Lima Peru

Arkansas

Spring Field Trip, OK

Port au Prince, Haiti

Carrefour, Haiti

Dogtooth Bend, IL

Shelby Co. TN - EOC

Applied and Engaged Scholarship:
Perspectives of a Hazards Geographer

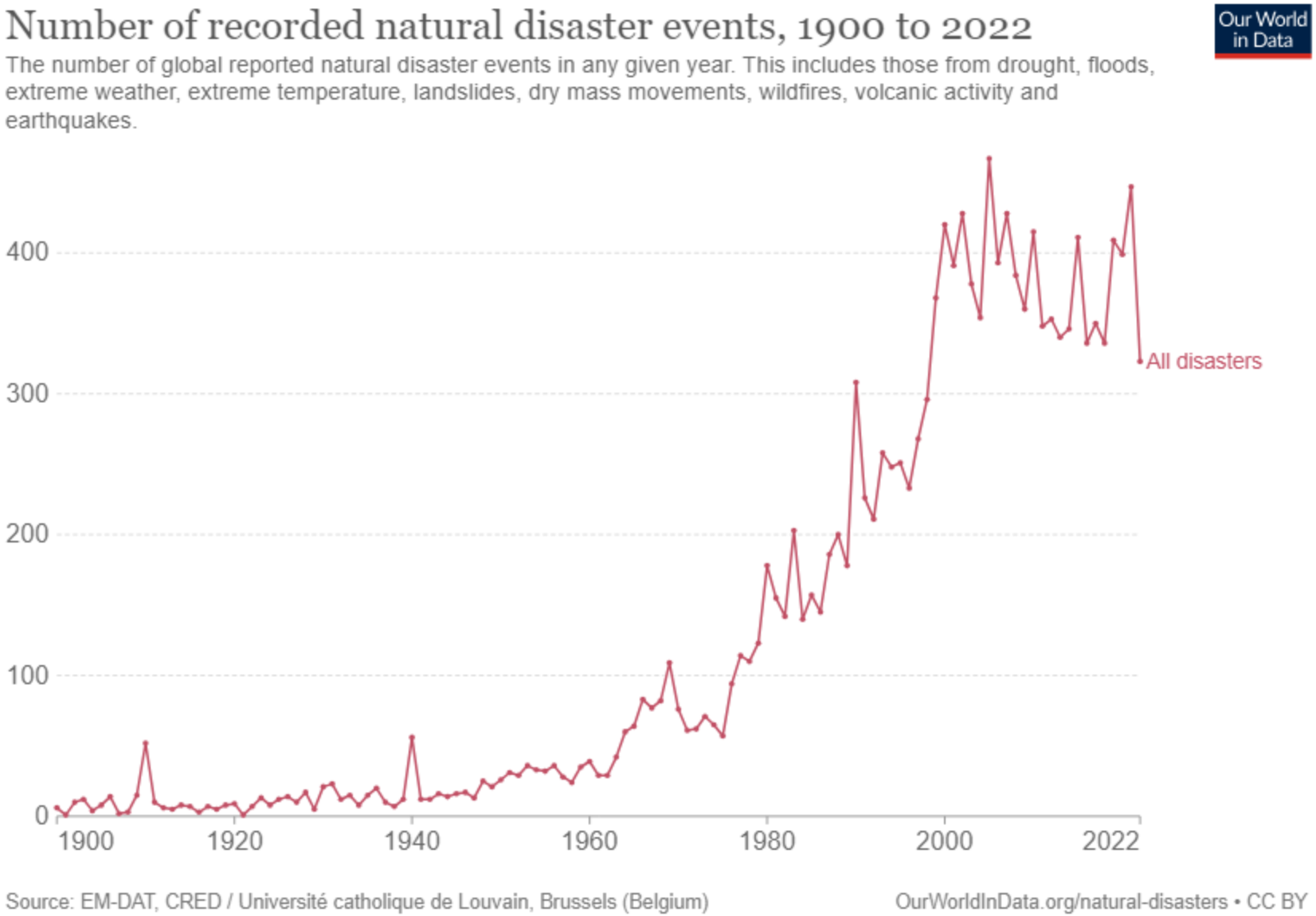
Arleen A. Hill

Conversation Roadmap

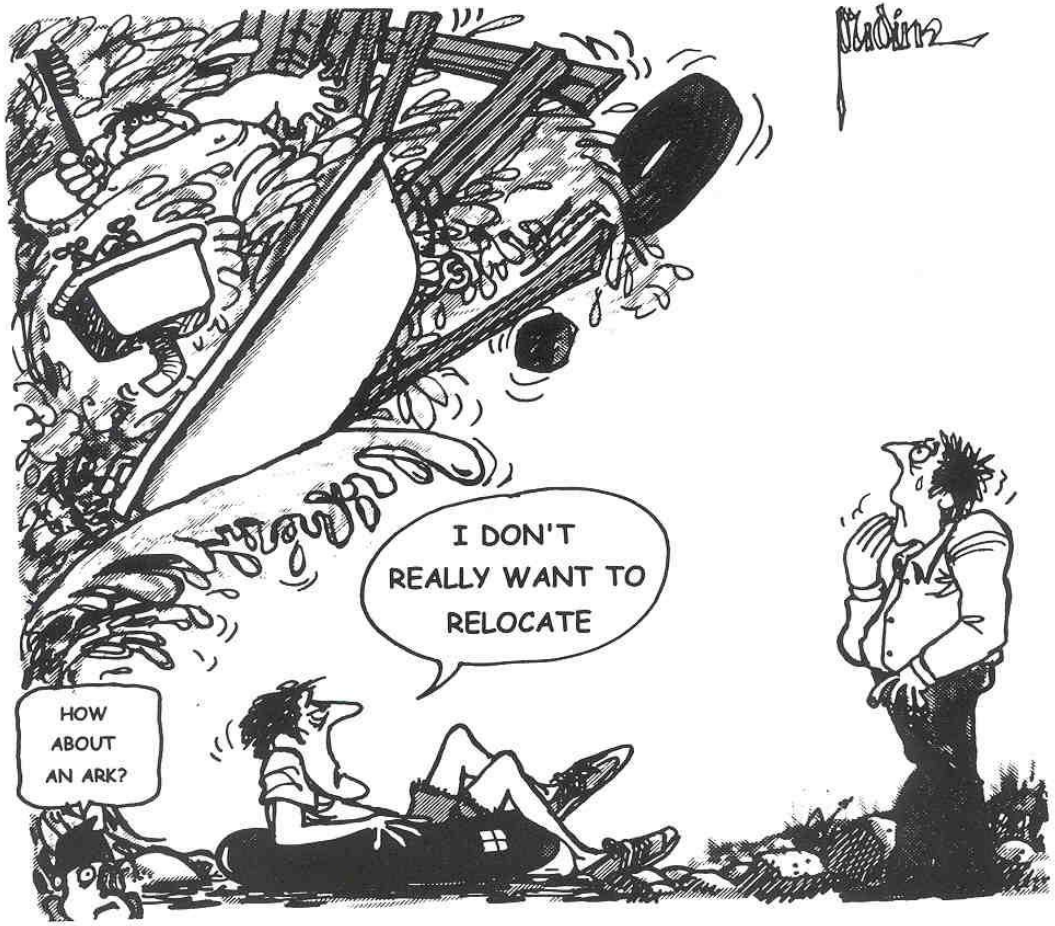
1. Motivations – driving my curiosity and approach
2. Background and experiences – events, projects, people
3. Goals – contributions I seek to make
4. Field Trips
5. Your questions!

Motivation – *hazardscapes*

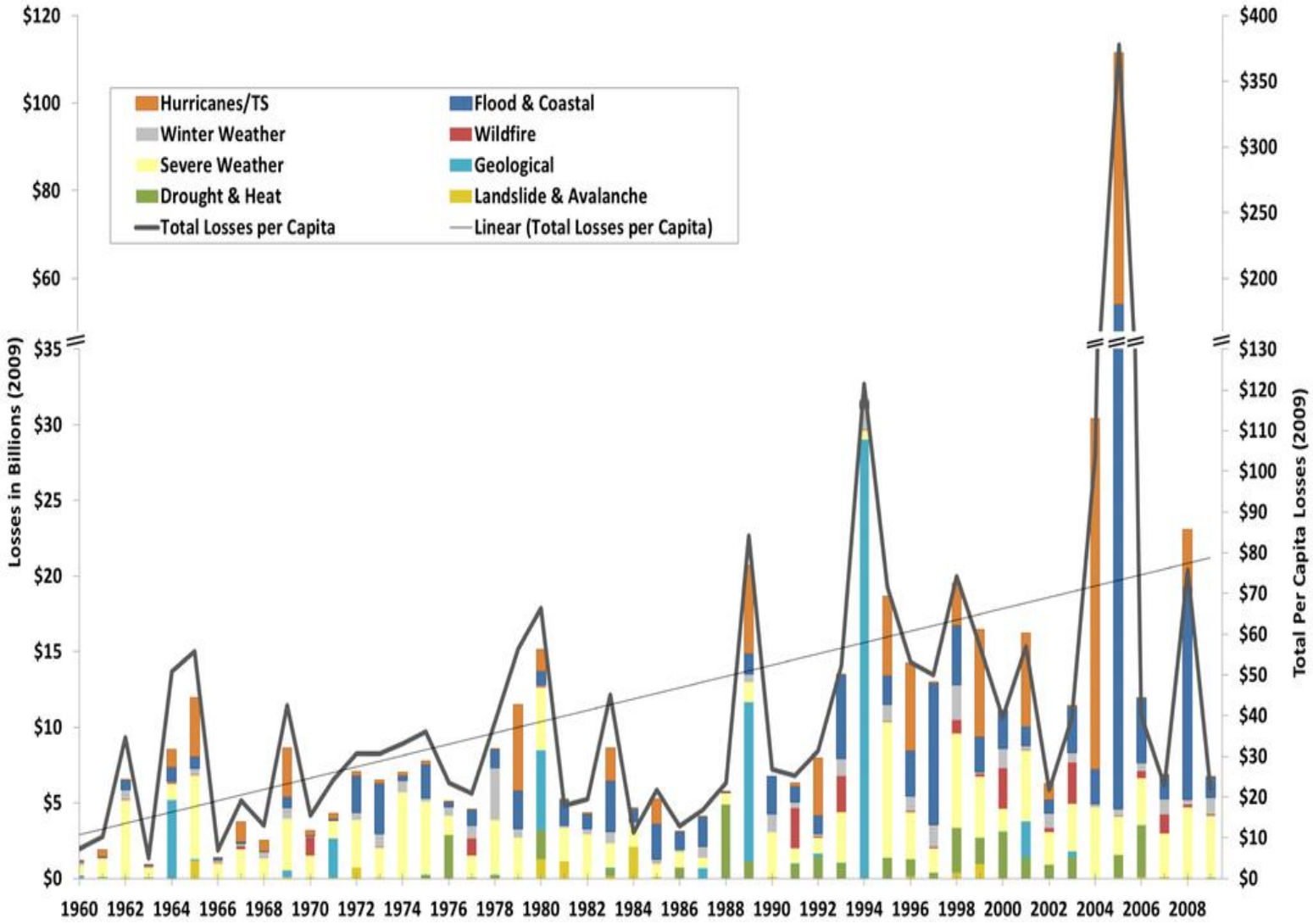
Motivation – *Disaster Loss/Experience*



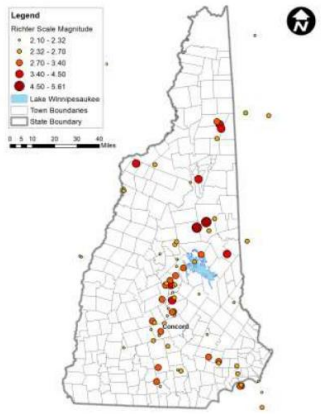
Motivation – *Disaster Loss/Experience*



Motivation – *Disaster Loss/Experience*



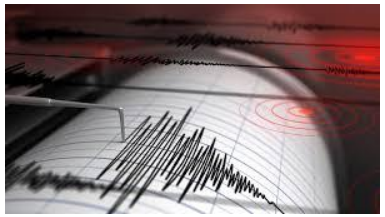
Events – *Dictating my path*

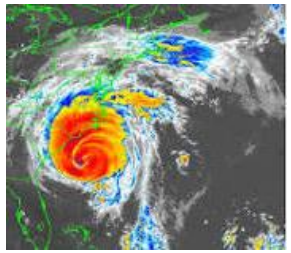


1982 EQ in NH

NESEC
NORTHEAST STATES EMERGENCY CONSORTIUM

MWC Geology





HVRI
HAZARDS & VULNERABILITY RESEARCH INSTITUTE

USC Geography

NATURAL HAZARDS CENTER

EER
REDUCING EARTHQUAKE RISK FOR 70 YEARS

Curiosity

Opportunities

Goals - *Personal & Professional*

1. Listen to voices and experiences outside my own.
2. Support data-driven decision making.
3. Apply my knowledge to use for others.
4. Empower local and practitioner knowledge.
5. Build and sustain connections.
6. Question, learn, contribute.

Business, Port-au-Prince

Earth Scientist in Action – *Research Agenda*

- What makes people and places vulnerable and/or resilient to disruption?
- What is the nature of differential vulnerability?
- How can vulnerabilities be addressed to promote community resilience?

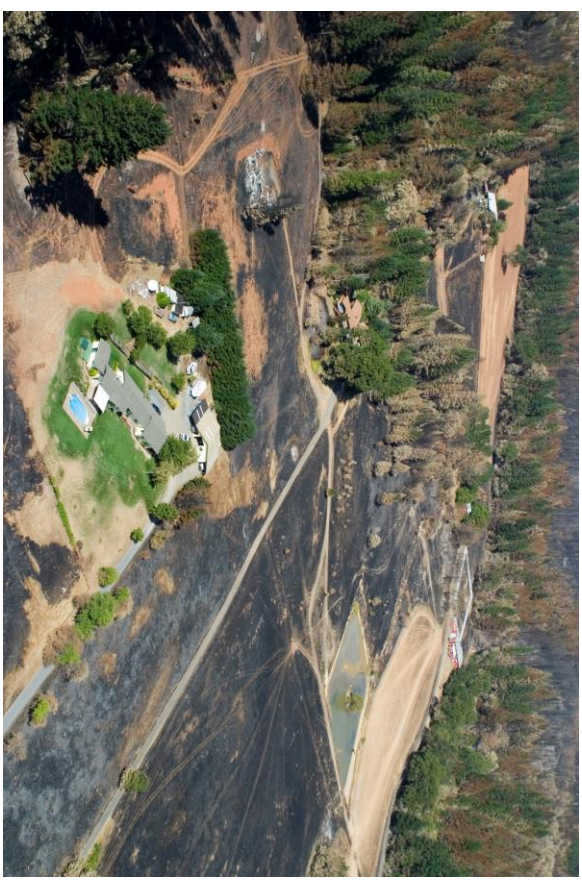
- Mixed methods; multi-disciplinary; collaborative; applied and engaged.

Yokahama, Japan

Punta Gorda, FL

Carrefour, Haiti

Place as an Integrative Tool:
How do we occupy places?

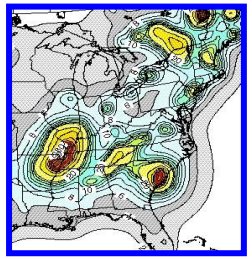


Place – *revealed through extreme events*

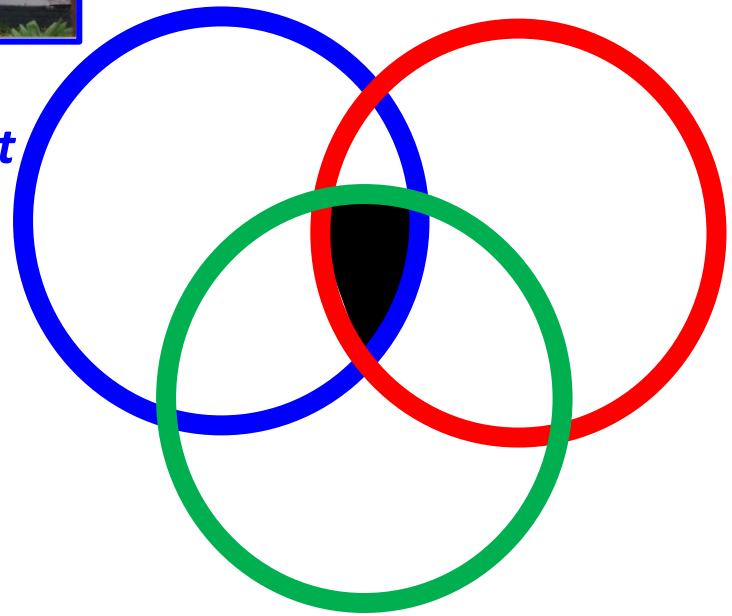

March 15, 2006

Vulnerability –
Driven by exposure + sensitivity of systems.

Physical Environment

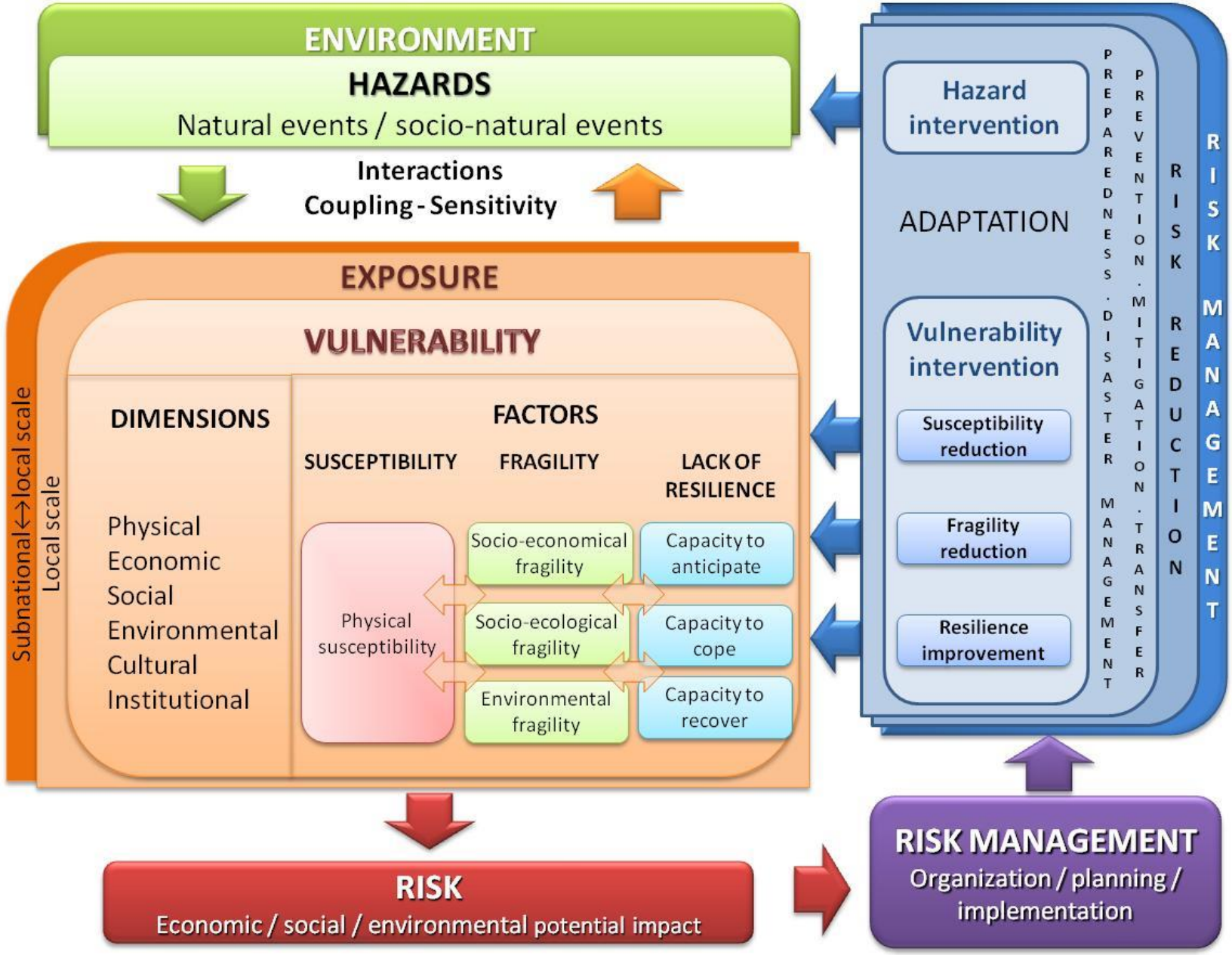


Human Environment



Built Environment

Potential for loss.
Capacity to suffer harm.


ENVIRONMENT
HAZARDS
Natural events / socio-natural events
Interactions
Coupling - Sensitivity
EXPOSURE
VULNERABILITY
Subnational↔local scale
Local scale
DIMENSIONS
Physical
Economic
Social
Environmental
Cultural
Institutional
FACTORS
SUSCEPTIBILITY
FRAGILITY
LACK OF RESILIENCE
Physical susceptibility
Socio-economical fragility
Socio-ecological fragility
Environmental fragility
Capacity to anticipate
Capacity to cope
Capacity to recover
RISK
Economic / social / environmental potential impact
RISK MANAGEMENT
Organization / planning / implementation
Hazard intervention
ADAPTATION
Vulnerability intervention
Susceptibility reduction
Fragility reduction
Resilience improvement
PREPAREDNESS . DISASTER MANAGEMENT
PREVENTION . MITIGATION . TRANSFER
RISK REDUCTION
RISK MANAGEMENT

Lessons Revealed Through Place:
Damage and Disruption in Haiti

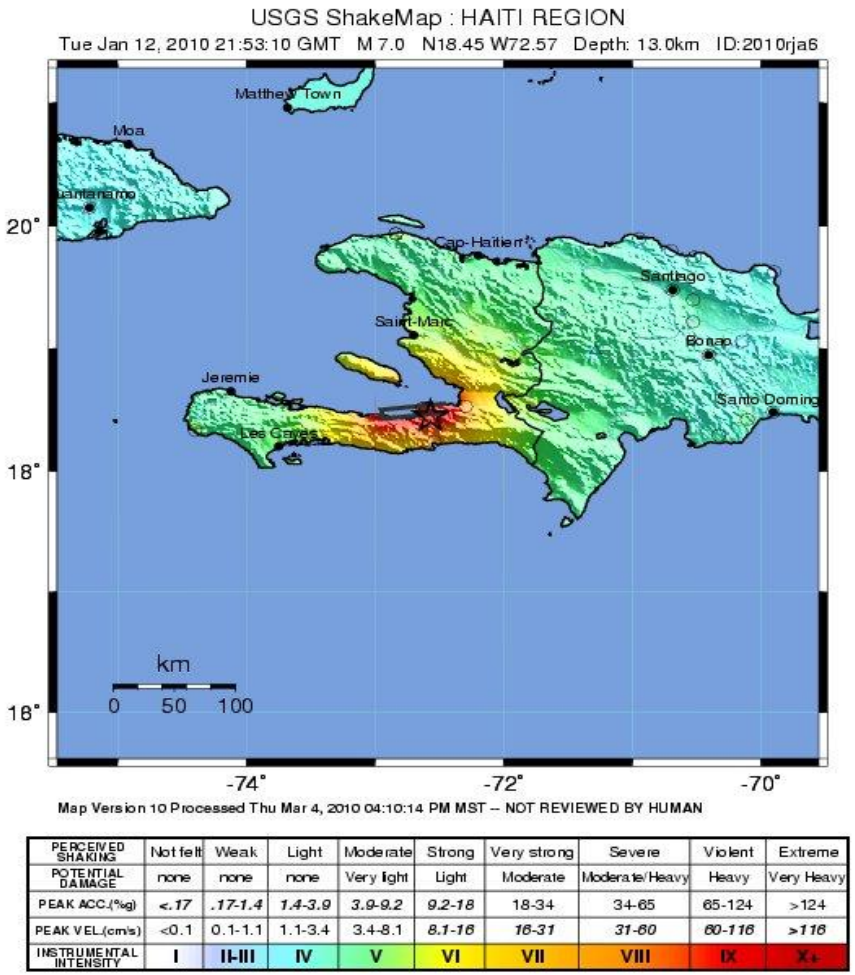
ImageCat, Inc. UBC THE UNIVERSITY OF MEMPHIS

Relationship between damage and disruption

Community-scale resilience

Using remote sensing to measure and monitor recovery

EXAMPLE – Haiti
12 January 2010 Earthquake



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

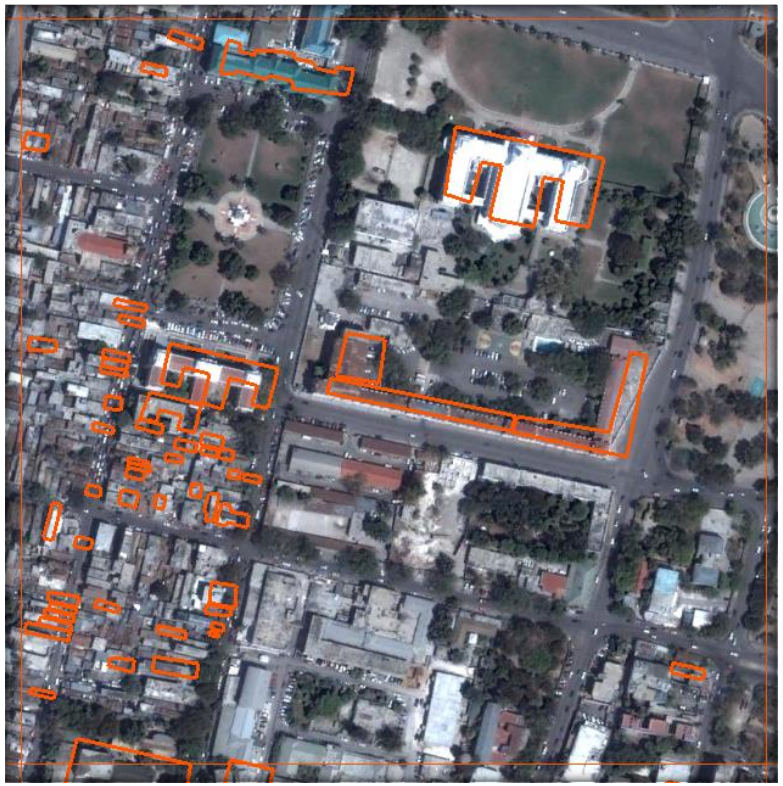
Population Exposed (USGS est.)		
MMI	**City**	**Population**
X	Petit Goâve	118,000
X	Grand Goâve	49,000
X	Gressier	26,000
IX	Léogâne	134,000
VIII	Port-au-Prince	1,235,000
VIII	Carrefour	442,000
VIII	Delmas 73	383,000
VIII	Miragoane	89,000
V	Verrettes	49,000
IV	Santo Domingo	2,202,000
IV	Santiago de los Caballeros	556,000

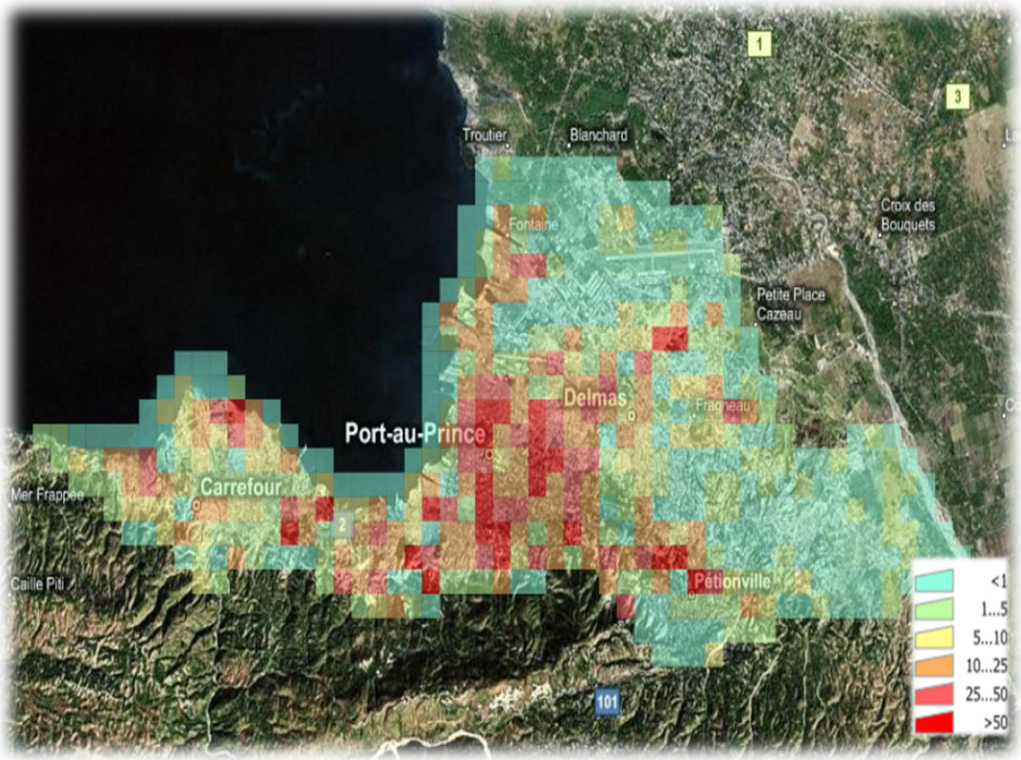
DAMAGE ASSESSMENT: *Phased Approach*

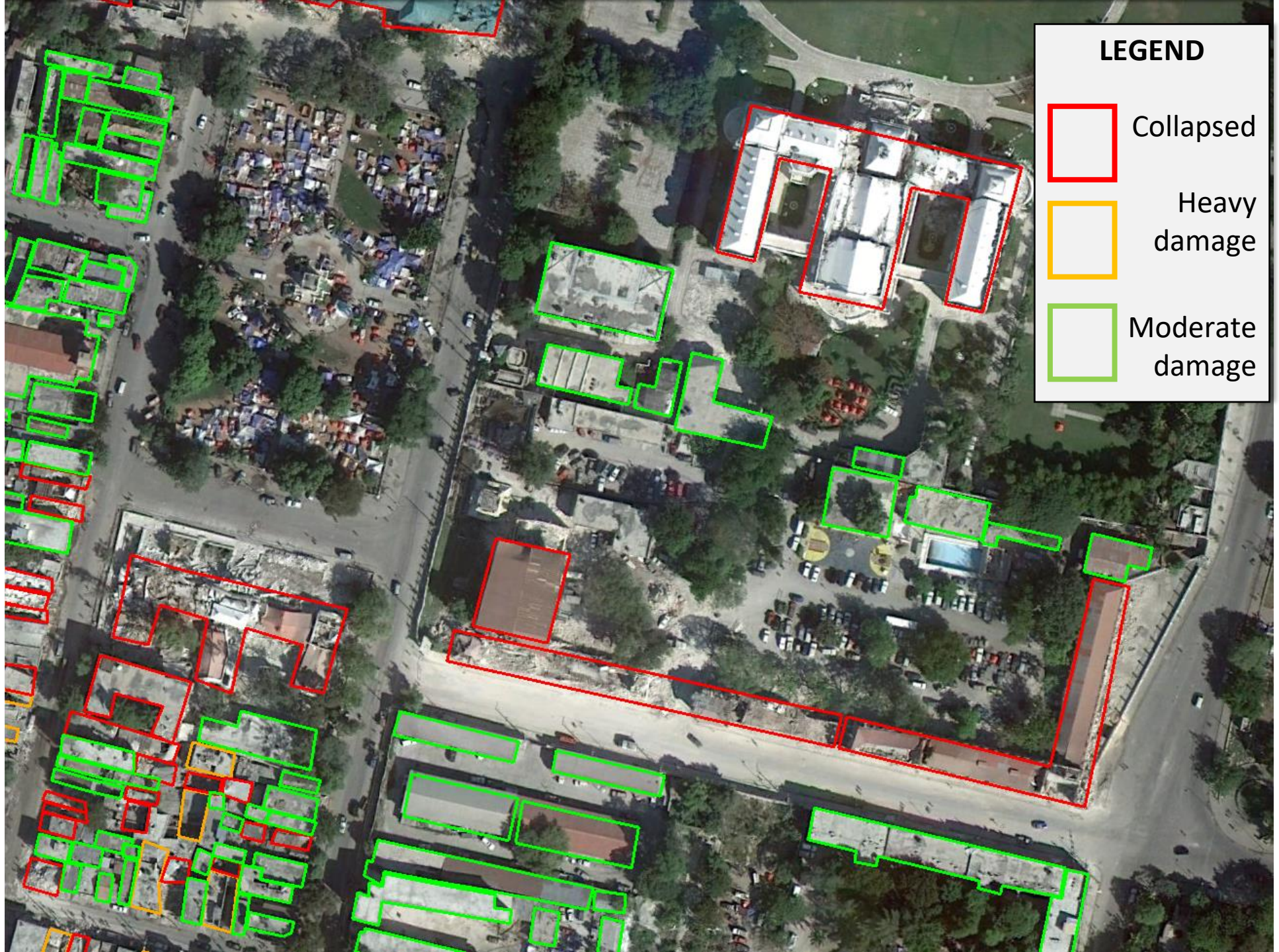
	Data Used	Duration	Products
Phase 1	• Post-event imagery: 50 cm **satellite** imagery (GeoEye-1) • Pre-event imagery: Quickbird-2 • Gridded area: 133.75 km^2	48 hours	Damage map – point location of every collapsed building (>5000)
Phase 2a	• Post-event imagery: 15 cm **aerial** imagery (Google) • Pre-event imagery: Quickbird-2 satellite • Gridded area: 346 km^2	96 hours	Damage map showing polygon footprints of collapsed & heavily damaged buildings (>30,000) Estimate of square footage requiring reconstruction Generation of land use information
Phase 2b	• Post-event imagery: 15 cm **aerial** imagery (RIT/ImageCat) • Pre-event imagery: Quickbird-2 satellite • Gridded area: 1024.75 km^2 • Multi-agency validation process	3 weeks	

DAMAGE ASSESSMENT: *Geo-Can*

Satellite and aerial imagery used for assessments
Identification of communities most affected by the earthquake.






LEGEND
Collapsed
Heavy damage
Moderate damage

Project Objectives

Characterize community-scale disruption and changes in disruption with time.

Explore the damage-disruption relationship

- Strength and nature of relationship
- Changes with time
- Cross-community comparisons
- Balance of perspectives

DATA COLLECTION - *WHERE*

DATA COLLECTION - *HOW*

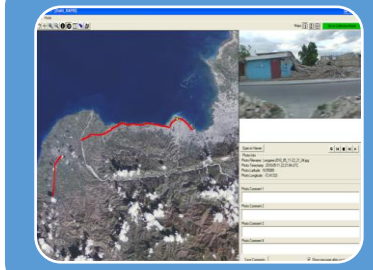
Field deployment in Haiti: May 6-16, 2010

Remote sensing

- GEO-CAN damage assessment
- Early recovery assessment

Interviews

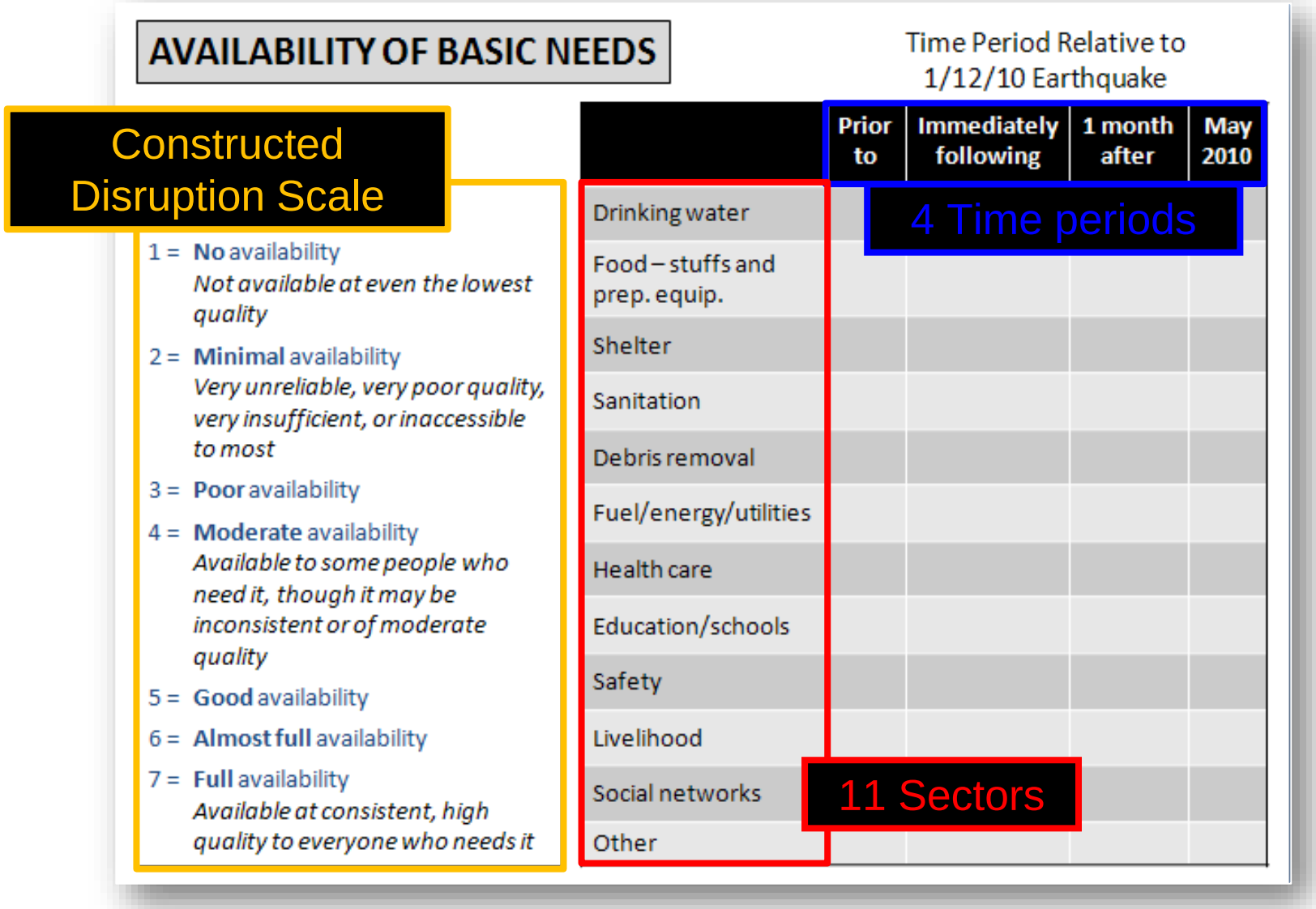
- Community leaders
- Sector representatives



Field Data Collection

VIEWS™ & GPS Photos

DISRUPTION - *COMMUNITY MEETINGS*



DATA - *AVERAGE AVAILABILITY OF SERVICES*

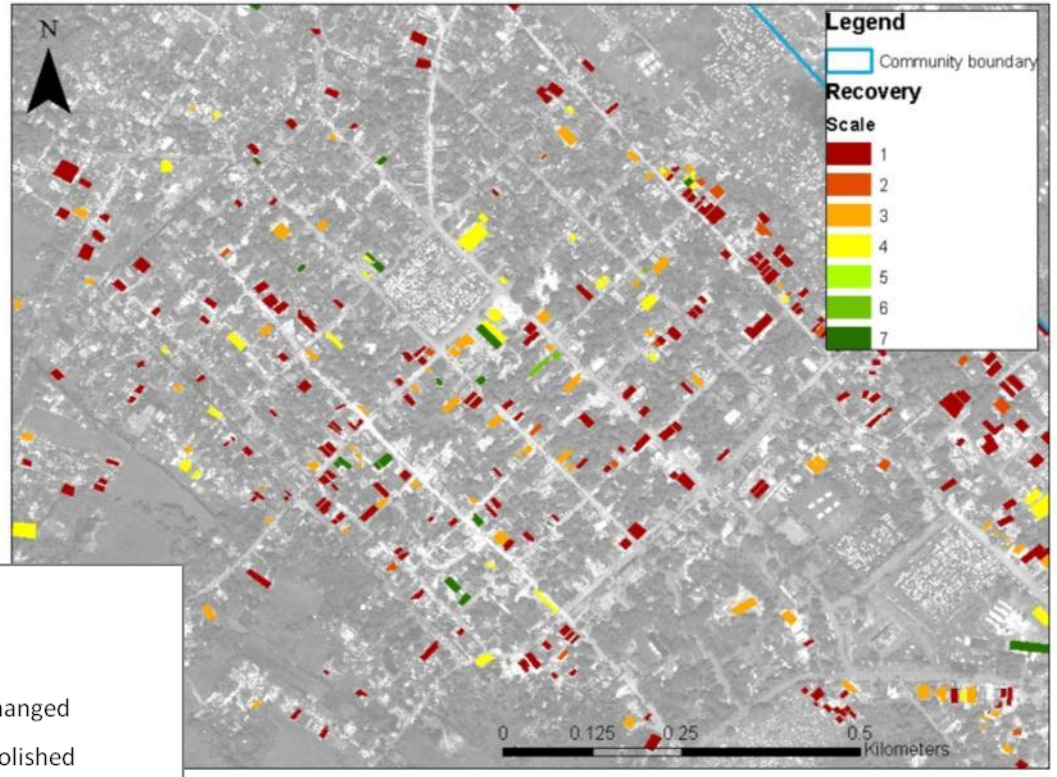
Pre- to post-earthquake comparison

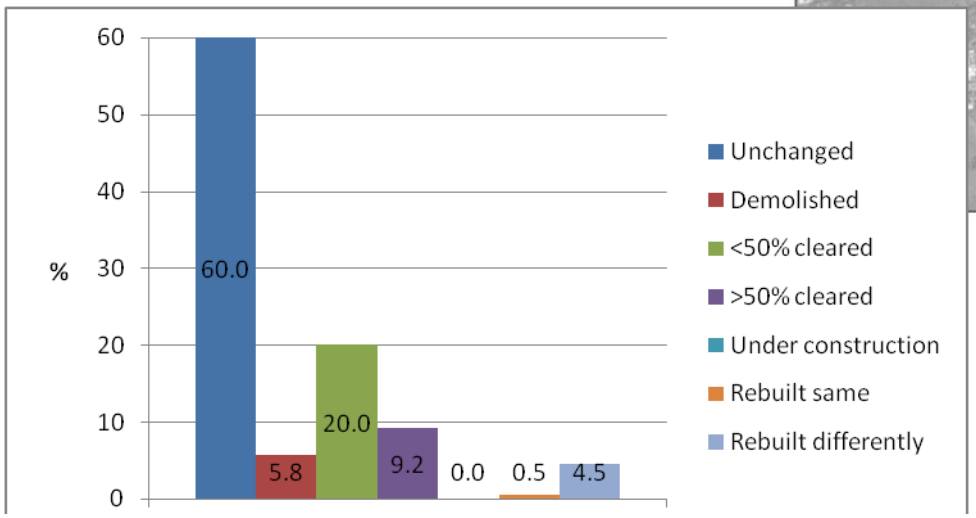
Damage (%)	Drinking water	Food	Shelter	Sanitation	Debris	Energy	Healthcare	Education	Safety	Livelihood	Social networks
21.10	▼ 1	▼ 3	▼ 4	▼ 1	▲ 1	▼ 1	▼ 2	▼ 3	▶ 0	▼ 3	▶ 0
14.98	▼ 0.5	▼ 3	▼ 5	▼ 2	▲ 1	▼ 3	▼ 1.5	▼ 3	▲ 0.75	▼ 1.5	▲ 2.5
8.86	▼ 2	▼ 2	▼ 2	▼ 2	▲ 1	▼ 5	▼ 1	▼ 4	▼ 3	▼ 2	▲ 1
8.75	▼ 2	▼ 1	▼ 3	▼ 1	▶ 0	▼ 1	▼ 3	▼ 3	▶ 0	▼ 3	▶ 0
8.25	▼ 2	▼ 1	▼ 3	▼ 3	▲ 1	▼ 1	▼ 2	▼ 3	▼ 1	▼ 1	▲ 2
6.65	▼ 3	▲ 1	▼ 2	▼ 3	▶ 0	▼ 3	▼ 2	▼ 2	▼ 2	▼ 1	▼ 2
1.56	▼ 3	▼ 2	▼ 3	▶ 0	▲ 1	▼ 3	▲ 2	▼ 3	▲ 2.5	▶ 0	▲ 1

Post-disaster to recovery comparison

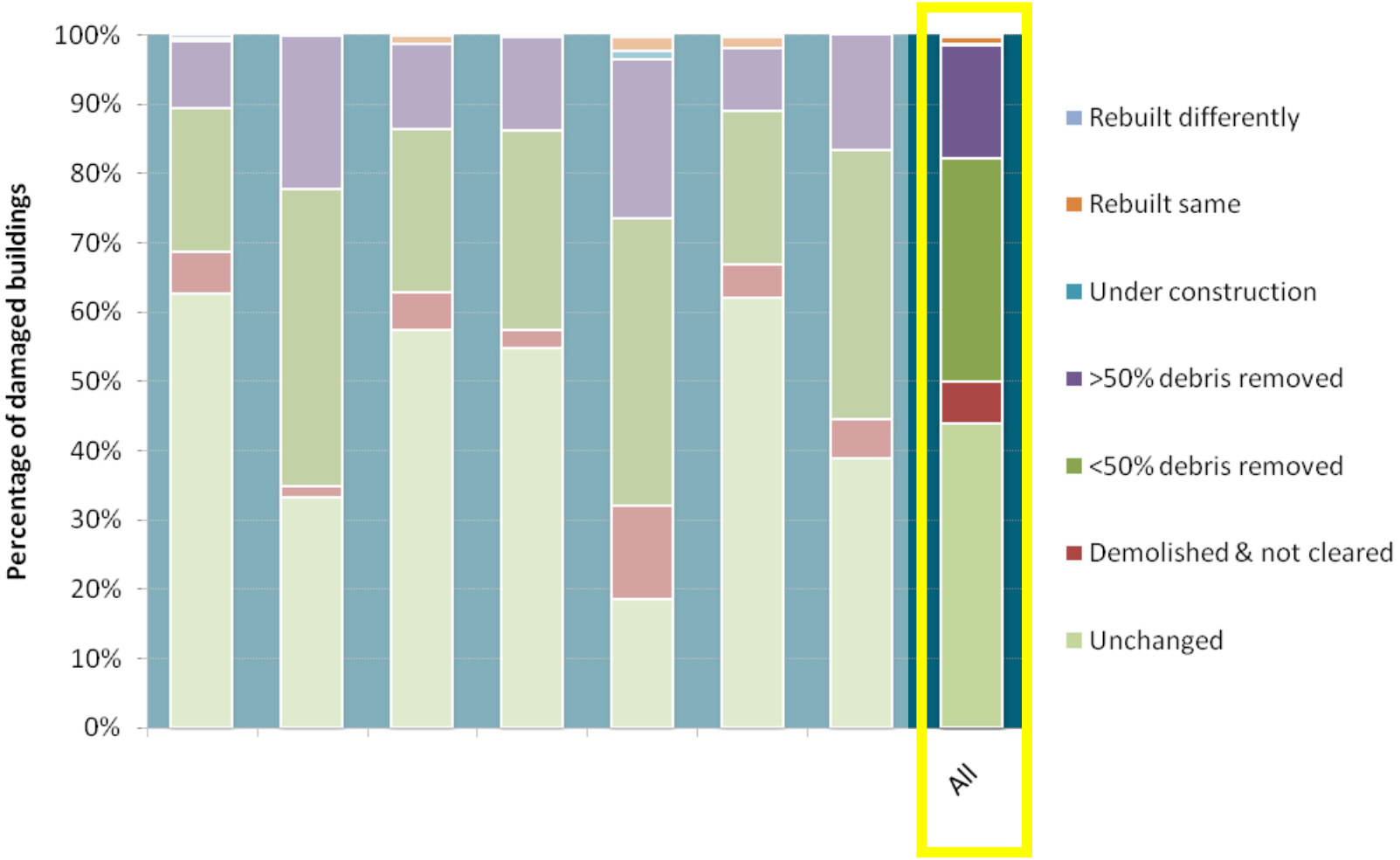
Damage (%)	Drinking water	Food	Shelter	Sanitation	Debris	Energy	Healthcare	Education	Safety	Livelihood	Social networks
21.10	▶ 0	▲ 1	▶ 0	▶ 0	▶ 0	▲ 1	▲ 3	▲ 2	▶ 0	▶ 0	▲ 1
14.98	▲ 1.5	▲ 1	▲ 3	▲ 3	▲ 2	▲ 2	▲ 4.5	▲ 2	▼ 1.5	▲ 0.75	▼ 4
8.86	▲ 1	▶ 0	▶ 0	▲ 1	▲ 2	▲ 3	▲ 2	▲ 2	▲ 3	▲ 2	▼ 1
8.75	▲ 3	▲ 1	▶ 0	▶ 0	▲ 3	▶ 0	▲ 3	▲ 1	▼ 1	▶ 0	▶ 0
8.25	▶ 0	▲ 3	▶ 0	▲ 1	▶ 0	▲ 0.5	▼ 1	▲ 1	▼ 2	▶ 0	▼ 1
6.65	▲ 2	▼ 1	▶ 0	▼ 1	▶ 0	▲ 1	▲ 3	▲ 1	▲ 2	▶ 0	▶ 0
1.56	▲ 2	▲ 1	▶ 0	▶ 0	▶ 0	▲ 2	▶ 0	▲ 1	▼ 3	▶ 0	▼ 4

RECOVERY EXAMPLE





EARLY RECOVERY: *Change in the Built Environment*



Exercise ….

1. What attributes define resilience?

2. How do we recognize resilience *before* a disruption?

Lessons: *Disruption and Resilience*

1. The relationship between damage-state and disruption = complex.

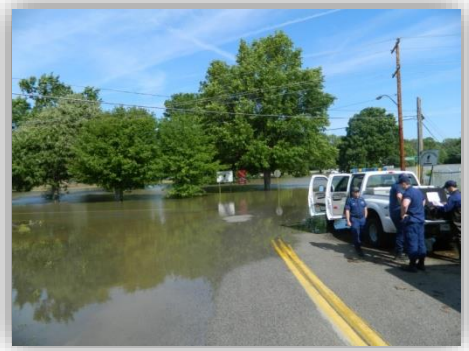
2. What do Haitian communities reveal about disruption?

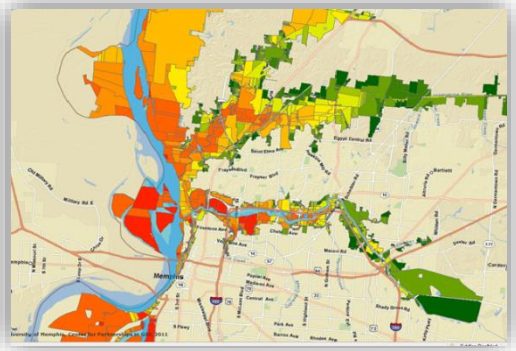
3. What is resilience?

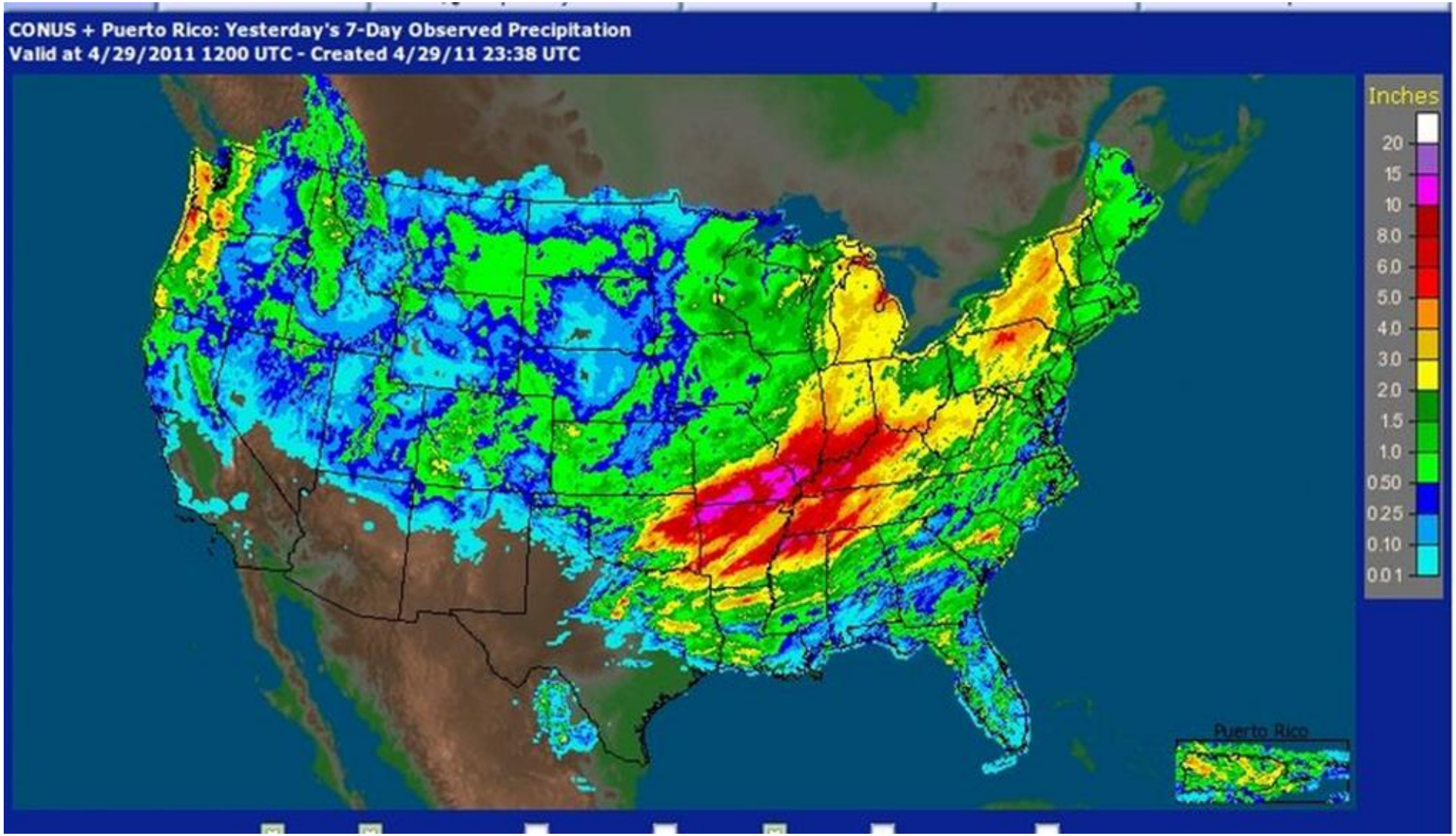
4. How do we recognize resilience?

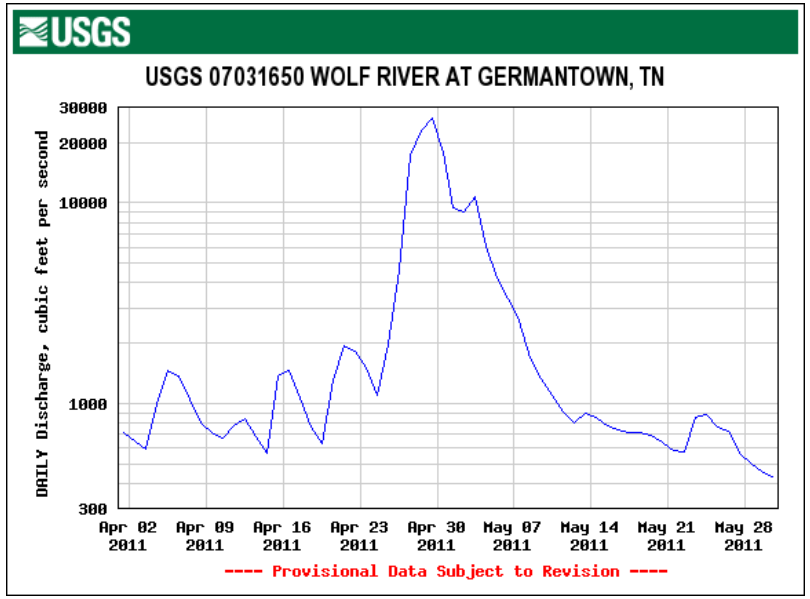
Lessons – revealed through extreme events

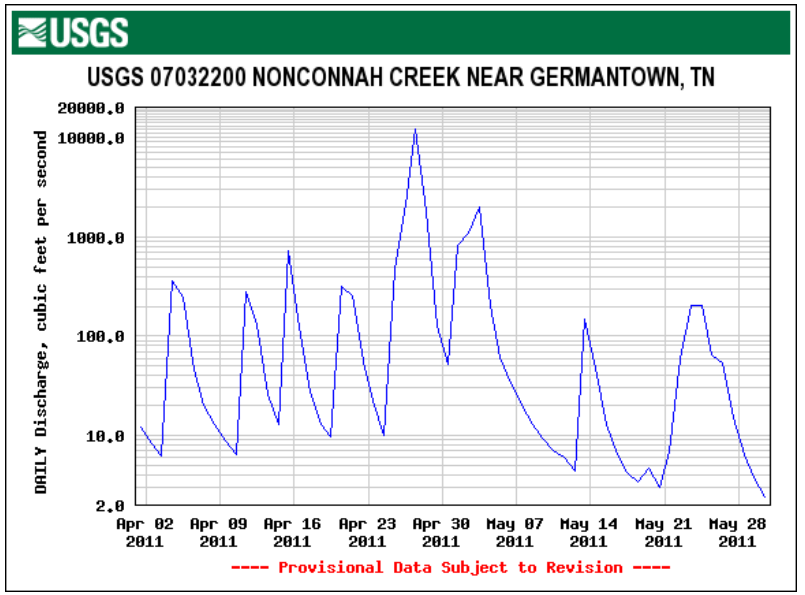
2011 Mississippi River Flood

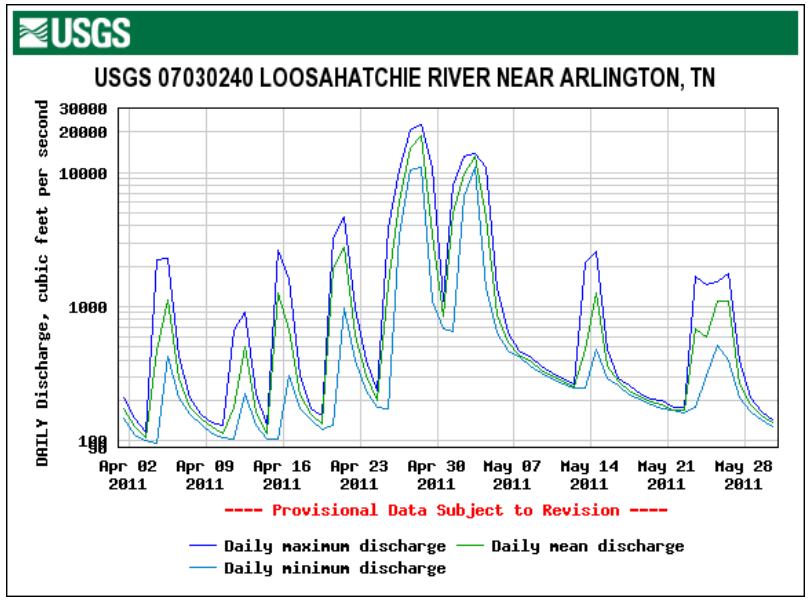


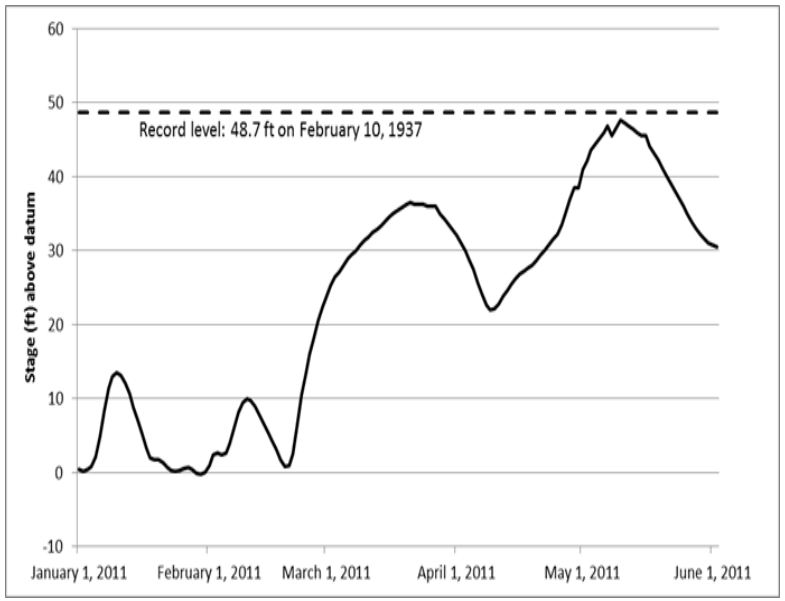



CONUS + Puerto Rico: Yesterday's 7-Day Observed Precipitation
Valid at 4/29/2011 1200 UTC - Created 4/29/11 23:38 UTC
Inches
20
15
10
8.0
6.0
5.0
4.0
3.0
2.0
1.5
1.0
0.50
0.25
0.10
0.01
Puerto Rico


USGS
USGS 07031650 WOLF RIVER AT GERMANTOWN, TN
DAILY Discharge, cubic feet per second
30000
20000
10000
1000
300
Apr 02 2011
Apr 09 2011
Apr 16 2011
Apr 23 2011
Apr 30 2011
May 07 2011
May 14 2011
May 21 2011
May 28 2011
---- Provisional Data Subject to Revision ----


USGS
USGS 07032200 NONCONNAH CREEK NEAR GERMANTOWN, TN
DAILY Discharge, cubic feet per second
20000.0
10000.0
1000.0
100.0
10.0
2.0
Apr 02 2011
Apr 09 2011
Apr 16 2011
Apr 23 2011
Apr 30 2011
May 07 2011
May 14 2011
May 21 2011
May 28 2011
---- Provisional Data Subject to Revision ----


USGS
USGS 07030240 LOOSAHATCHIE RIVER NEAR ARLINGTON, TN
DAILY Discharge, cubic feet per second
30000
20000
10000
1000
100
Apr 02 2011
Apr 09 2011
Apr 16 2011
Apr 23 2011
Apr 30 2011
May 07 2011
May 14 2011
May 21 2011
May 28 2011
---- Provisional Data Subject to Revision ----
Daily maximum discharge
Daily mean discharge
Daily minimum discharge


Record level: 48.7 ft on February 10, 1937
Stage (ft) above datum
60
50
40
30
20
10
0
-10
January 1, 2011
February 1, 2011
March 1, 2011
April 1, 2011
May 1, 2011
June 1, 2011

The Situation

An urban flood event manifested in late April of 2011.

1. Major tributaries in Shelby County (Wolf River, Loosahatchie River, Nonconnah Creek) began to swell as a large rain event stalled over the local area

2. Another massive precipitation event in the Ohio valley melted headwater snow packs resulting in a historic Mississippi River flood

Would the Mississippi River flood waters reach Memphis before urban flooding of the tributaries subsided?

Mississippi River 2011: Timeline

1927
historic flood
at 45.8 ft

1937
historic flood
at 48.7 ft

Planning ***Response***

April 27
Flooding #1 ends; MS River begins to rise

April 28
Flooding is modeled; secure GIS mapping website is created

May 2
Evacuation list is produced from GIS modeling

May 4
Public awareness maps are created; call center opens

May 3-10
GIS maps modified based on NWS predictions of river stage; evacuations begin

Response ***Recovery***

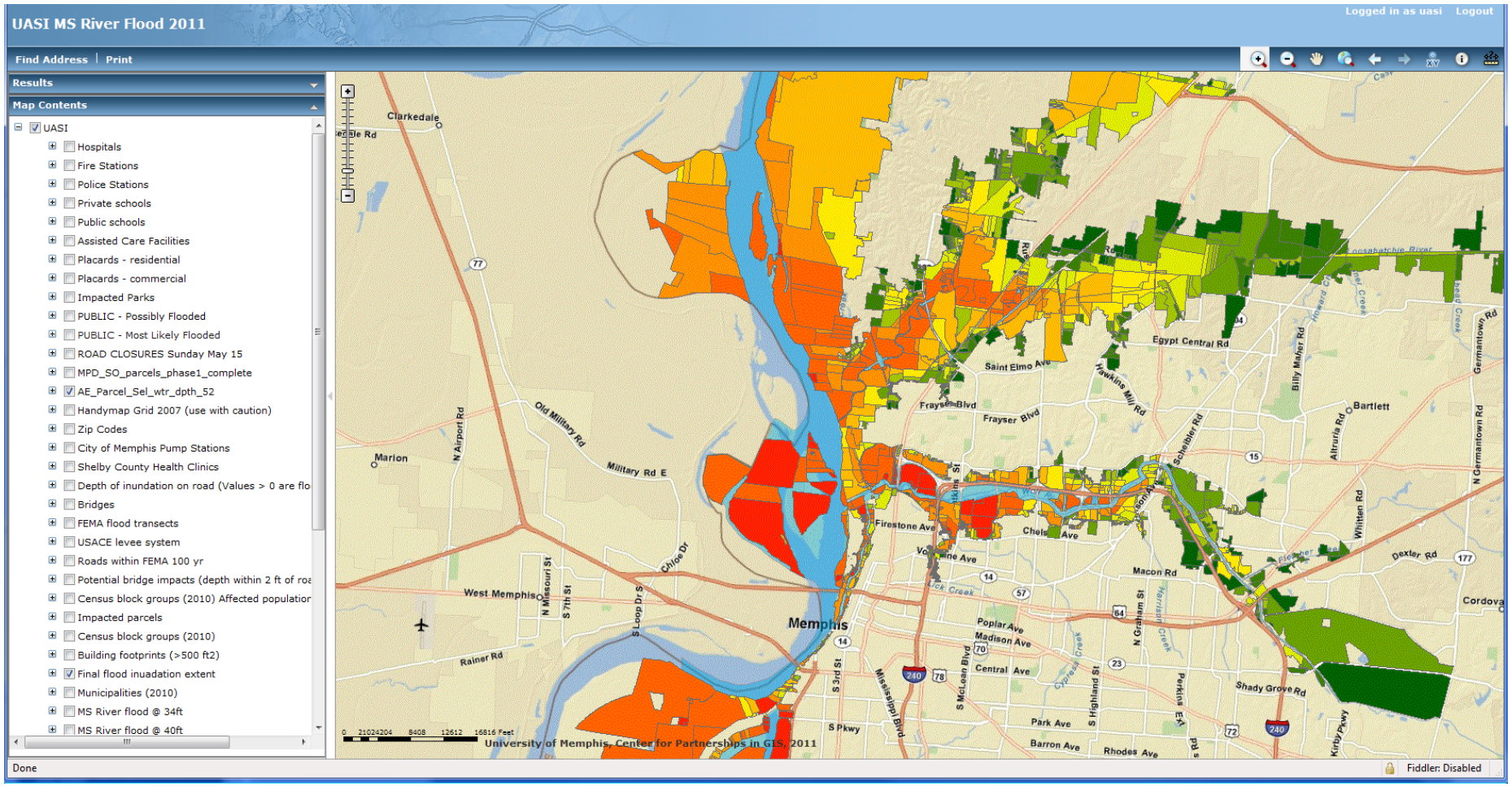
May 10
MS River crests at 47.6 ft

May 11
Recon to validate GIS flood extent model

May 13
Properties identified for inspections as waters recede

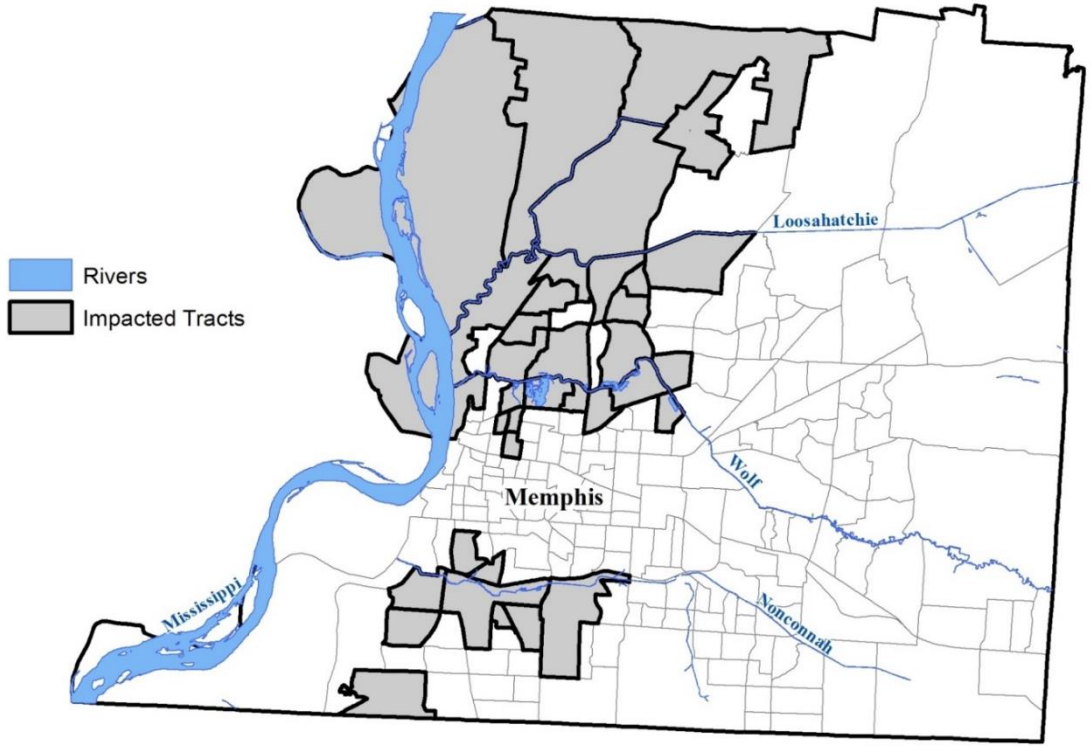
May 29
Damage assessment QA/QC'd

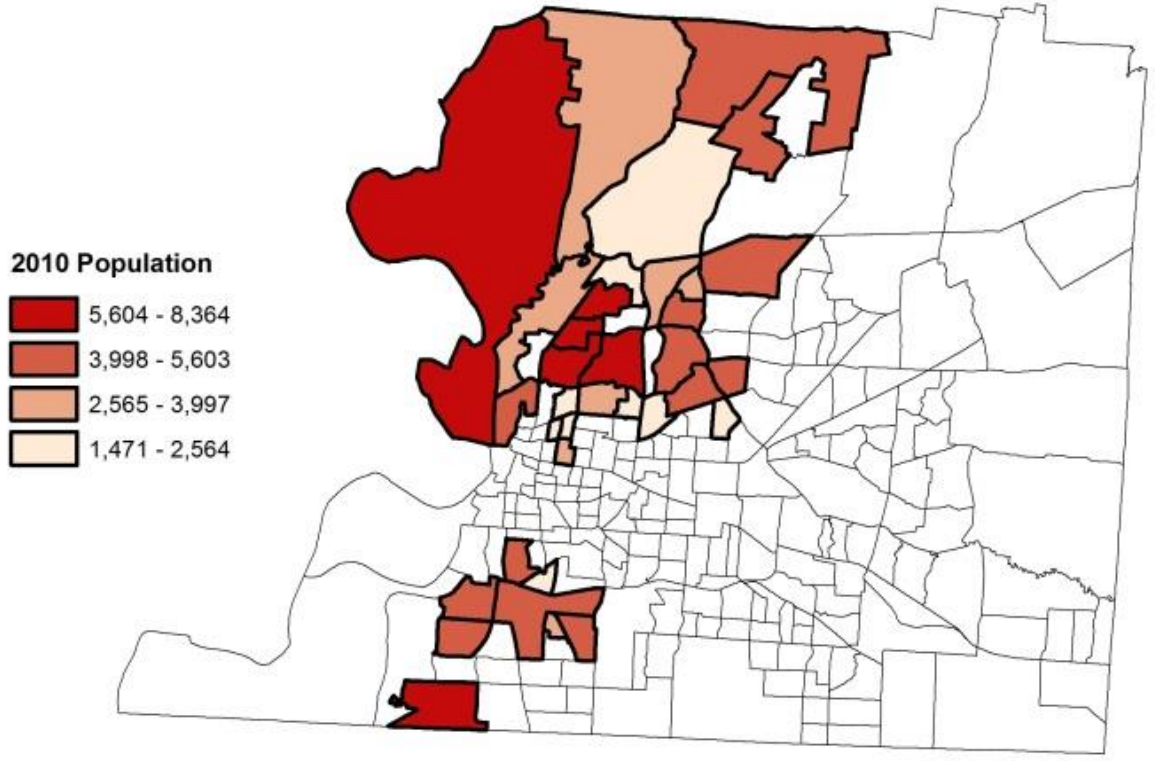
June 5
Damage assessment validated through GIS & field survey


UASI MS River Flood 2011
Logged in as uasi
Logout
Find Address | Print
Results
Map Contents
UASI
Hospitals
Fire Stations
Police Stations
Private schools
Public schools
Assisted Care Facilities
Placards - residential
Placards - commercial
Impacted Parks
PUBLIC - Possibly Flooded
PUBLIC - Most Likely Flooded
ROAD CLOSURES Sunday May 15
MPD_SO_parcels_phase1_complete
AE_Parcel_Sel_wtr_dpth_52
Handymap Grid 2007 (use with caution)
Zip Codes
City of Memphis Pump Stations
Shelby County Health Clinics
Depth of inundation on road (Values > 0 are flo
Bridges
FEMA flood transects
USACE levee system
Roads within FEMA 100 yr
Potential bridge impacts (depth within 2 ft of roa
Census block groups (2010) Affected population
Impacted parcels
Census block groups (2010)
Building footprints (>500 ft2)
Final flood inuadation extent
Municipalities (2010)
MS River flood @ 34ft
MS River flood @ 40ft
Clarkedale
Marion
West Memphis
Memphis
Bartlett
Cordova
Egypt Central Rd
Saint Elmo Ave
Frayser Blvd
Old Military Rd
Military Rd E
N Airport Rd
Firestone Ave
Macon Rd
Poplar Ave
Madison Ave
Central Ave
Park Ave
Barron Ave
Rhodes Ave
Shady Grove Rd
Dexter Rd
Rainer Rd
S Pkwy
Mississippi Blvd
Germantown Rd
Billy Mafer Rd
Altruria Rd
Whitten Rd
Scheibler Rd
Hawkins Mill Rd
Chloe Dr
N Missouri St
S 7th St
S Loop Dr S
S Pkwy
S McLean Blvd
S Highland St
N Graham St
Kirby Pkwy
University of Memphis, Center for Partnerships in GIS, 2011
Done
Fiddler: Disabled

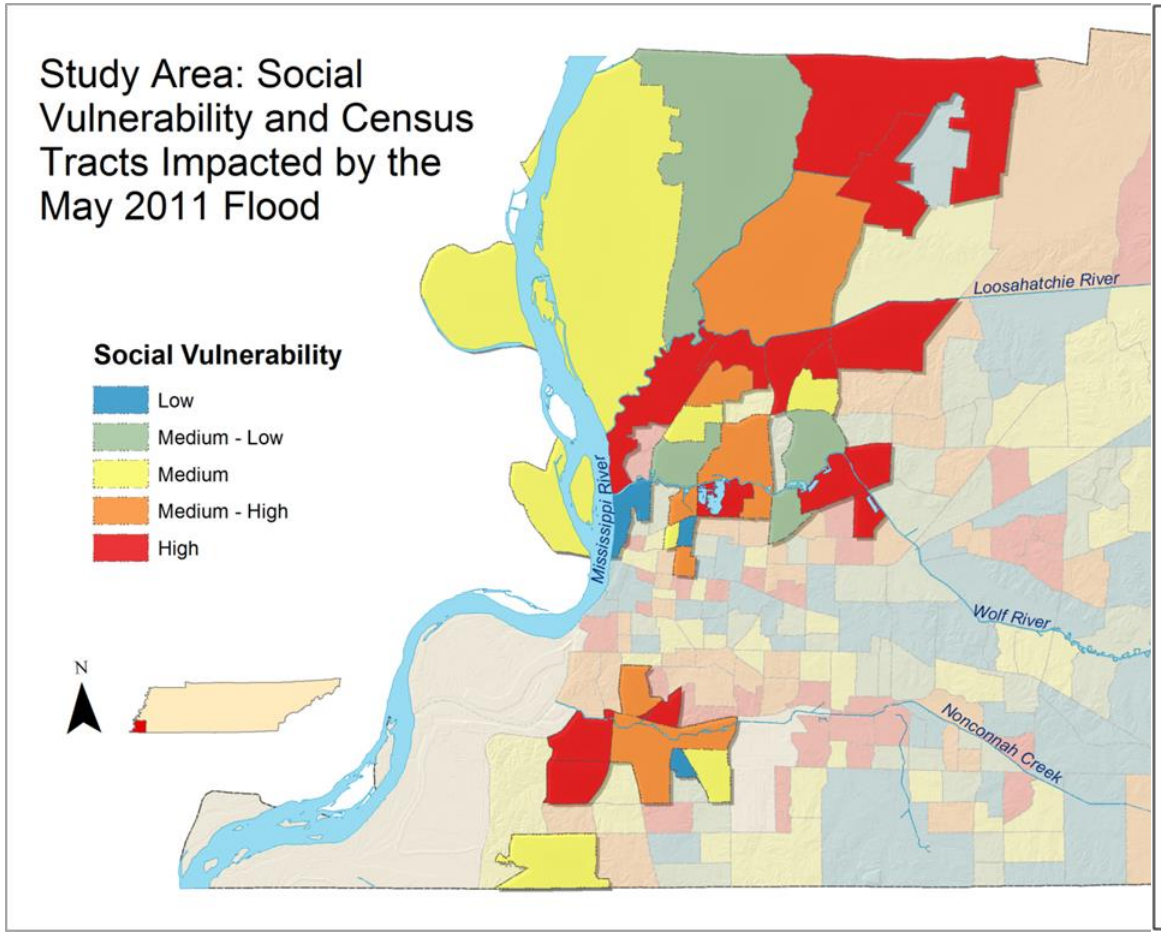
Vulnerability in Action –

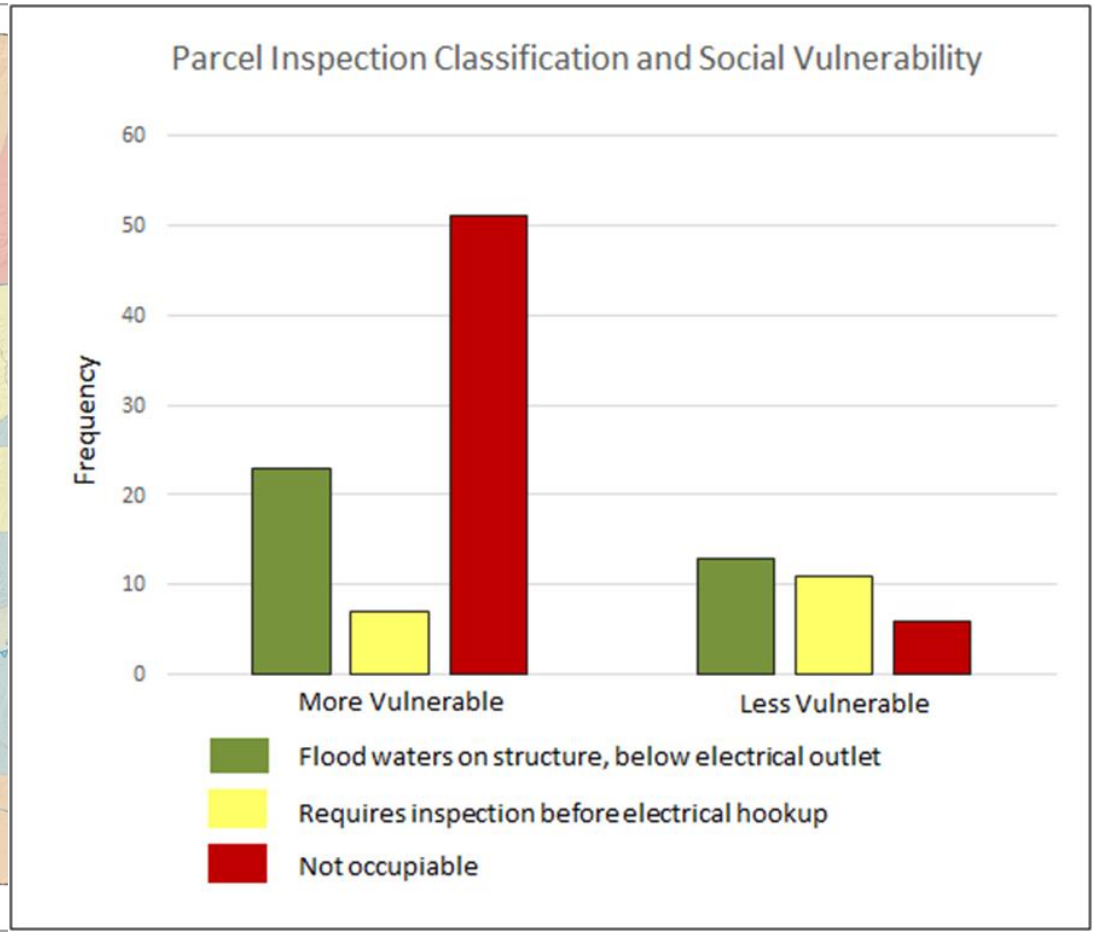
Driven by exposure and sensitivity of systems.



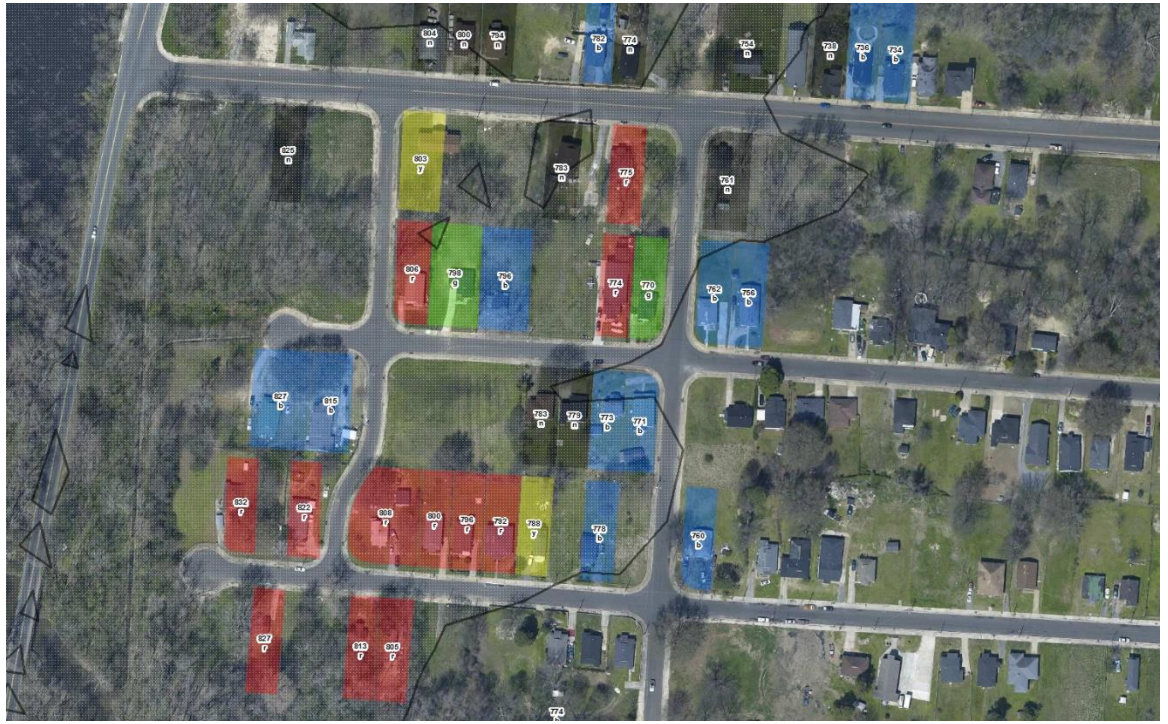


Vulnerability –
Intersecting Exposure with Vulnerability.





Exercise ….



What places would you consider “vulnerable” to disruption?

What places would you consider “resilient” to disruption?

Thoughts of a Hazards Geographer

1. Extreme events serve as sources of shock to a system.
2. The social fabric of place serves to amplify or dampen the consequences of the shock.

3. Context of place matters.
4. Building community capacity to absorb extreme events is key to lessening their consequences.

5. Complexity – multi-disciplinary and multi-generational teams are crucial.

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