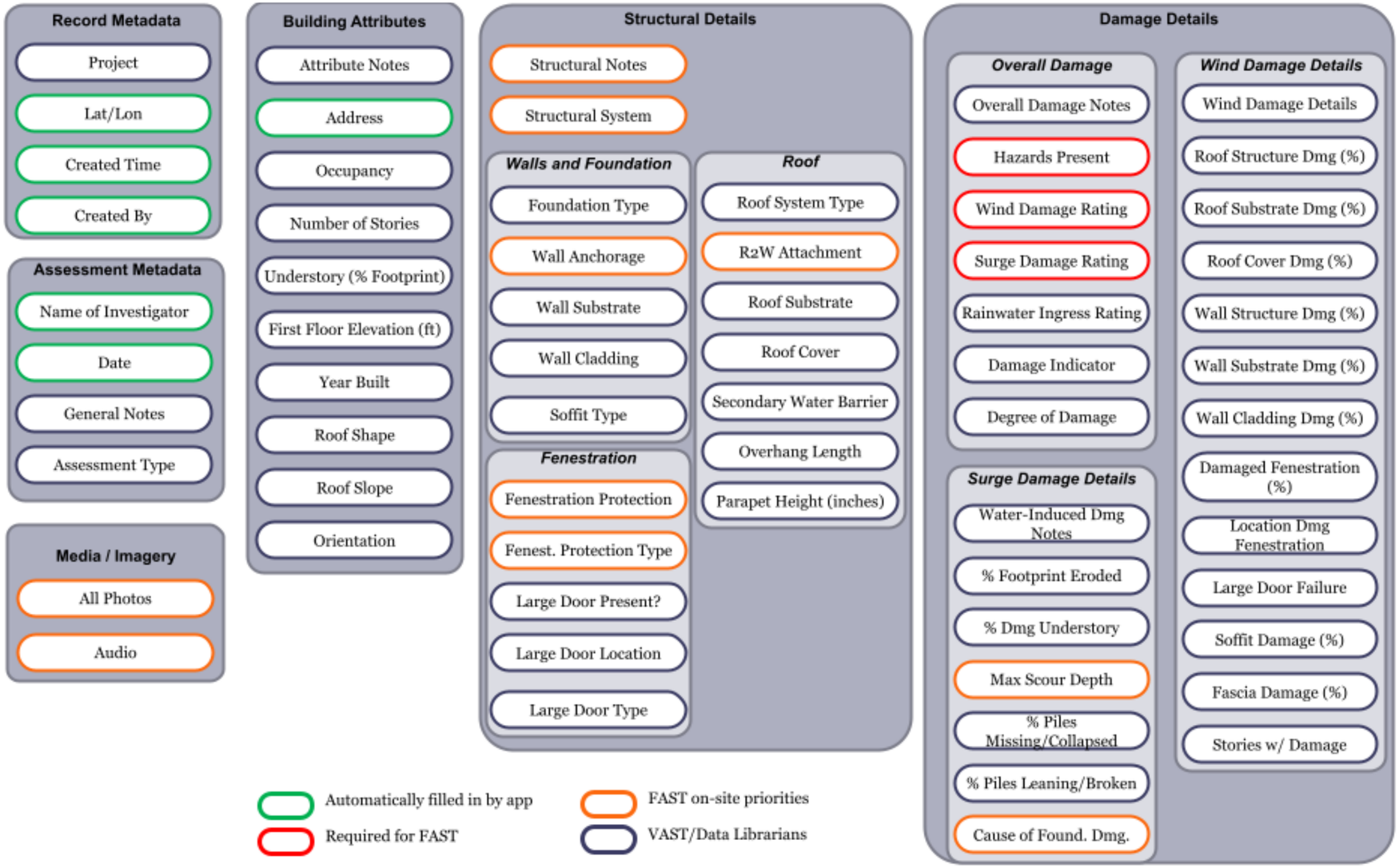
Overlapping data collection technologies ensure FASTs can sample efficiently in the field while still capturing the context and broad damage patterns

Surface-level panoramas

UAS for structure-from-motion models

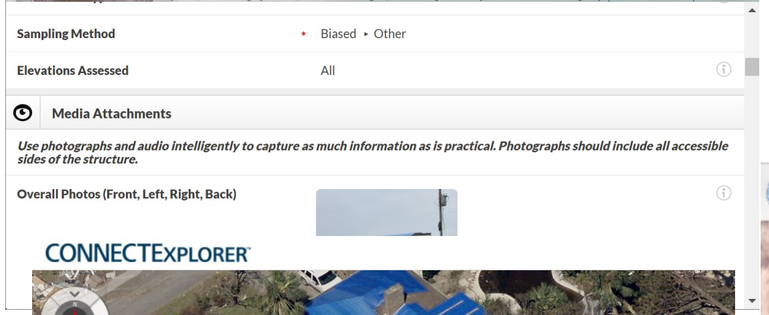


BUILDING PERFORMANCE DATABASE



SUPPLEMENTAL DATA SOURCES FOR DE/QC

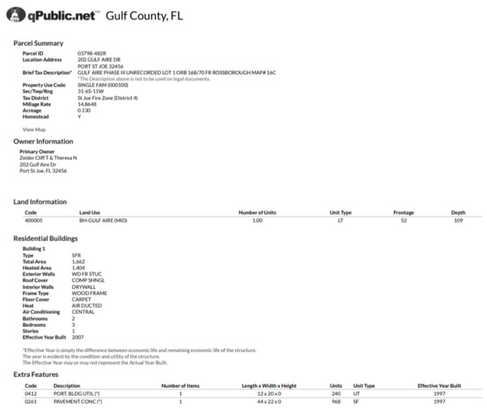
Field Observations (Fulcrum)

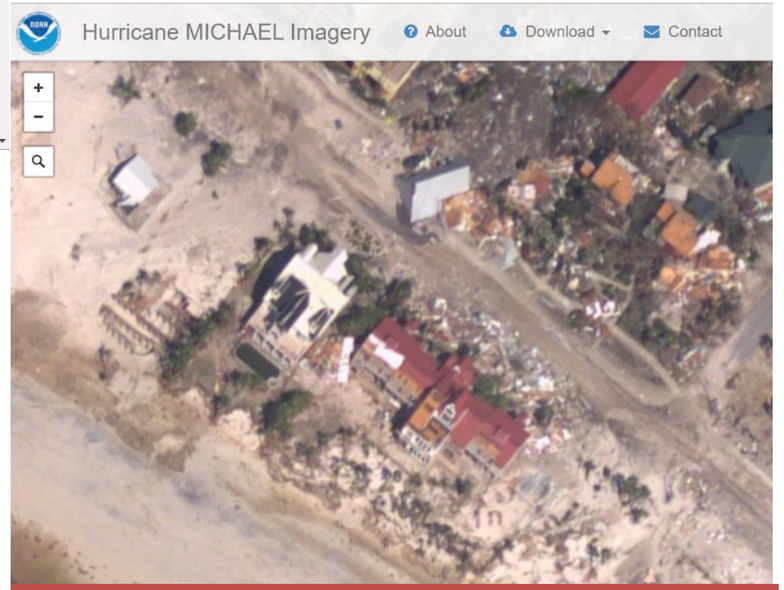


CONNECTEXPLORER

Oblique Imagery

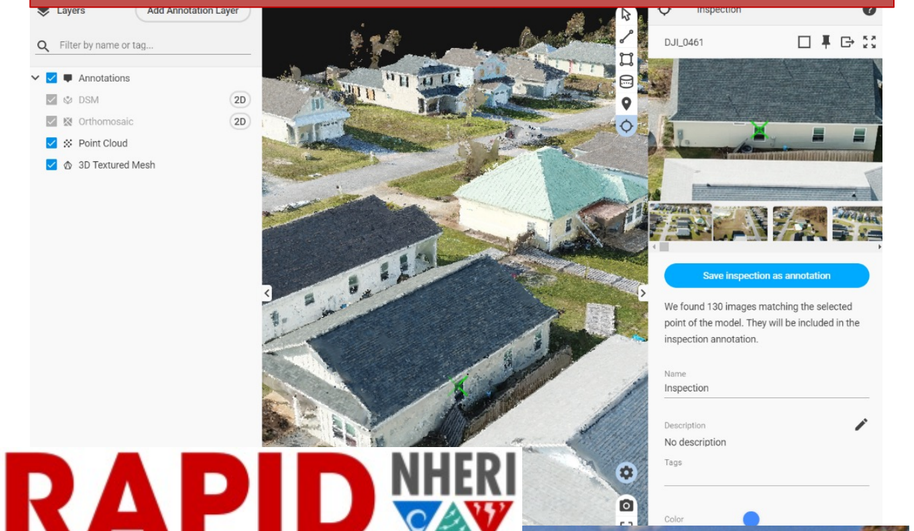
Parcel Records





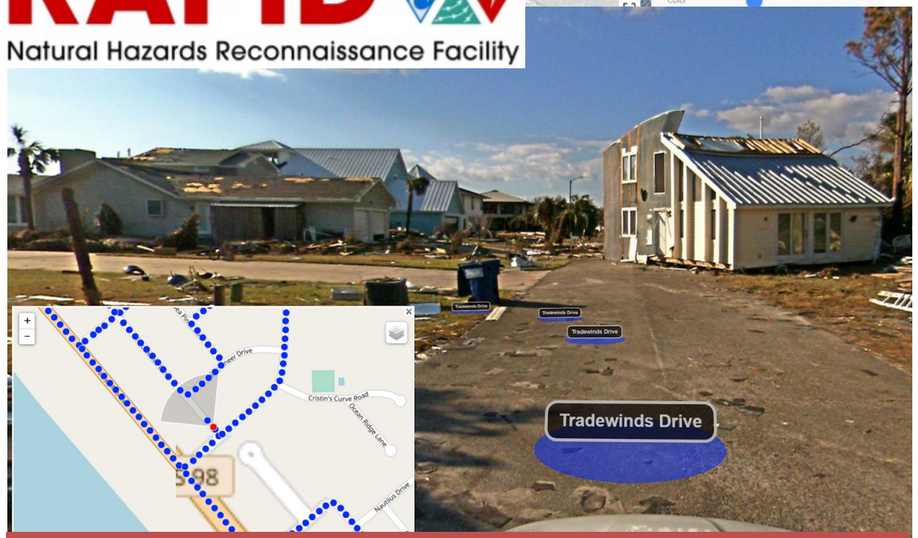
NOAA Nadir Imagery

SfM Models / Point Clouds



RAPID NHERI

Natural Hazards Reconnaissance Facility

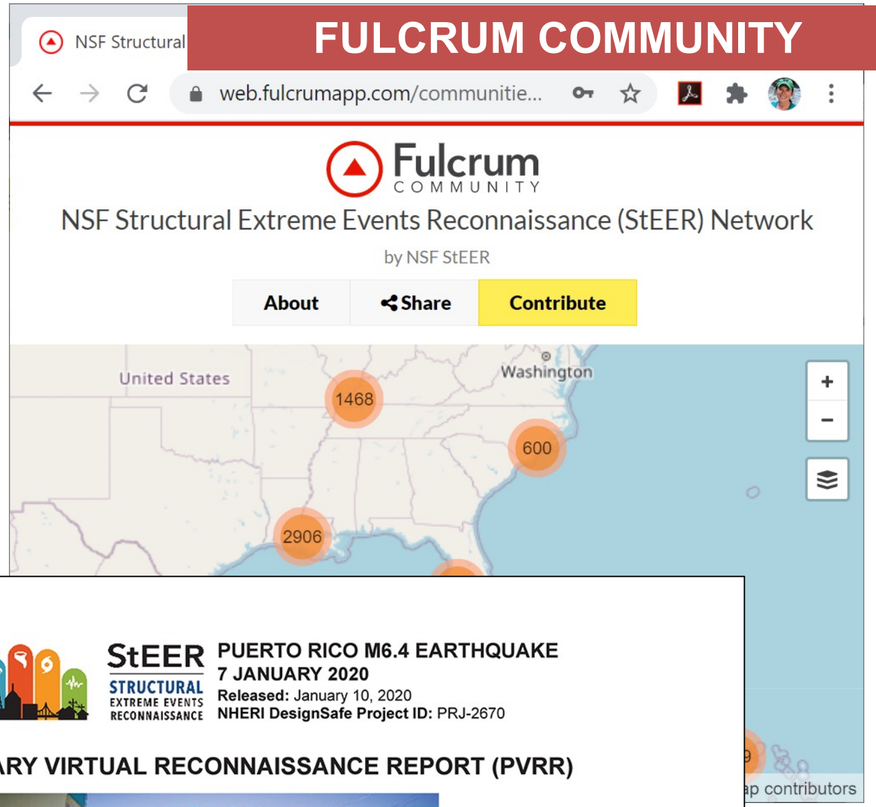


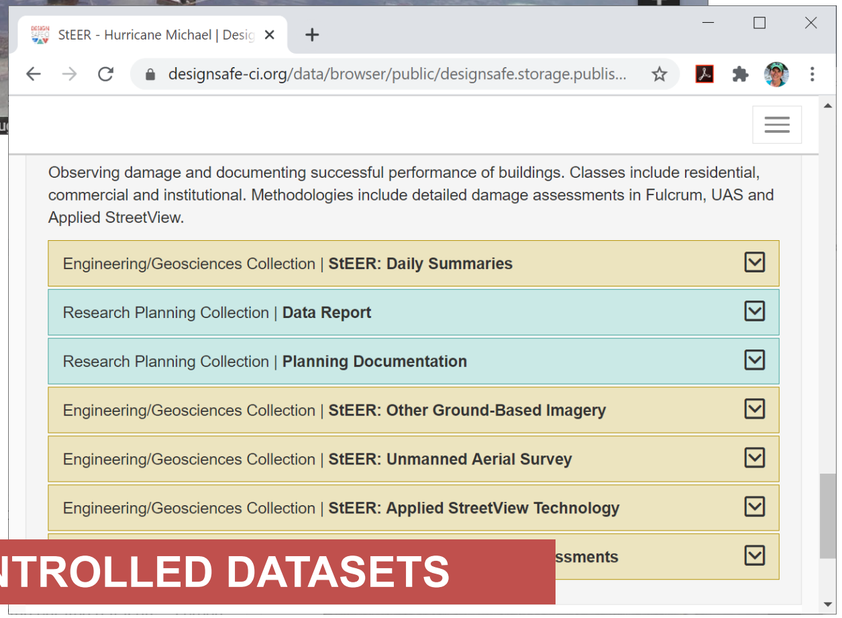
Street-level Panoramas

DISSEMINATION OF DATA AND KNOWLEDGE

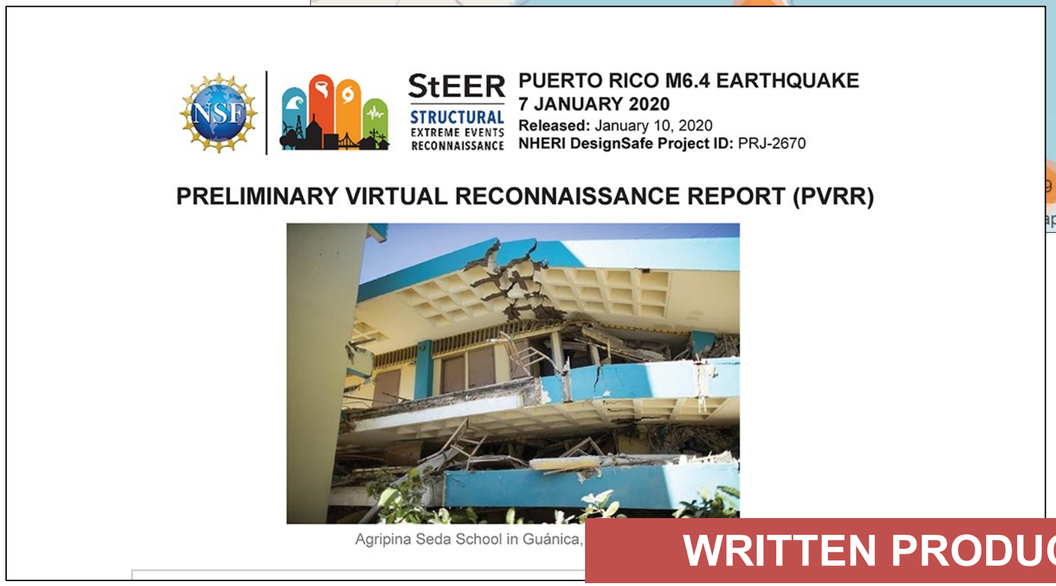
MAPILLARY/GOOGLE STREET VIEW

FULCRUM COMMUNITY



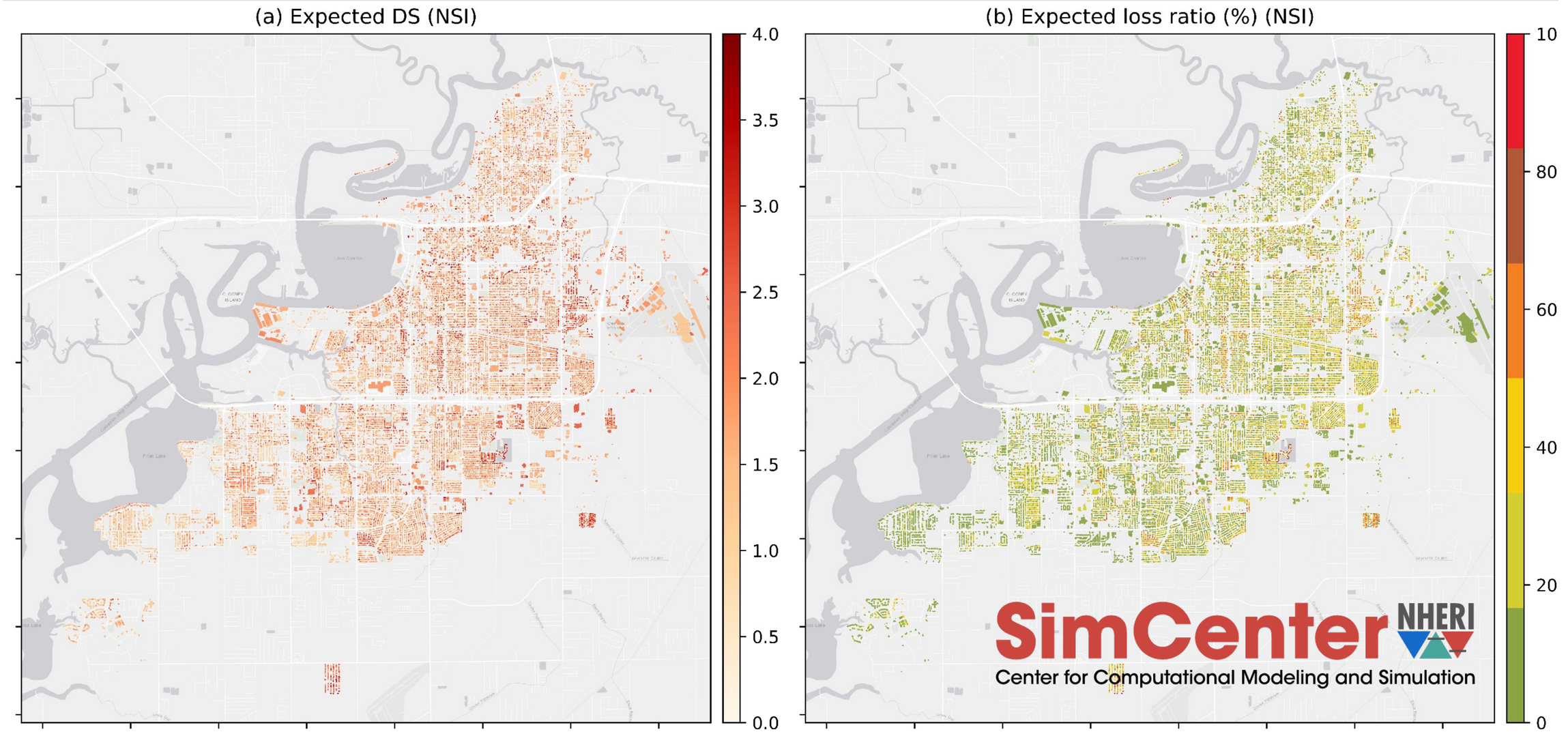


QUALITY-CONTROLLED DATASETS

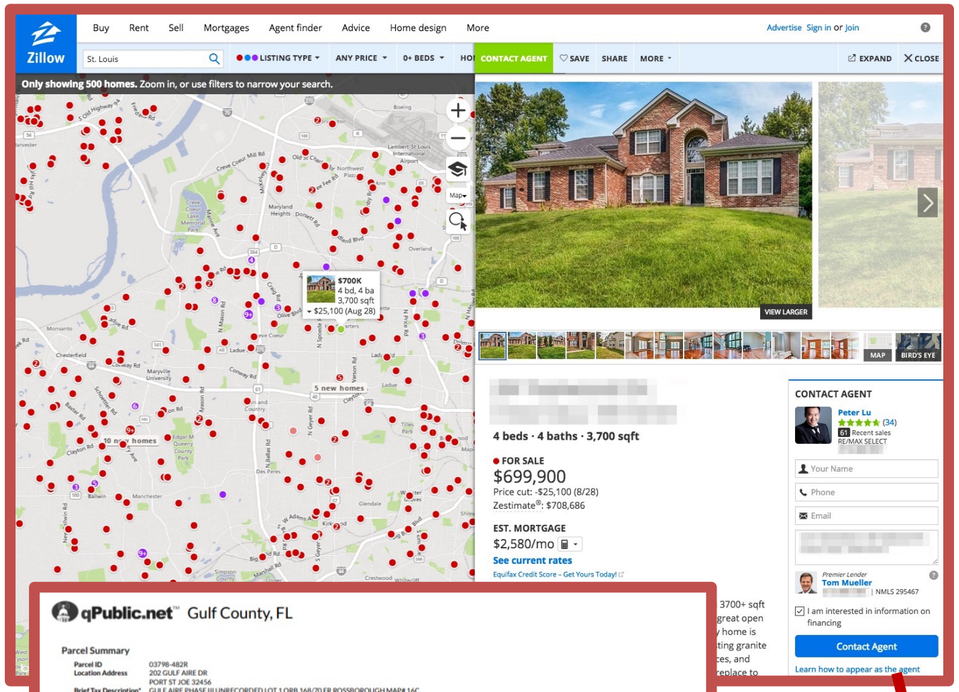


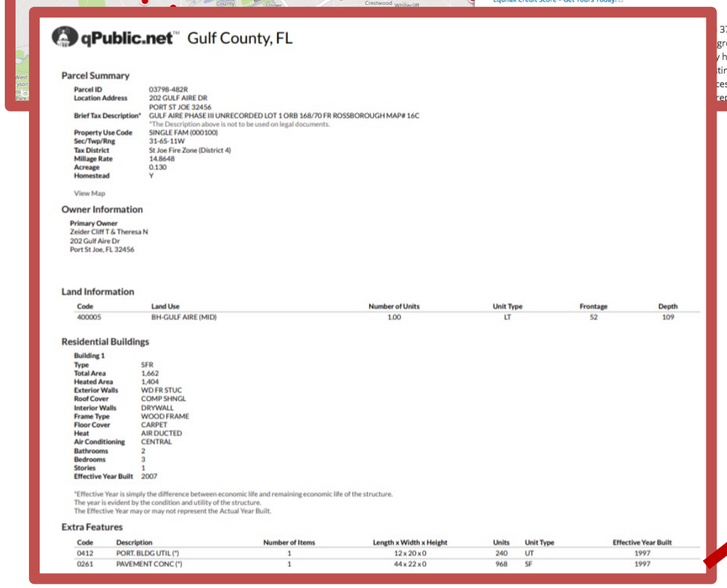
WRITTEN PRODUCTS

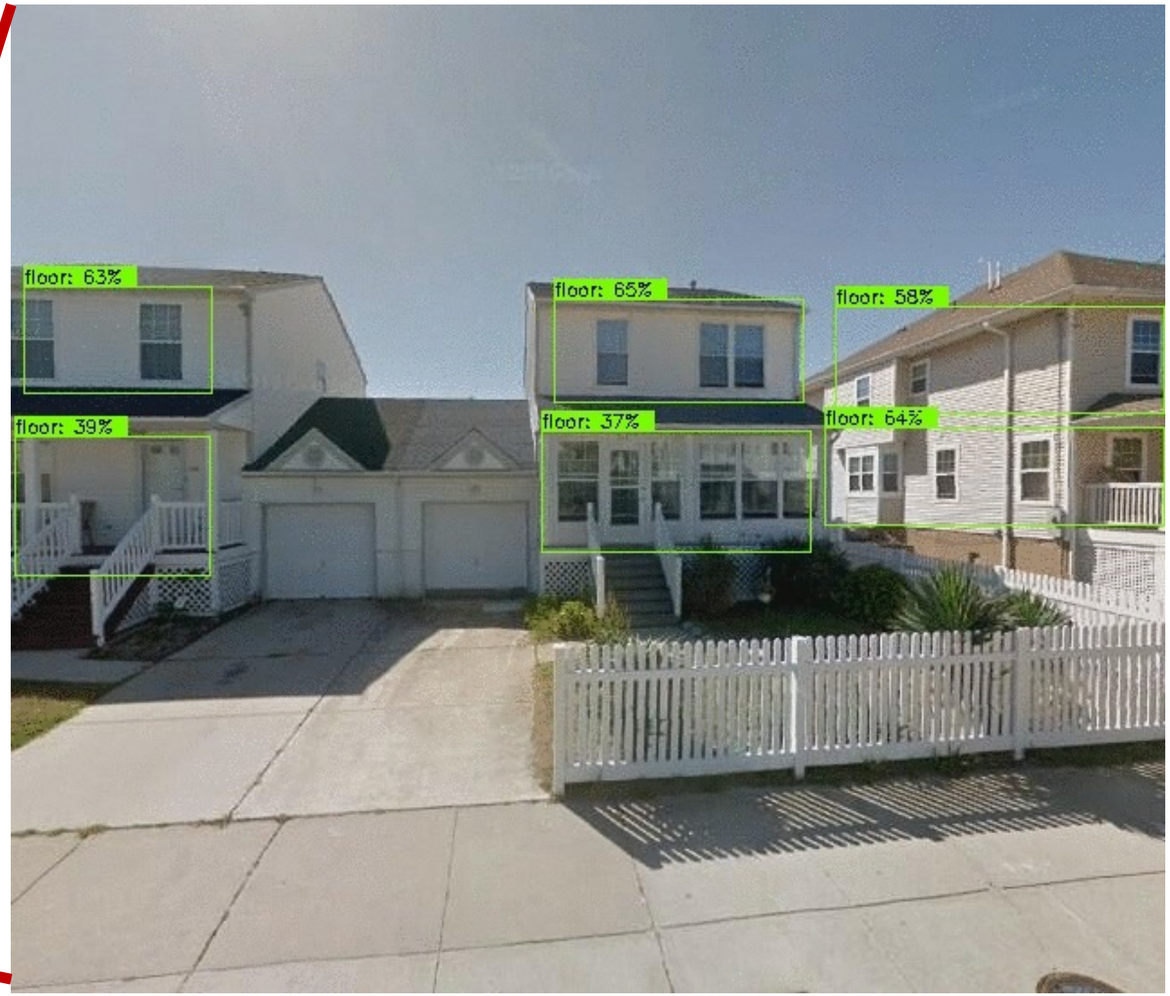
SIMULATION-INFORMED MITIGATION DECISIONS



AUGMENTING PARCEL RECORDS







SimCenter NHERI
Center for Computational Modeling and Simulation

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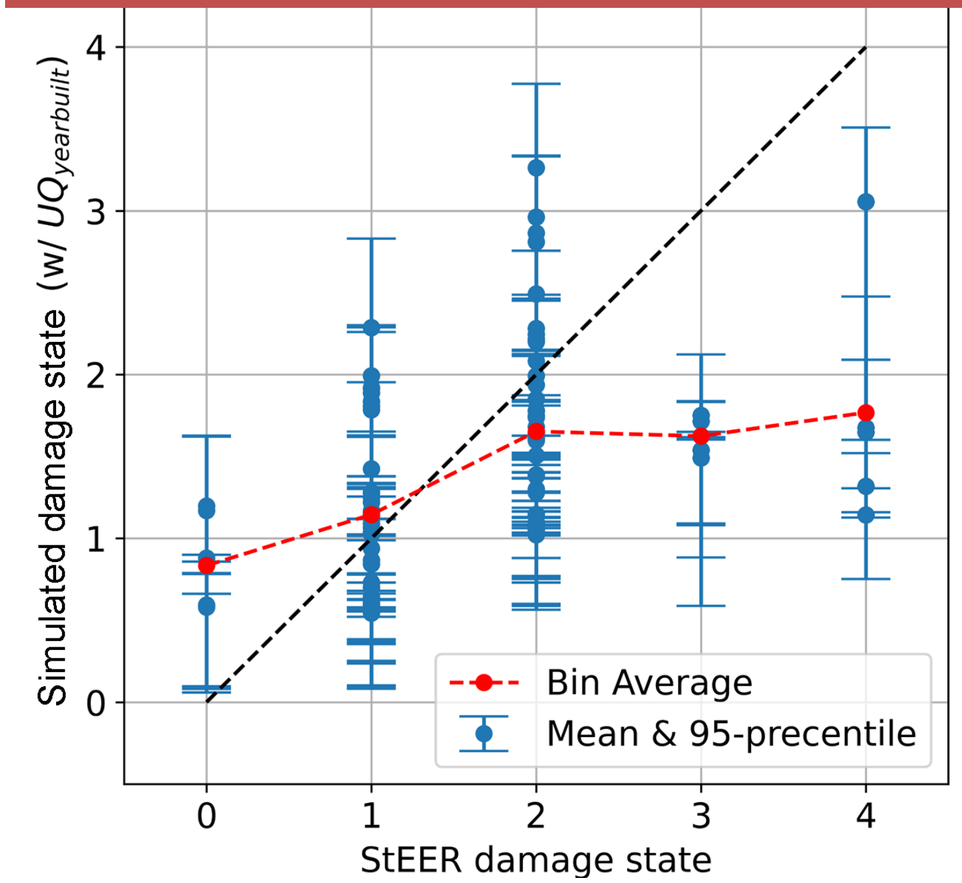
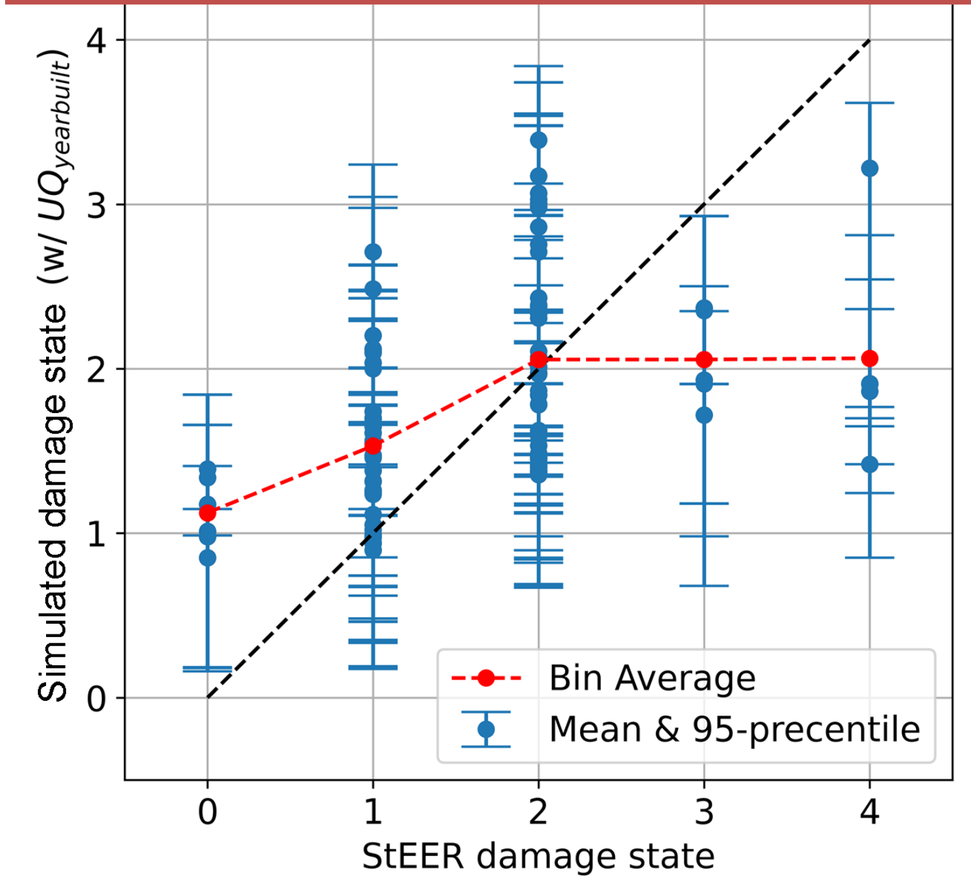
VALIDATION OF LOSS ESTIMATION TOOLS

UNCERTAINTY IN YEAR BUILT WITH SHUTTERING COMPLIANCE



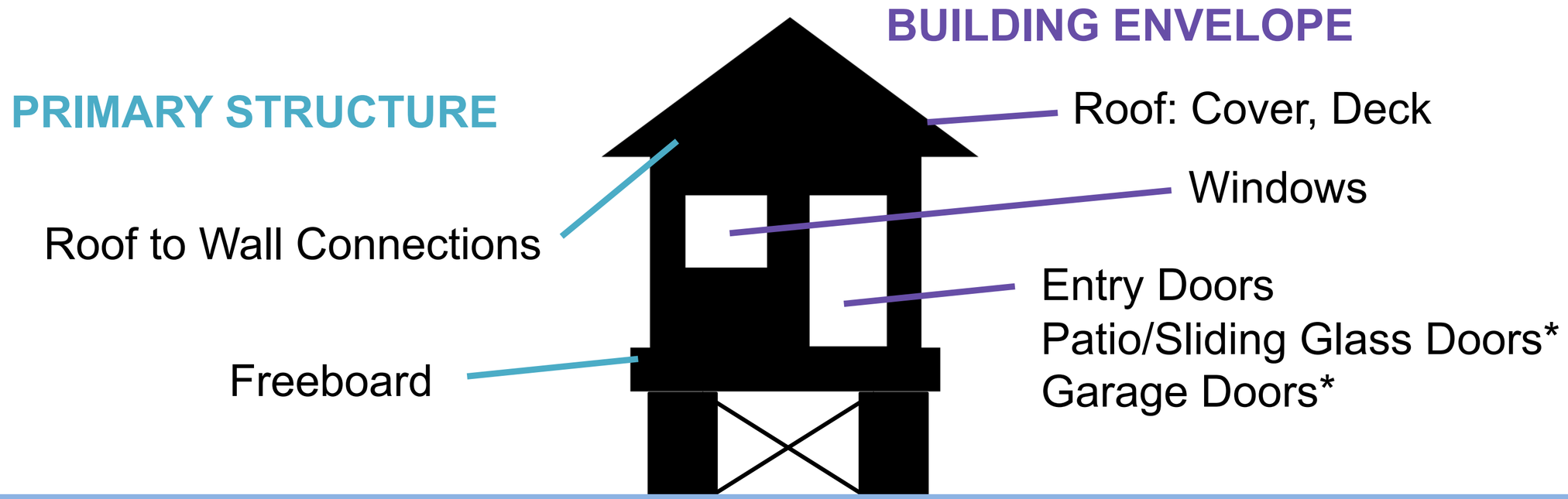
UNCERTAINTY IN YEAR BUILT WITHOUT SHUTTERING COMPLIANCE



KEEPING HUMANS IN THE LOOP
Barriers and drivers of mitigation actions?
Fusion and rapid processing of open data
Targeted household surveys
Protocols for rapid baselining and post-event data collection (human & built environments)

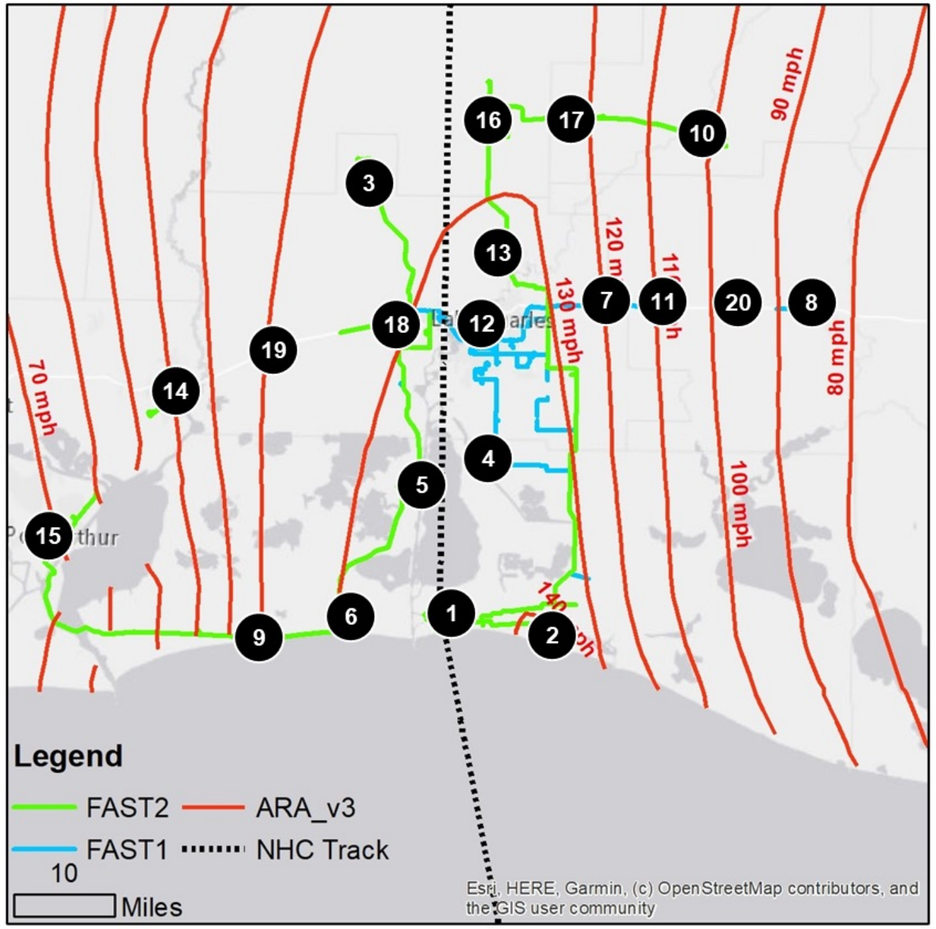
QUANTIFYING MITIGATION UPTAKE

Quantifying Protection, Action and Intentions		
HPI: HOME PROTECTION INDEX	**HAI: HOMEOWNER ACTION INDEX**	**HII: HOMEOWNER INTENTION INDEX**
As purchased	*Past remodeling/retrofits*	*Planned remodeling/retrofits*

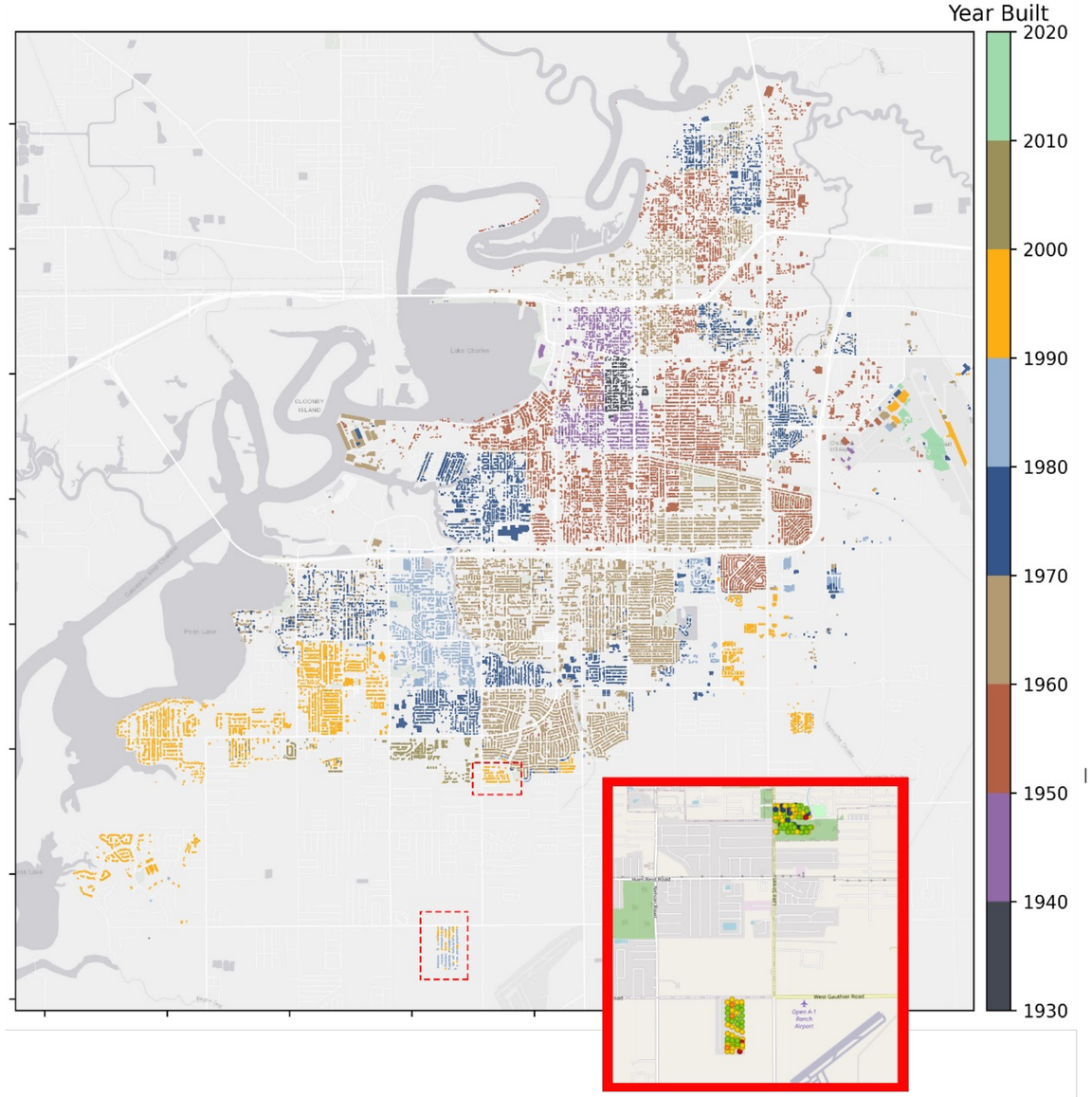


Javeline, D. and **Kijewski-Correa, T.** (2019) "Coastal Homeowners in a Changing Climate," *Climatic Change*. 152(2): 259-276 https://doi.org/10.1007/s10584-018-2257-4

STRENGTHENING AMERICAN INFRASTRUCTURE: LAKE CHARLES, LA



1. Cameron	6. Holly Beach	11. Lacassine	16. Ragley
2. Creole	7. Iowa	12. Lake Charles	17. Reeves
3. DeQuincy	8. Jennings	13. Moss Bluff	18. Sulphur
4. Grand Lake	9. Johnson Bayou	14. Orange	19. Vinton
5. Hackberry	10. Kinder	15. Port Arthur	20. Welsh

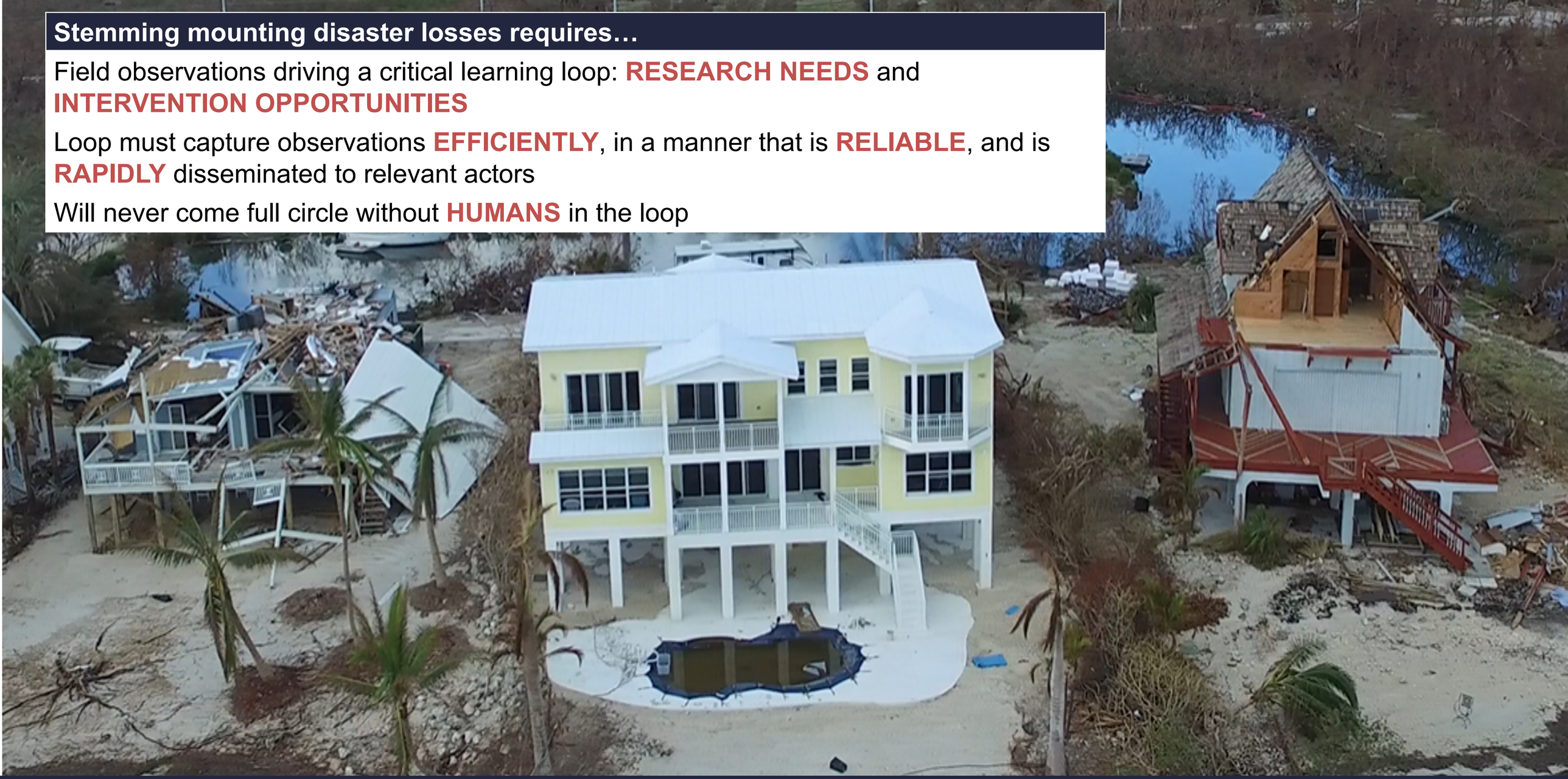


Stemming mounting disaster losses requires…

Field observations driving a critical learning loop: **RESEARCH NEEDS** and **INTERVENTION OPPORTUNITIES**

Loop must capture observations **EFFICIENTLY**, in a manner that is **RELIABLE**, and is **RAPIDLY** disseminated to relevant actors

Will never come full circle without **HUMANS** in the loop



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Any opinions, findings, and conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect the views of the National Science Foundation

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  - Ian Robertson, Associate Director for Coastal Hazards
  - David Roueche, Associate Director for Data Standards
- CONVERGE node and wider Extreme Events consortium
- NHERI RAPID Facility, DesignSafe-CI and SimCenter
- Spatial Networks Inc. (Fulcrum Community)
- Network of organizations & agencies responding to and learning from natural hazard events
- Our Research Associates (M. Alam, A. Safiey), Hazard Advisory Boards, members and their institutions
- Angela Chesler, Debra Javeline, William Kakenmaster

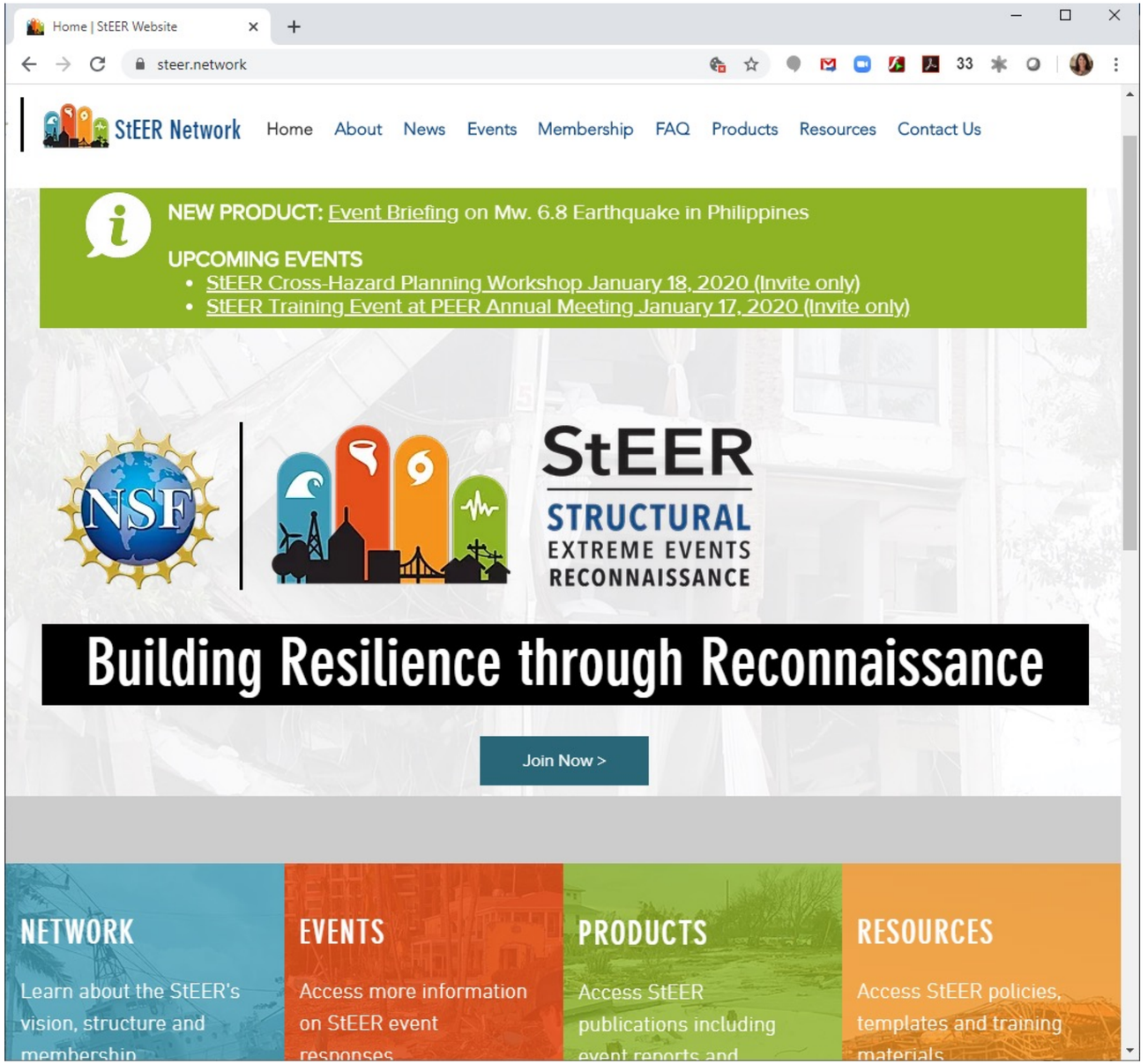
NHERI
Natural Hazards Engineering Research Infrastructure

Fulcrum

COLLABORATION OPPPORTUNITIES

- Learn more at **www.StEER.network**

- Become a member:
  - ✓ Create a DesignSafe account
  - ✓ Activate your Slack account
  - ✓ Complete membership form at **www.StEER.network**
  - ✓ Review Member Guidelines and accept terms

- Monitor **#steer** channel on Slack, email announcements

- Email: **admin@steer.network**