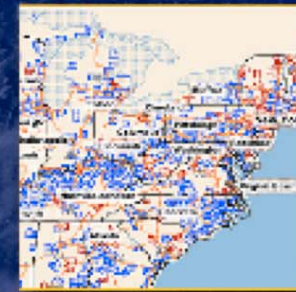
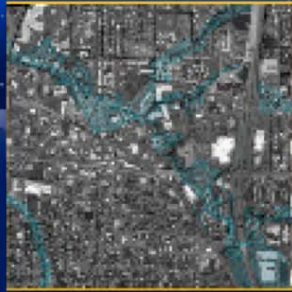


GIS and HAZUS-MH

New Madrid --
Wasatch

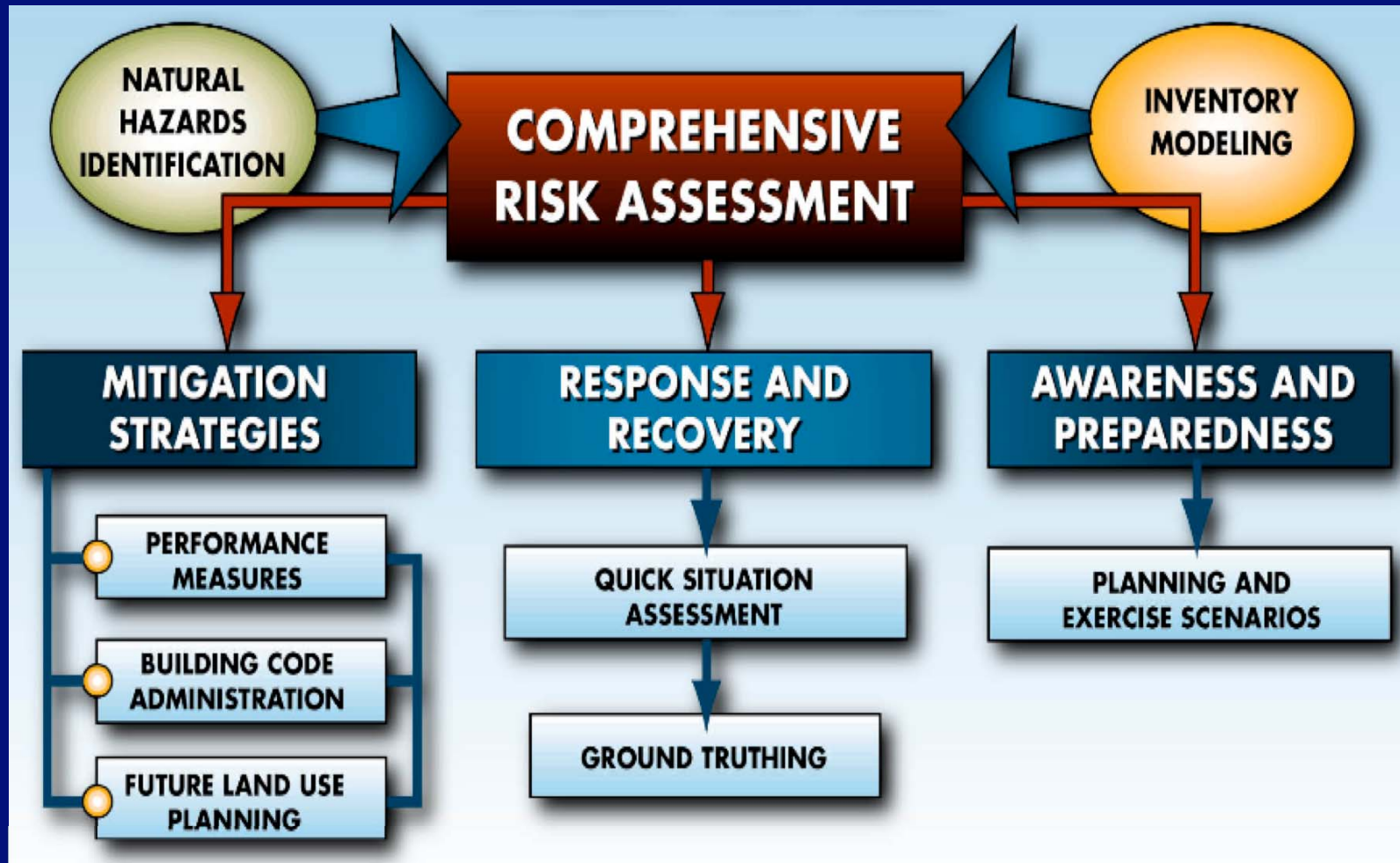


HAZUS Applications for Catastrophic Planning



FEMA

HAZUS Applications



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

UofU Suite of ShakeMap Scenarios

USGS Earthquake Hazards Program » ShakeMap Archive - Microsoft Internet Explorer

Address: <http://earthquake.usgs.gov/eqcenter/shakemap/list.php?x=1&n=ut&s=>

EQ Notification Service
Feeds & Data
Animations

Recent Earthquakes Last 8-30 Days
Historic Earthquakes
"Top 10" Lists & Maps
Significant EQs
Earthquake Search
EQ Summary Posters
Scientific Data
About EQ Maps
Did You Feel It?
Fast Moment Tensors
Media Info
PAGER
Seismogram Displays

ShakeMaps
ShakeMap Archive
Scientific Background
Product Formats
Disclaimer
Related Links

Years: **All** | 2005 | 2004
Type: **Regular** | **Scenarios**

ShakeMap Scenarios in Utah

18 Matching ShakeMaps Found!

Mag	Event ID	Name/Epicenter
6.0	TAYLORS_se	West Valley Scenario
6.5	BOUNTIFUL_se	Weber Segment Aftershock Scenario
7.0	WEBERseg_se	Weber Segment Scenario
6.9	ASHCREEKseg_se	Ash Creek Segment Hurricane Fault Scenario
6.6	CEDARCTYseg_se	Cedar City Segment Hurricane Fault Scenario
6.7	ANDERSONseg_se	Anderson Junction Segment Hurricane Fault Scenario
6.5	WASHINGTON_se	North Washington Fault Scenario
7.2	PROVseg_se	Provo Segment Scenario
7.4	STGEORG_se	Anderson Junction/Hurricane Segment Scenario
6.5	CLARKseg_se	Clarkston Mtn Segment Scenario
6.8	COLLISseg_se	Colliston Segment Scenario
6.2	FAYETseg_se	Fayette Segment Scenario
6.5	MCseg_se	Malad City Segment Scenario
6.9	NEPHseg_se	Nephi Segment Scenario
6.7	LEVANseg_se	Levan Segment Scenario
6.5	RICHFIELD_se	1901 Richfield Scenario
7.0	BCseg_se	Brigham City Segment Scenario
7.0	SLCseg_se	Salt Lake City Segment Scenario

Shakemap utWASHINGTON_se - Microsoft Internet Explorer

Address: <http://earthquake.usgs.gov/eqcenter/shakemap/ut/shake/WASHINGTON>

Animations
Recent Earthquakes Last 8-30 Days
Historic Earthquakes
"Top 10" Lists & Maps
Significant EQs
Earthquake Search
EQ Summary Posters
Scientific Data
About EQ Maps
Did You Feel It?
Fast Moment Tensors
Media Info
PAGER
Seismogram Displays

ShakeMaps
ShakeMap Archive
Scientific Background
Product Formats
Disclaimer
Related Links
Comments

Media Maps [Decorated](#) [Data](#)
Downloads

Downloads

Maps

Instrumental Intensity
[JPG \(177 kB\)](#)
[PS \(612 kB\)](#)

Peak Ground Acceleration
[JPG \(153 kB\)](#)
[PS \(274 kB\)](#)

Peak Ground Velocity
[JPG \(150 kB\)](#)
[PS \(274 kB\)](#)

Spectral Response
0.3 sec Period
[JPG \(167 kB\)](#)
[PS \(276 kB\)](#)

1.0 sec Period
[JPG \(154 kB\)](#)
[PS \(273 kB\)](#)

3.0 sec Period
[JPG \(156 kB\)](#)
[PS \(274 kB\)](#)

Data

Raw Grids
[Text X_Y_Z Values \(297 kB\)](#)

GIS Files
[HAZUS Zip File \(1 Mb\)](#)
[Shape Files \(3 Mb\)](#)

Station Lists
[Text \(276 B\)](#)
[XML \(1 kB\)](#)

Metadata
[HTML \(41 kB\)](#)
[Text \(30 kB\)](#)
[XML \(26 kB\)](#)

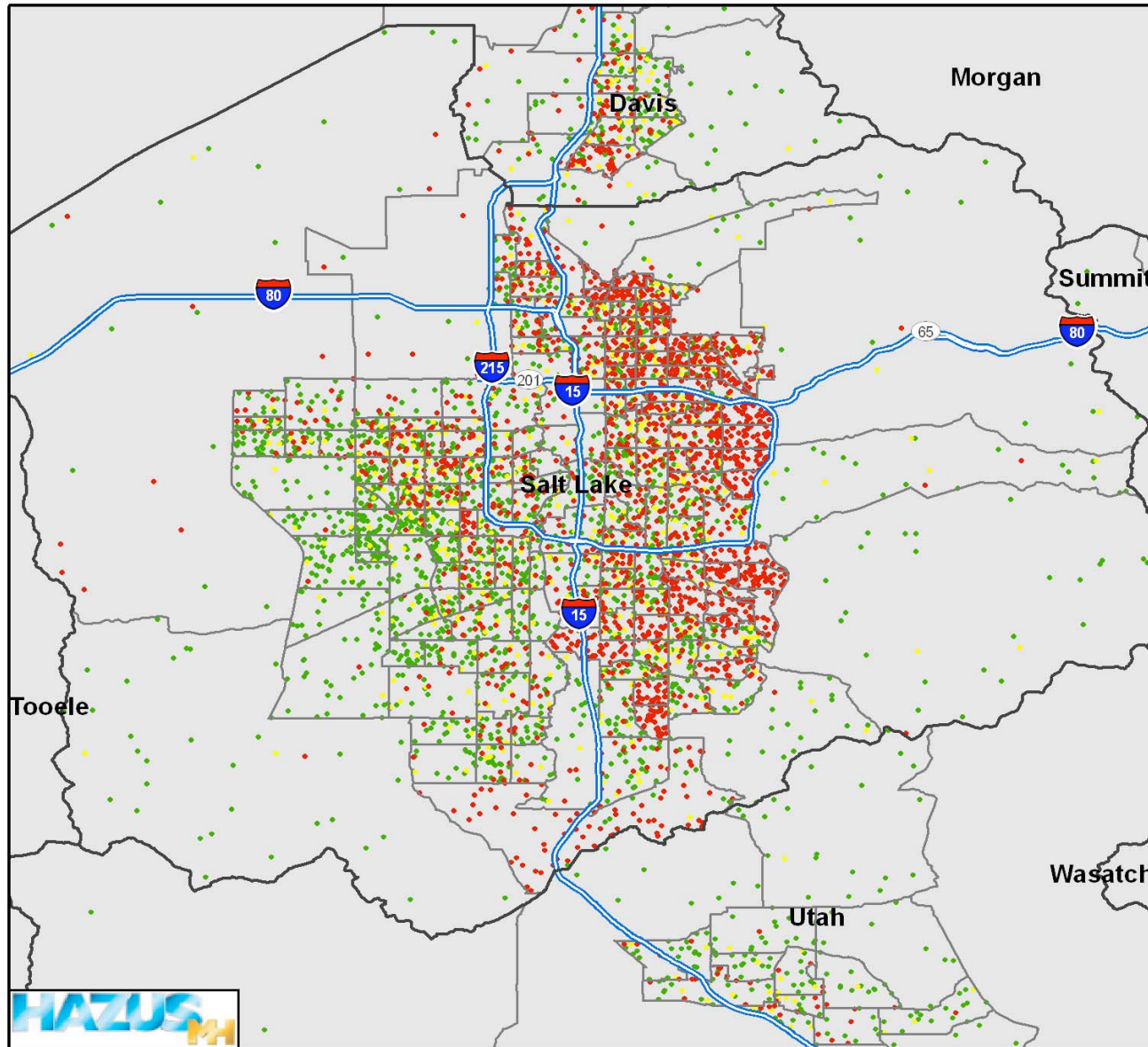


FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

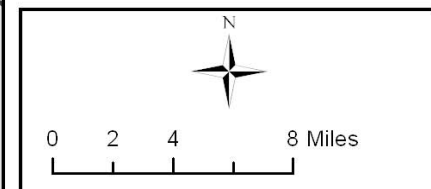
Estimated Building Inspection Needs - Earthquake Scenario: Wasatch Front



Wasatch Front Magnitude 7.0

	Estimated # of Structures
Red (Complete)	119,219
Yellow (Extensive)	41,219
Green (Slight/ Moderate)	159,701
TOTAL	320,139

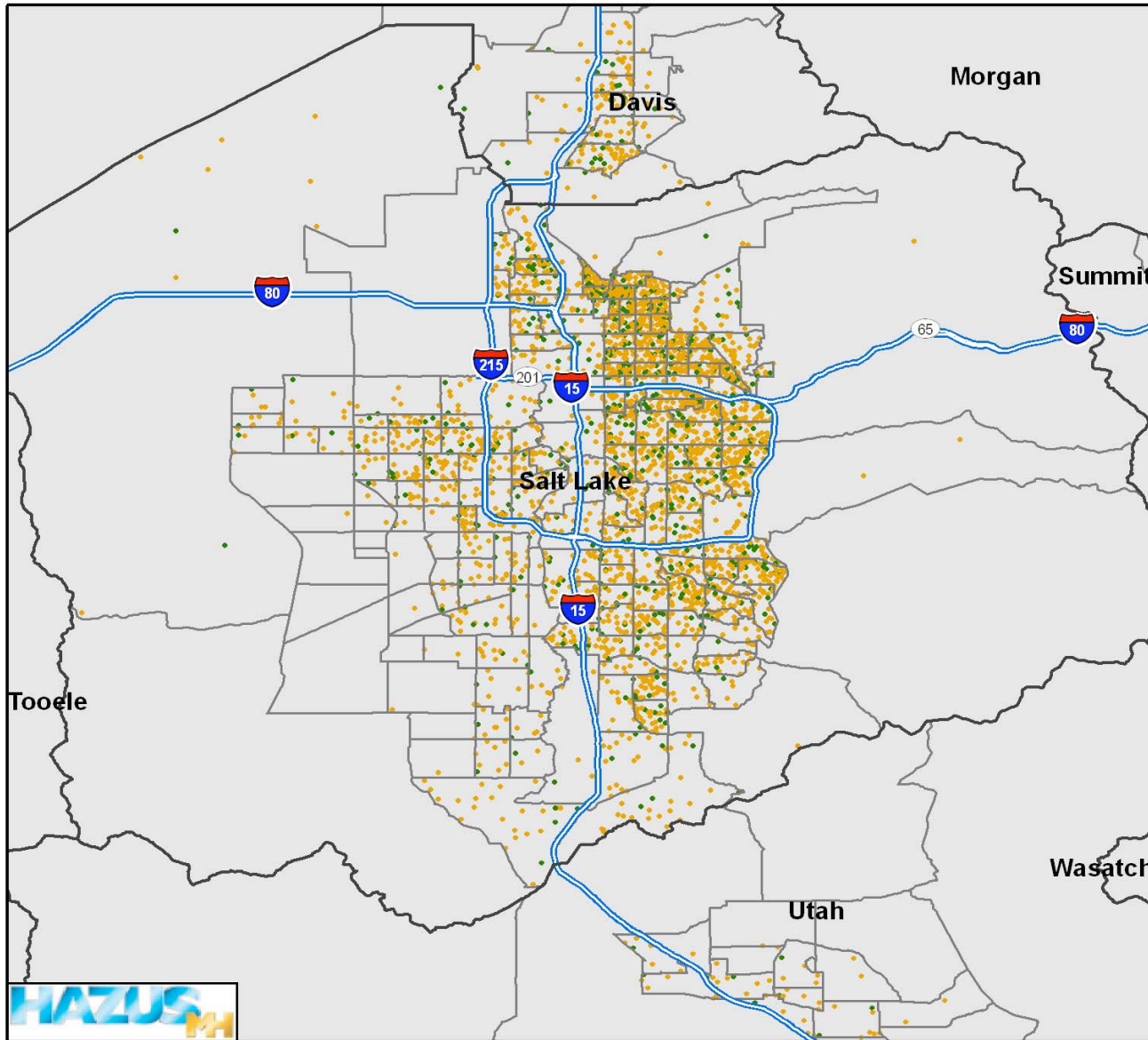
- 1 Dot = 50 Structures
- Red Tag (Complete Damage)
- 1 Dot = 50 Structures
- Yellow Tag (Extensive Damage)
- 1 Dot = 50 Structures
- Green Tag (Slight/Moderate Damage)
- County Boundaries
- State Boundaries



Location Map



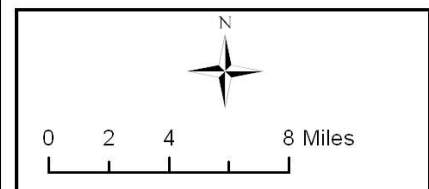
Estimated Displaced Households & Short-Term Public Shelter Needs - Earthquake Scenario: Wasatch Front



Wasatch Front Magnitude 7.0

	Total #
Public Shelter Needs (Individuals)	34,284
Displaced Households	151,375

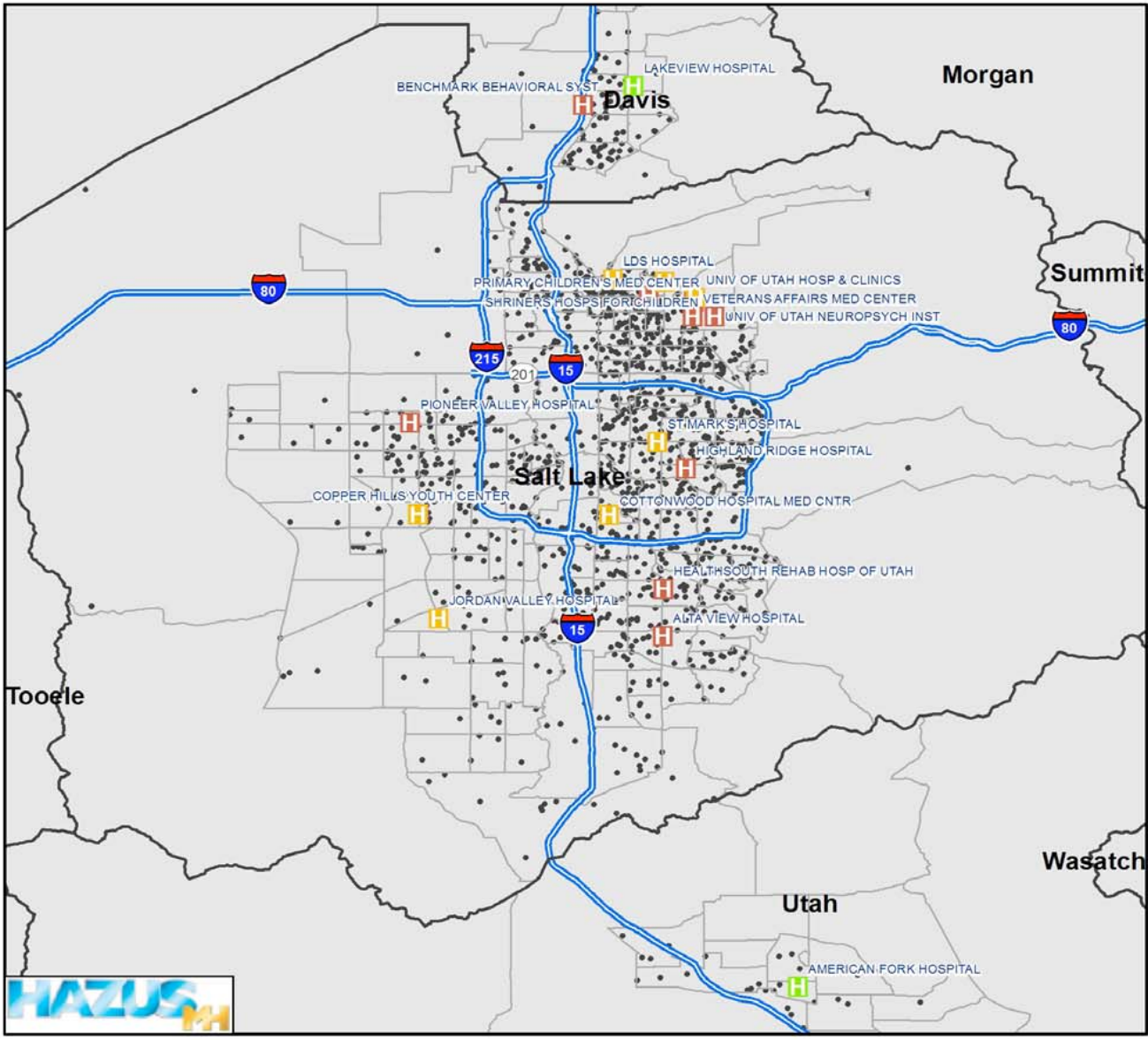
- 1 Dot = 50
- Public Shelter Needs (Individuals)
- Displaced Households
- County Boundaries
- State Boundaries



Location Map



Estimated Casualties (Severity 3) & Hospital Functionality - Earthquake Scenario: Wasatch Front



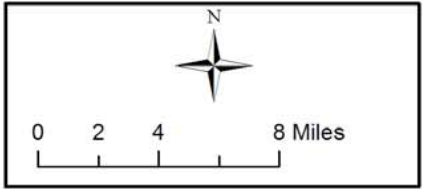
Wasatch Front Magnitude 7.0 - 2:00PM

1 Dot = 5 Persons
 Life-Threatening Injury

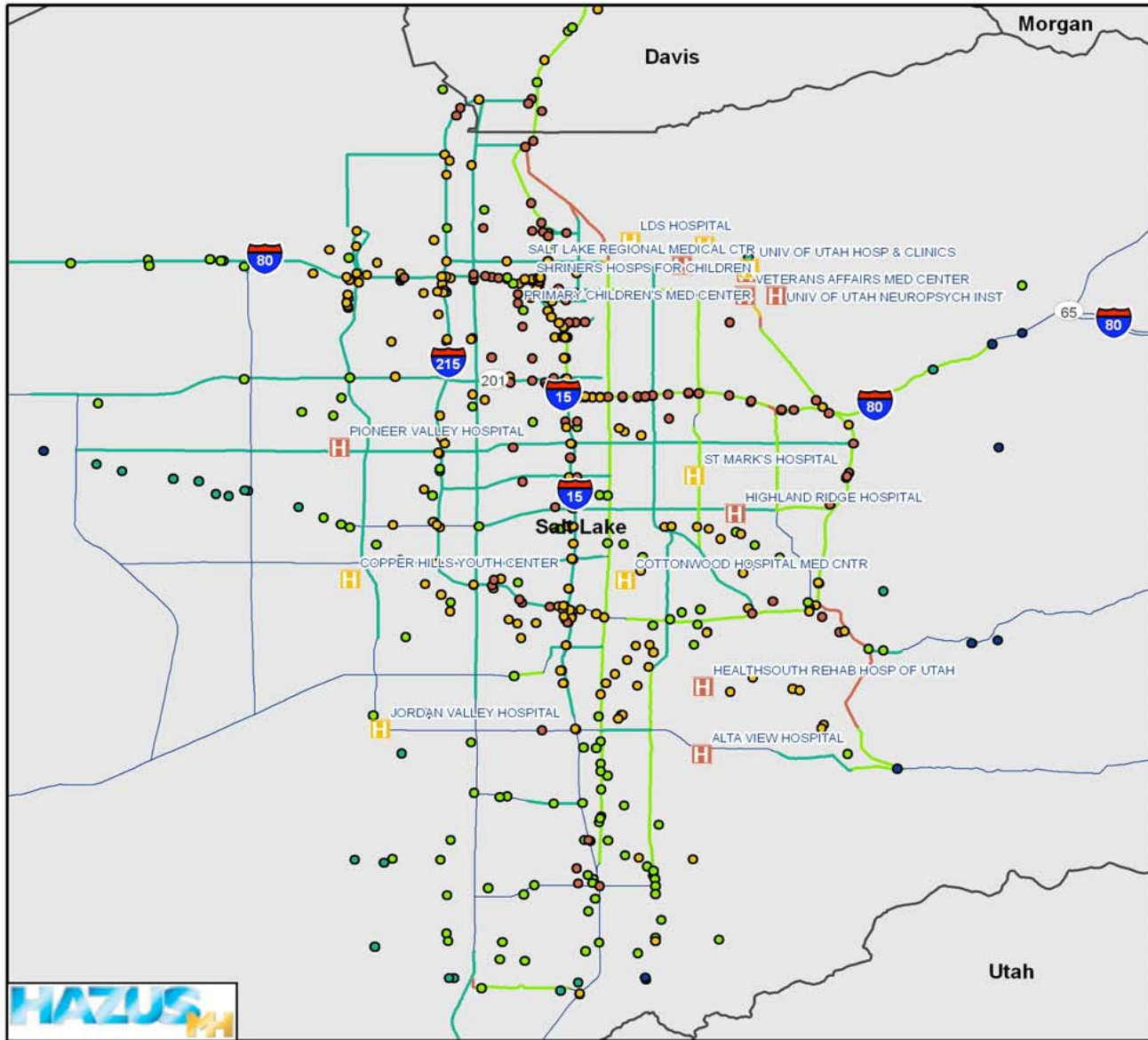
Impaired Hospitals (Day 1)
 Damage is expressed as the percentage chance that a given hospital will be functional on Day 1.

	< 10%
	10 - 25%
	25 - 50%
	50 - 75%
	> 75%

County Boundaries
 State Boundaries



Estimated Highway Infrastructure Damage & Hospitals - Earthquake Scenario: Wasatch Front



Wasatch Front Magnitude 7.0

Major Roadway Bridge Damage
Damage is expressed as the percentage chance that a given roadway bridge will realize at least moderate damage

- < 10%
- 10 - 25%
- 25 - 50%
- 50 - 75%
- > 75%

Highway Segment Damage

Damage is expressed as the percentage chance that a given highway segment will realize at least moderate damage

- < 10%
- 10 - 25%
- 25 - 50%
- 50 - 75%
- > 75%

Impaired Hospitals (Day 1)

Damage is expressed as the percentage chance that a given hospital will be functional on Day 1.

- H < 10%
- H 10 - 25%
- H 25 - 50%
- H 50 - 75%
- H > 75%

- ▭ County Boundaries
- ▭ State Boundaries

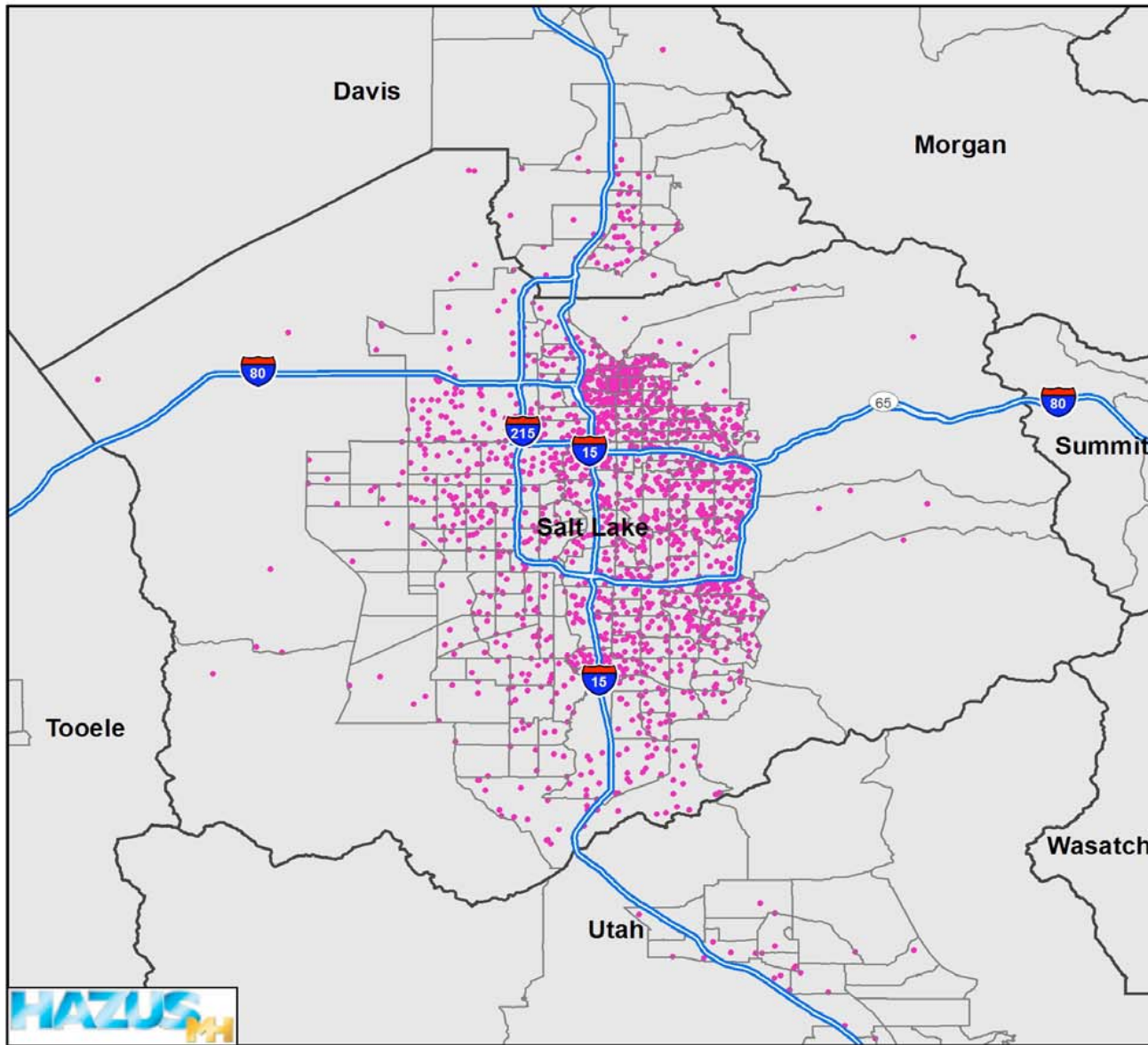


0 1 2 4 Miles

Location Map

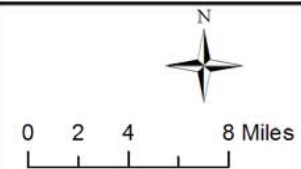


Estimated Concrete and Steel Debris - Earthquake Scenario: Wasatch Front



Wasatch Front Magnitude 7.0

- 1 Dot = 10 Tons
- Concrete & Steel Debris
- County Boundaries
- State Boundaries



Location Map



Wasatch Front-SLC Segment Building Damage Counts

**Major
Inspection
Needs:
Salt Lake
Davis
Utah
and
Weber counties
(2,000 inspectors,
30 days)**

	Damage Categories					Total
	None	Slight	Moderate	Extensive	Complete	
Box Elder	12,202	107	54	11	2	12,376
Davis	34,039	12,093	8,173	3,822	6,819	64,946
Morgan	1,776	209	100	22	3	2,111
Salt Lake	28,133	44,203	55,437	31,532	108,590	267,895
Summit	14,347	460	87	14	2	14,910
Tooele	9,571	1,457	868	292	93	12,281
Utah	53,266	13,868	8,453	3,136	2,877	81,599
Wasatch	5,497	313	92	16	2	5,919
Weber	40,108	7,843	5,609	2,375	1,215	57,151
Total State	252,194	80,554	78,872	41,220	119,602	572,442



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

Tabular Results Can be by Building Type

<i>Time of Day</i>	Daytime
<i>Severity 3 & 4* Casualties w/ out URM</i>	2,500
<i>Severity 3 & 4 Casualties w/ URMs</i>	8,800
<i>% Casualties Caused by URMs</i>	70%

**note: Severity 3 and 4 include life-threatening casualties and fatalities, respectively*



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007

NMSZ Baseline Scenarios

- 3 1811-12 Characteristic Scenarios supplied by USGS Memphis
- Ground motion product analogous to USGS ShakeMap
- Liquefaction susceptibility based on CUSEC State Geologists' soils mapping

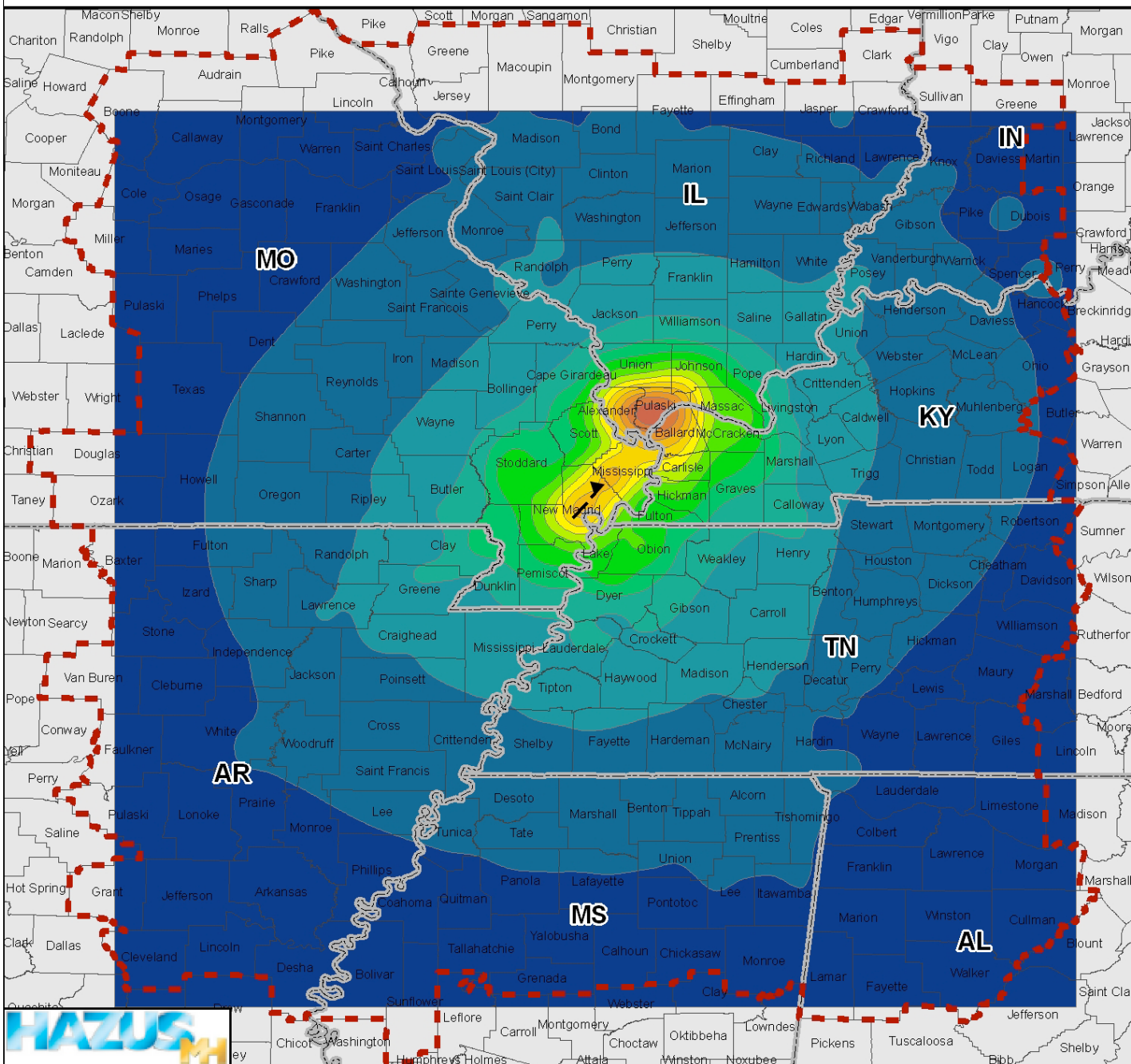


FEMA

ESRI-HAZUS in Catastrophic Planning

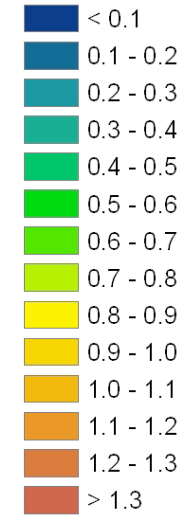
June 20th , 2007

Peak Ground Acceleration & Source - Earthquake Scenario: New Madrid Region

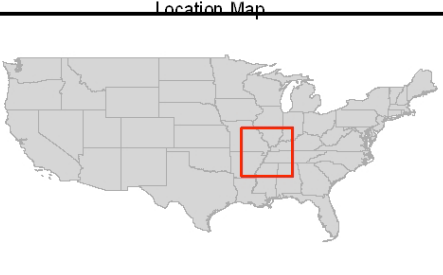
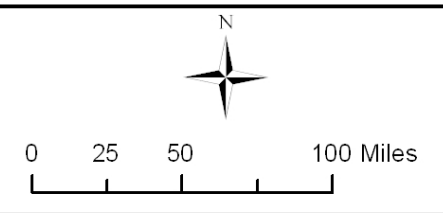


Northeast Scenario Magnitude 7.7

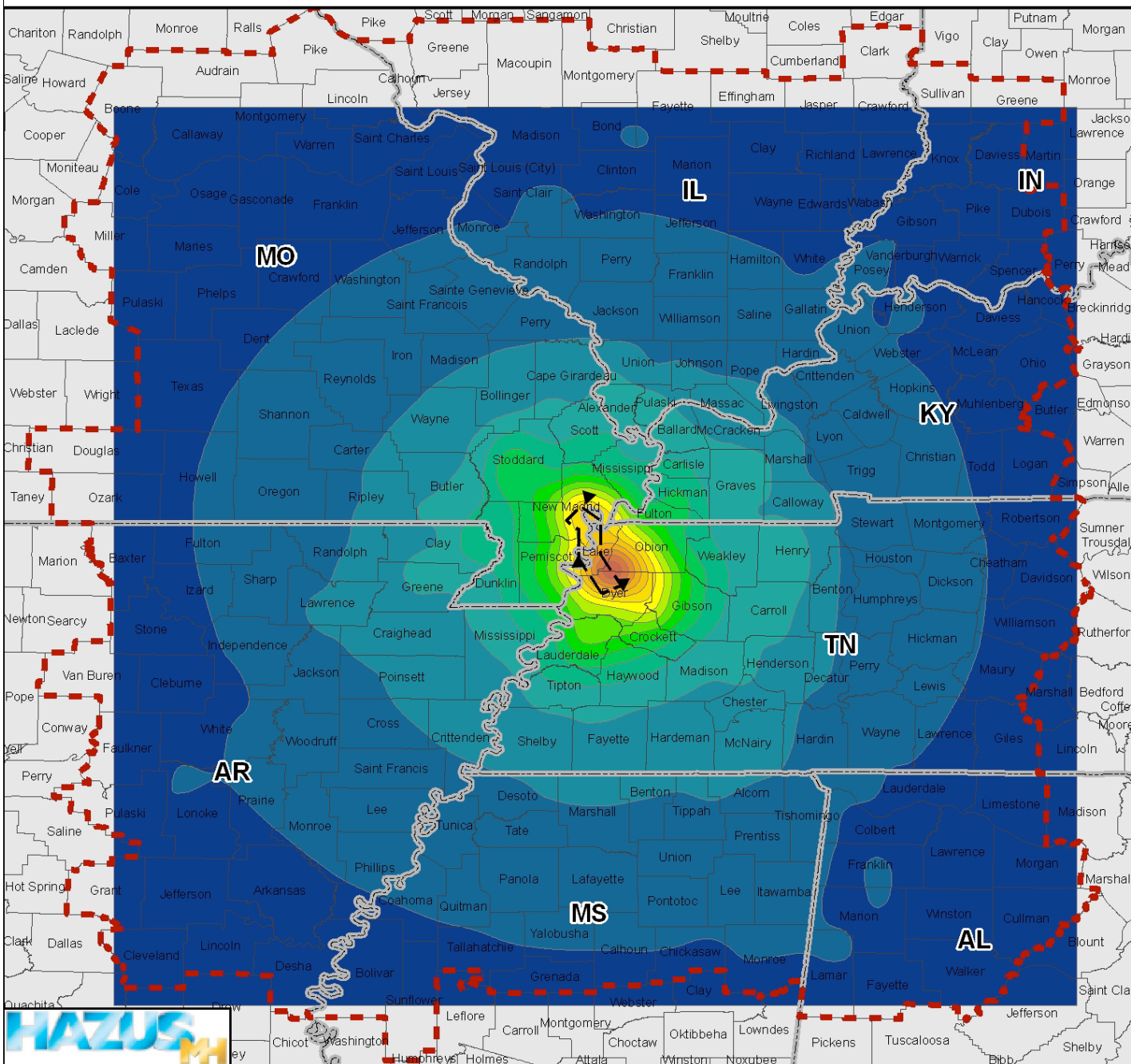
PGA



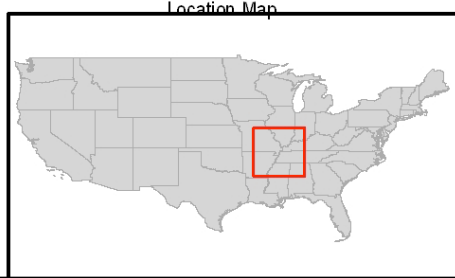
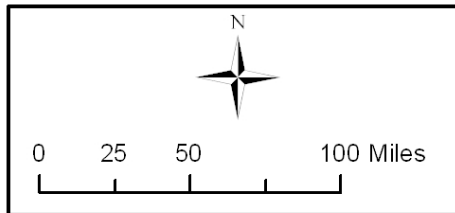
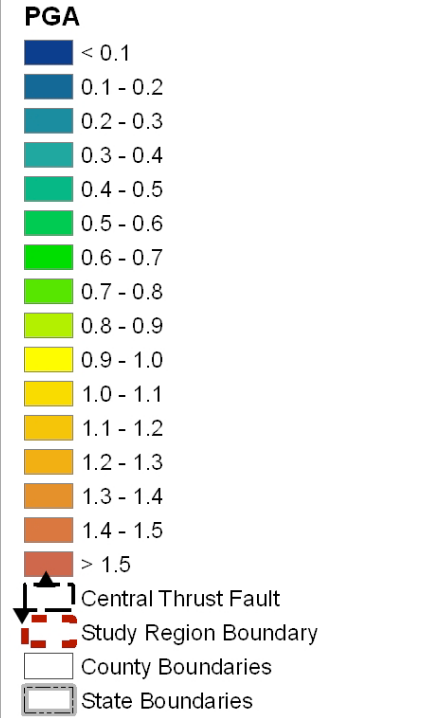
- Thrust Fault - NE Segment
- Study Region Boundary
- County Boundaries
- State Boundaries



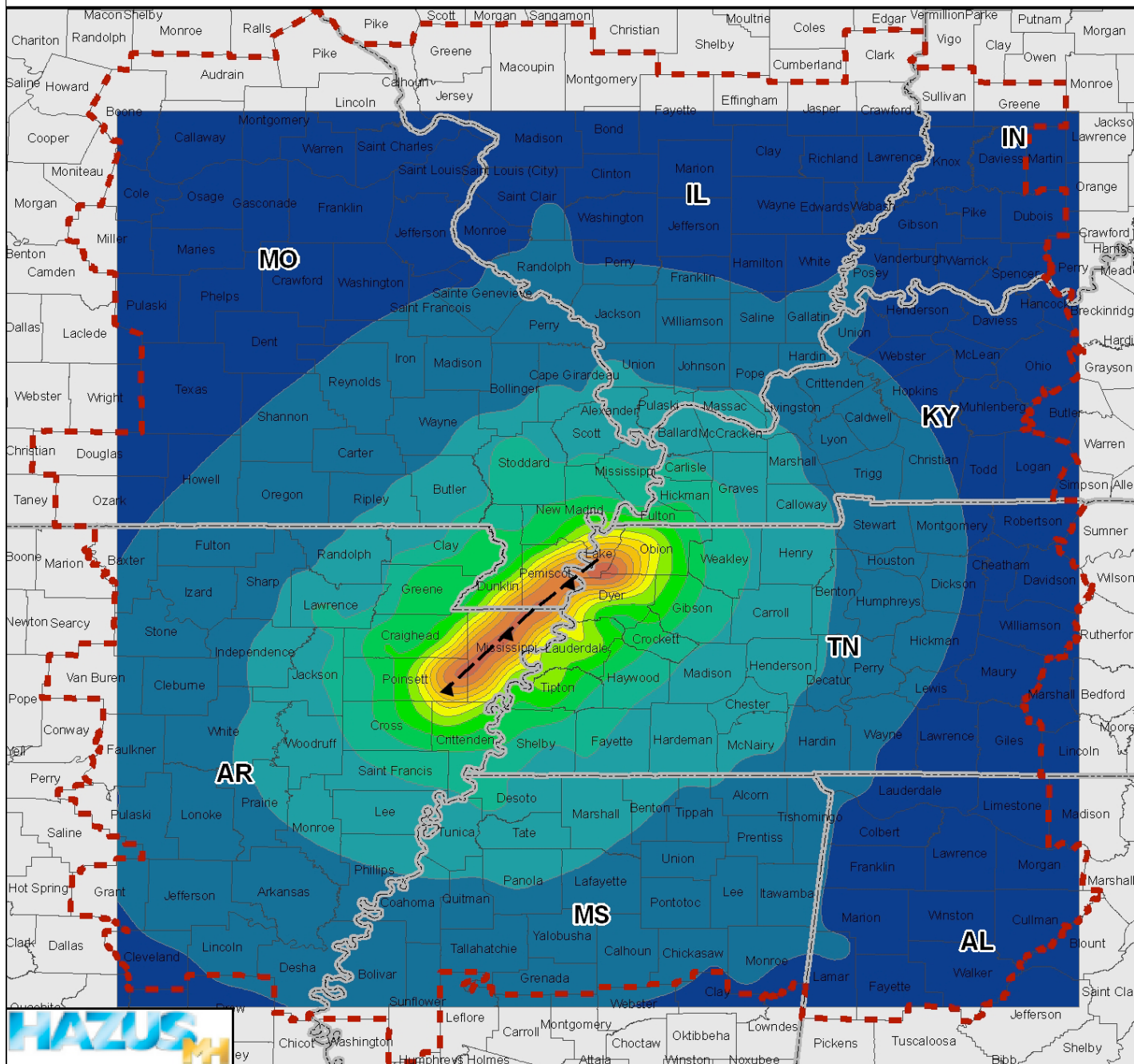
Peak Ground Acceleration - Earthquake Scenario: New Madrid Region



Central Thrust Scenario Magnitude 7.7

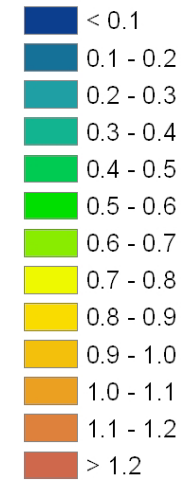


Peak Ground Acceleration & Source - Earthquake Scenario: New Madrid Region



Southwest Scenario Magnitude 7.7

PGA



- Thrust Fault - SW Segment
- Study Region Boundary
- County Boundaries
- State Boundaries

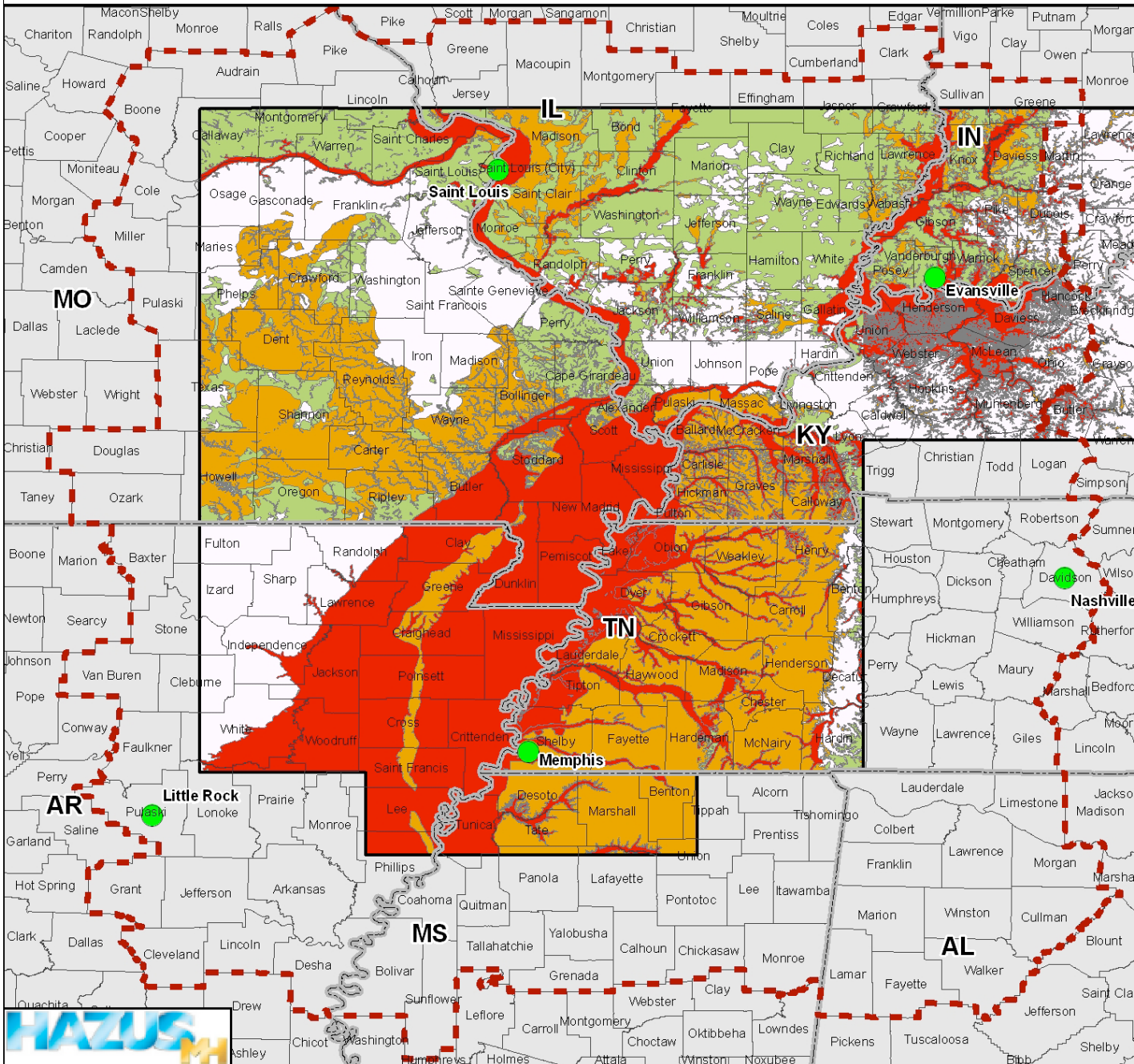


Location Map



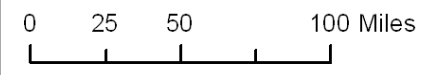
Liquefaction Susceptibility - Earthquake Scenario: New Madrid Region

New Madrid Scenario Magnitude 7.7



Liquefaction Susceptibility

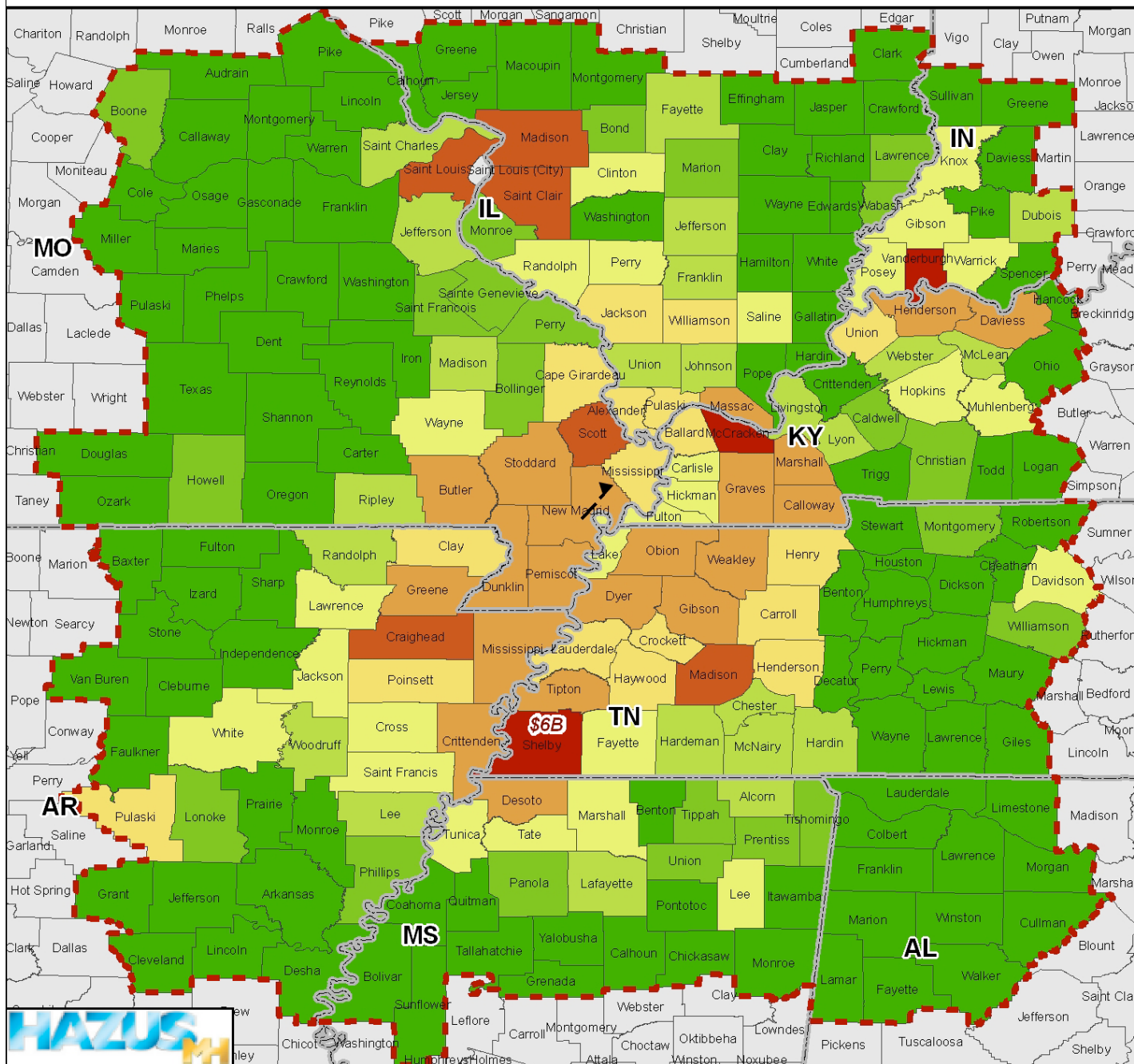
- None
- Very Low
- High
- Very High
- Major Cities
- Study Region Boundary
- County Boundaries
- State Boundaries



Location Map

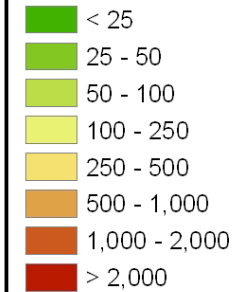


Estimated Total County Building Loss - Earthquake Scenario: New Madrid Region

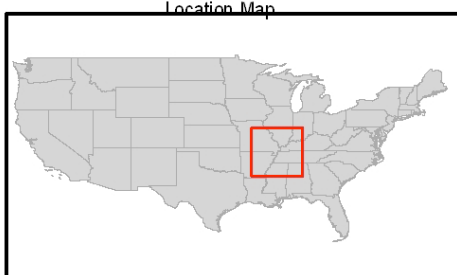
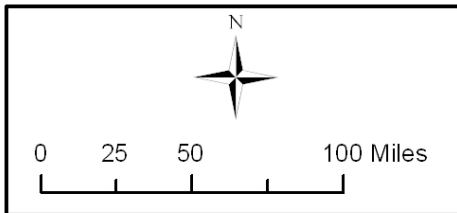


Northeast Scenario Magnitude 7.7

Direct Economic Losses (\$M)
(Losses are expressed in Millions of dollars and include all building related losses)



- Thrust Fault - NE Segment
- Study Region Boundary
- County Boundaries
- State Boundaries

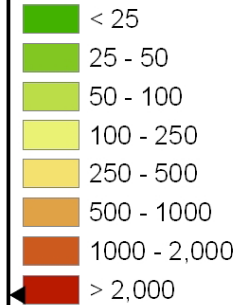


Estimated Total County Building Loss - Earthquake Scenario: New Madrid Region

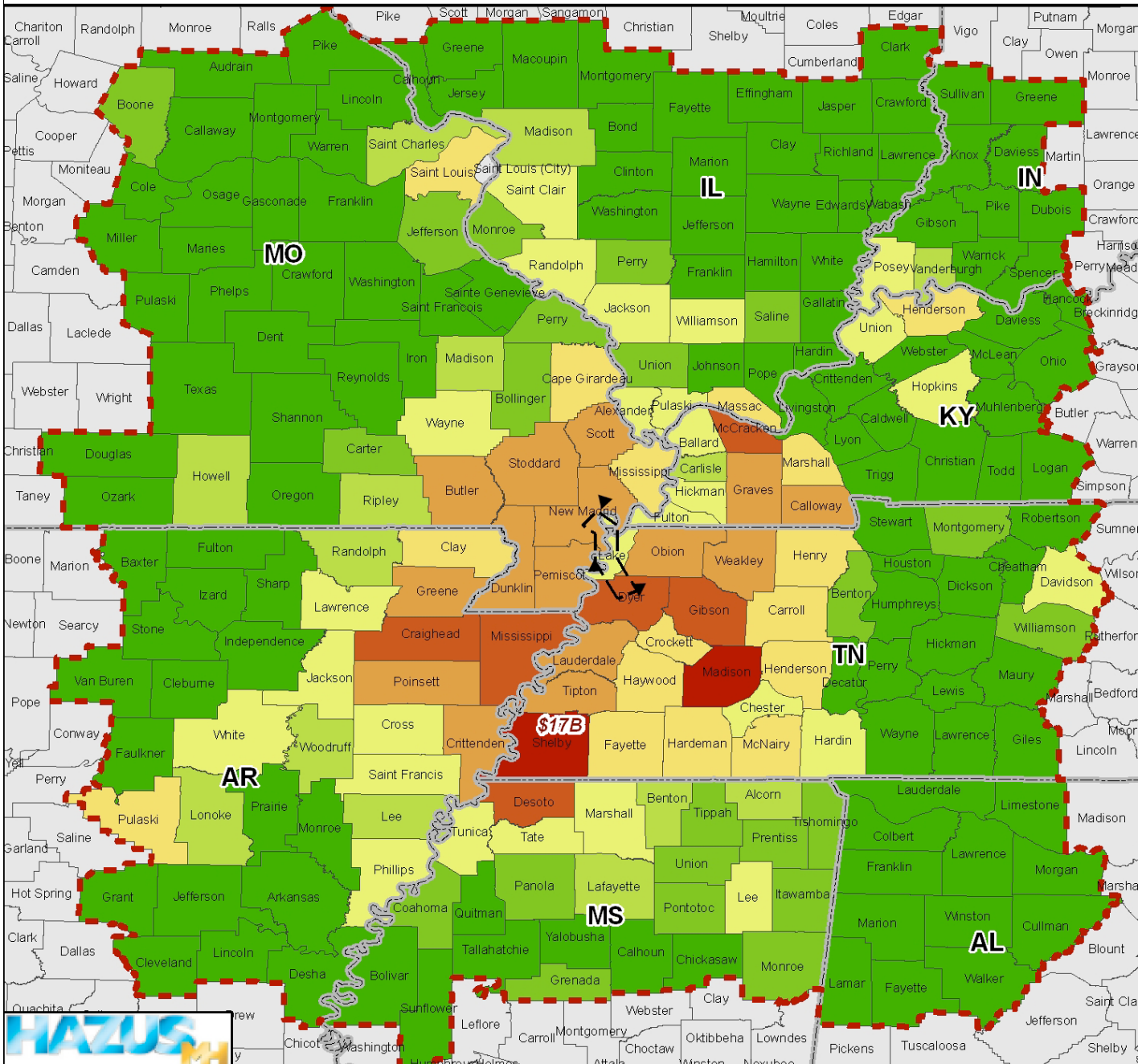
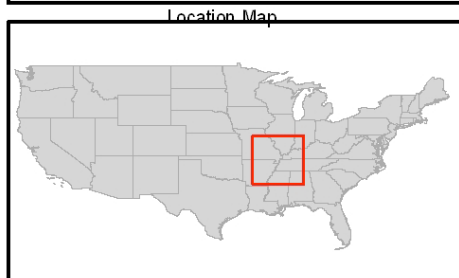
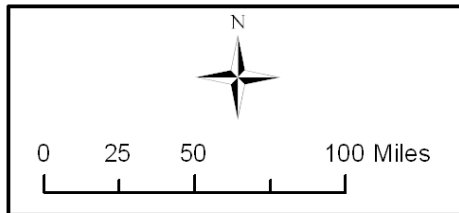
Central Thrust Scenario Magnitude 7.7

Direct Economic Losses (\$M)

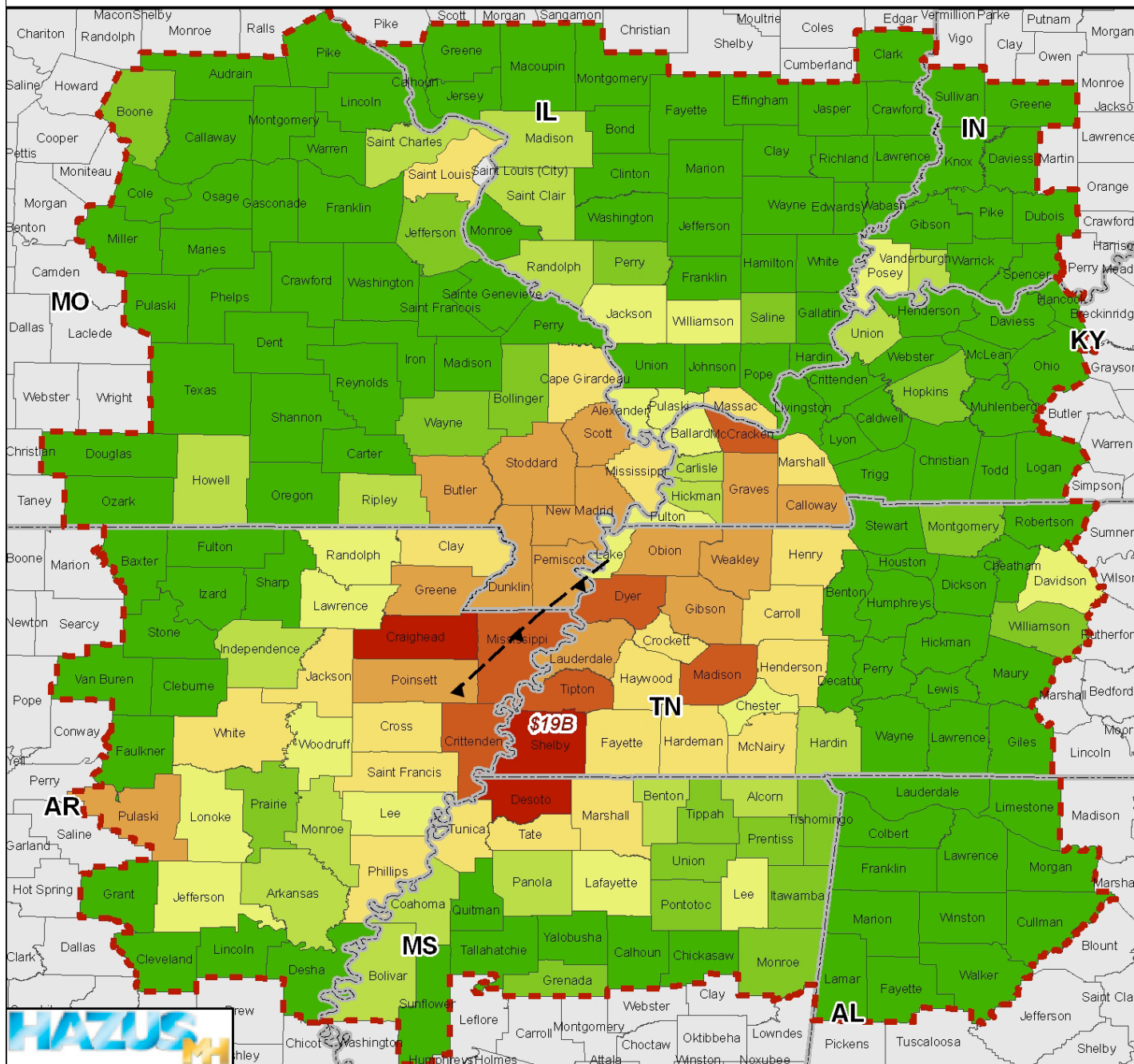
(Losses are expressed in Millions of dollars and include all building related losses)



- Central Thrust Fault
- Study Region Boundary
- County Boundaries
- State Boundaries

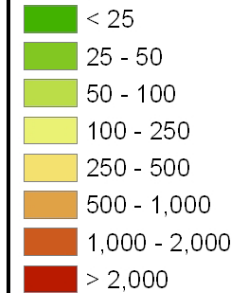


Estimated Total County Building Loss - Earthquake Scenario: New Madrid Region



Southwest Scenario Magnitude 7.7

Direct Economic Losses (\$M)
(Losses are expressed in Millions of dollars and include all building related losses)



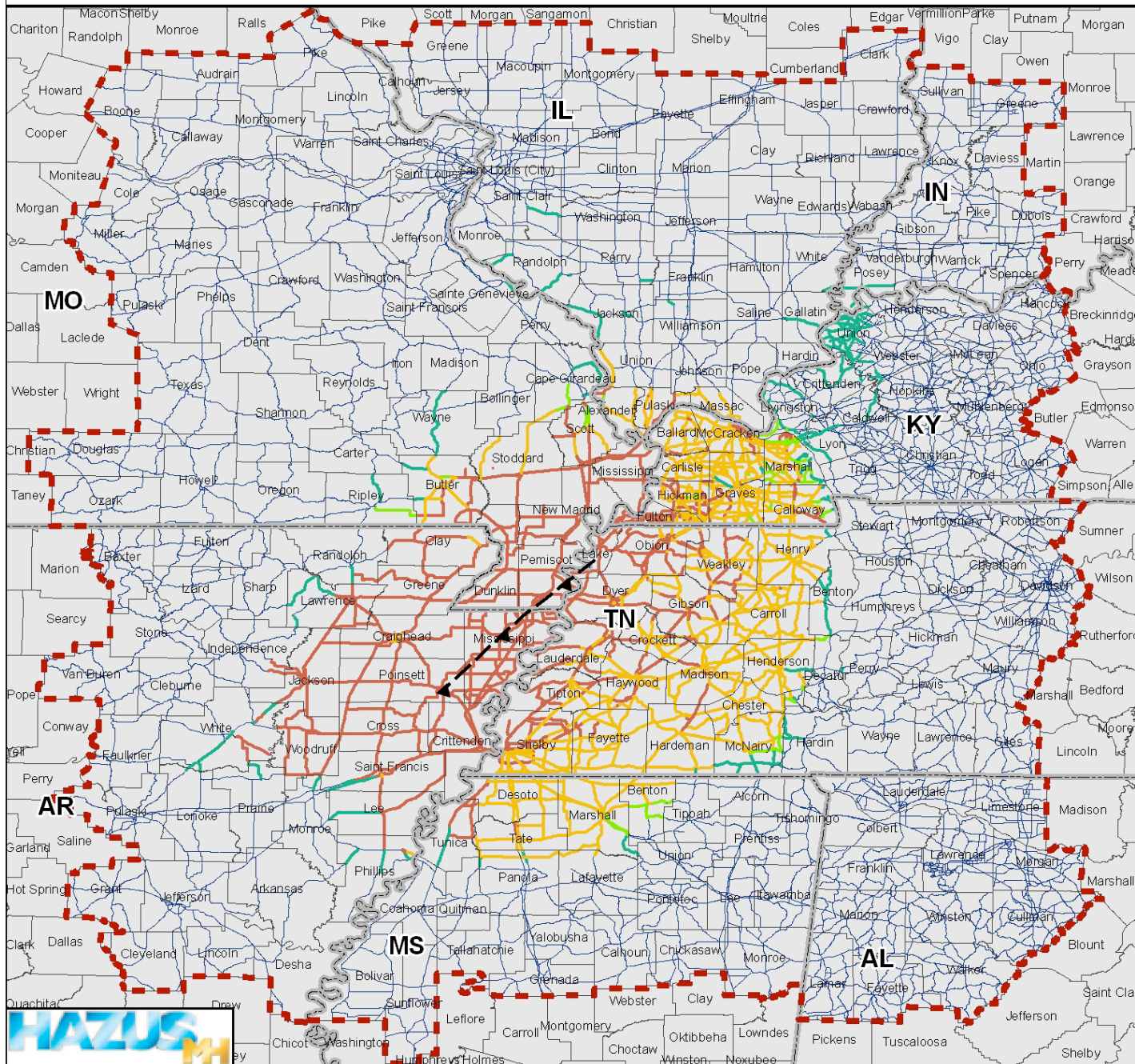
- Thrust Fault - SW Segment
- Study Region Boundary
- County Boundaries
- State Boundaries



Location Map



Estimated Highway Segment Damage - Earthquake Scenario: New Madrid Region



Southwest Scenario Magnitude 7.7

Probability of Moderate Damage
(Damage is expressed as the percentage chance that a given highway segment will realize at least moderate damage)

- < 1%
- 1 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 30%

- ▲ Thrust Fault - SW Segment
- Study Region Boundary
- County Boundaries
- State Boundaries



0 25 50 100 Miles

Location Map

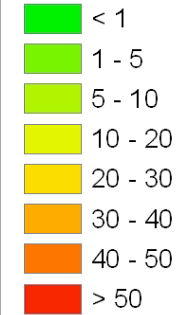


Estimated County Building Loss Ratios - Earthquake Scenario: New Madrid Region

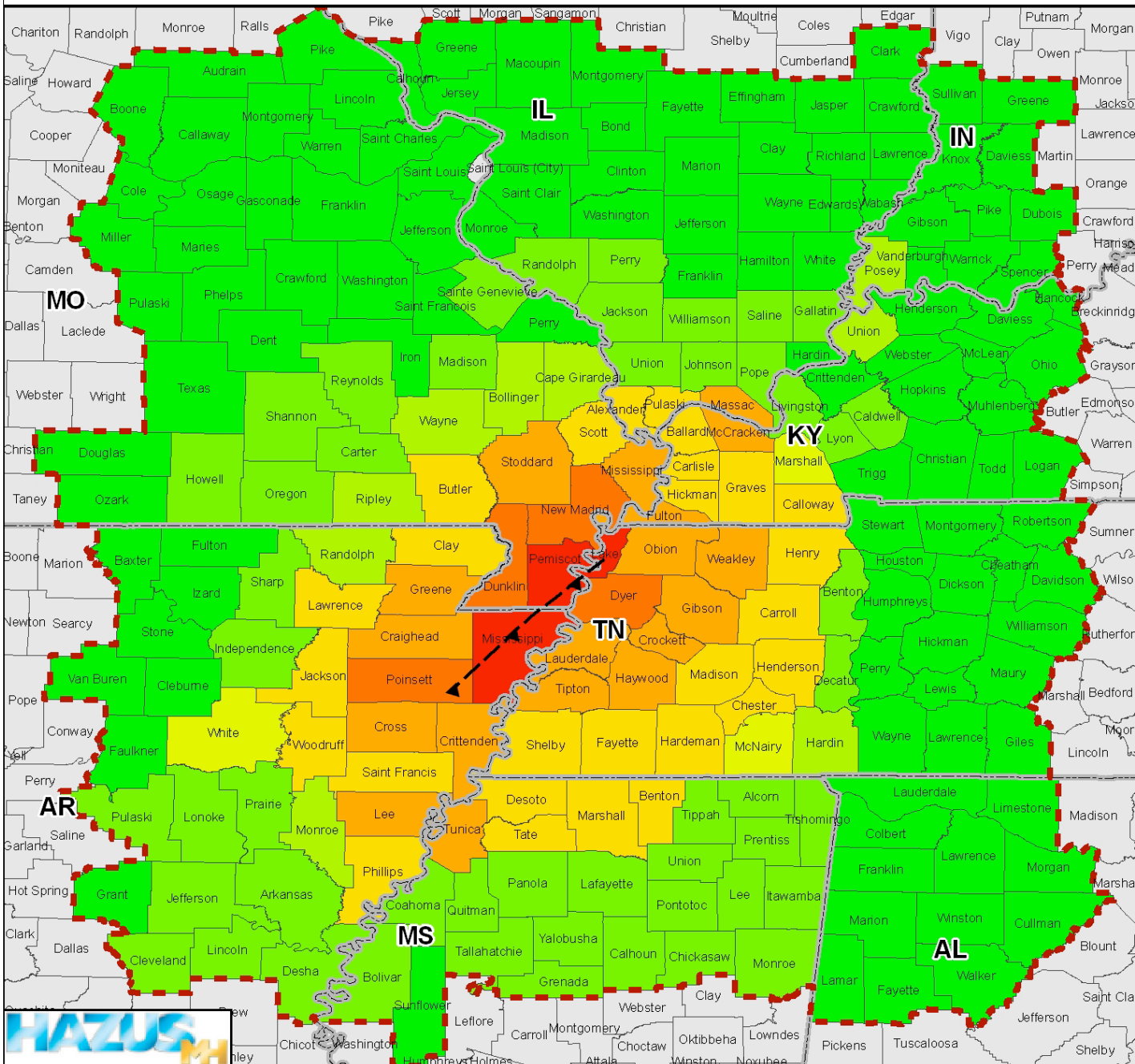
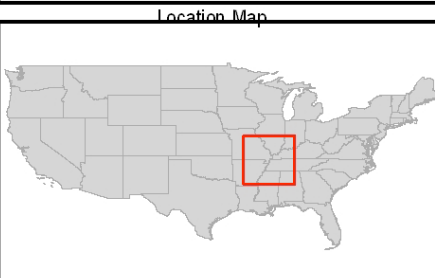
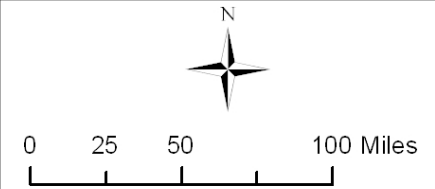
Southwest Scenario Magnitude 7.7

Building Loss Ratio

(Losses are expressed as a percentage of total building replacement value. Community Sustainability is generally considered at risk when losses exceed 10% of the built environment)



- Thrust Fault - SW Segment
- Study Region Boundary
- County Boundaries
- State Boundaries



New Madrid Baseline

Scenario	Bldg	Trans	Util.	Total
NE Segment	\$49.2	\$6.3	\$12.5	\$68.0
RT Segment	\$52.6	\$6.7	\$11.0	\$70.3
SW Segment	\$57.8	\$7.3	\$12.0	\$77.1



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007

Liquefaction Induced Losses Northeast Scenario (\$B)

State	AR	IL	IN	KY	MS	MO	TN	Total
No Liquefaction Layer	\$1.7	\$2.1	\$0.3	\$4.1	\$0.8	\$4.3	\$5.3	\$18.6
With Liquefaction Layer	\$6.3	\$5.3	\$2.9	\$8.3	\$1.4	\$9.9	\$7.3	\$41.3
% Loss Due to Liquefaction	73%	60%	88%	50%	46%	57%	27%	55%



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

Mitigation Priorities

Unreinforced Masonry Related Casualties

<i>Time of Day</i>	Nighttime	Daytime	Commute
<i>Severity 2, 3 & 4 Casualties w/ out URM</i>	1,750	3,750	5,500
<i>Severity 2, 3 & 4 Casualties w/ URM</i>	16,500	16,550	17,300
<i>% Casualties Caused by URM</i>	89%	77%	68%



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007

CUSEC Area Suite of Scenarios

- These 1811-12 Characteristic Earthquakes provide worst-case scenarios for TN, AR, KY, SE MO
- Wabash Area Scenario needed for IL, IN, and Southern Illinois SZ for St. Louis, MO
- Moderate southern source zone scenario needed for AL, MS

Other New Madrid Estimates

- Lloyds of London (\$74B)
- MAE Center Website (\$200B)
- MAE Center Research Publication (\$50B)



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

Baseline Scenarios - Observations

- URM's cause most the serious casualties
- Ground failure plays a significant role
- More than 400K households without potable water for 90-days or more (1M/4.2M on day one)
- Major transportation issues over a large geographic area
- 250K displaced households
- 32M tons of debris



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007

Not Assessed/Included in Baseline Scenarios

- *2005 Building Valuations (available in MR-2)*
- *St. Louis and Memphis detailed liquefaction susceptibility*
- *Landslide susceptibility*
- *Refined building occupancy mapping schemes*
- *Review of low and moderate seismic design assignments (will impact economic losses and could significantly increase casualties)*
- *Mississippi River Bridges- large multi \$B system*
- *Pipeline/infrastructure direct and indirect losses*
- *Transportation network analysis -- NBI, highway geospatial accuracy limitations – requires State DOT data*
- *Unused inventory attributes - replacement costs – can be refined with other attributes (runway length, number of students, HSIP attributes), total regional annual income, demographics (age, ethnicity, income, homeownership)*
- *No assessor data—(occupancy mapping by decade)*
- *No cascading impacts—levee failures, hazmat releases, dams*



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007

Improve Occupancy Mapping

Occupancy Mapping

Select the mapping scheme to use, and right-click mouse for context menu.

ID	Scheme Name	Description	# Tracts Assigned to	Created On
1	AL1	AL Default Mapping Scheme	143	12/13/2002
2	AR1	AR Default Mapping Scheme	235	12/13/2002
3	AR2	AR Default Mapping Scheme	90	12/13/2002
4	IL1	IL Default Mapping Scheme	329	12/13/2002
5	IL2	IL Default Mapping Scheme	11	12/13/2002
6	IN1	IN Default Mapping Scheme	116	12/13/2002
7	KY1	KY Default Mapping Scheme	154	12/13/2002
8	KY2	KY Default Mapping Scheme	9	12/13/2002
9	MO1	MO Default Mapping Scheme	562	12/13/2002
10	MO2	MO Default Mapping Scheme	83	12/13/2002

New Madrid-
Does not consider median year built, adoption and enforcement

context menu.

	# Tracts Assigned to	Created On
191	1	2/7/2006 3:32:16 PM
192	1	2/7/2006 3:32:16 PM
193	1	2/7/2006 3:32:16 PM
194	0	1/23/2006 5:06:46 PM
195	10	1/23/2006 5:08:06 PM
196	19	1/23/2006 5:08:58 PM
197	74	1/23/2006 5:09:43 PM
198	58	1/23/2006 5:10:51 PM
199	59	1/23/2006 5:11:57 PM
200	26	1/23/2006 5:12:41 PM

Wasatch-Based on Salt Lake County assessor data, assigned to surrounding region based on median year built

191	BIT49035113517	49035113517	1	2/7/2006 3:32:16 PM
192	BIT49035110103	49035110103	1	2/7/2006 3:32:16 PM
193	BIT49035102300	49035102300	1	2/7/2006 3:32:16 PM
194	UT - 1930s	Based on 49035103700	0	1/23/2006 5:06:46 PM
195	UT - 1940s	Based on 49035102900	10	1/23/2006 5:08:06 PM
196	UT - 1950s	Based on 49035104000	19	1/23/2006 5:08:58 PM
197	UT - 1960s	Based on 49035110103	74	1/23/2006 5:09:43 PM
198	UT - 1970s	Based on 49035112000	58	1/23/2006 5:10:51 PM
199	UT - 1980s	Based on 49035113405	59	1/23/2006 5:11:57 PM
200	UT - 1990s	Based on 49035112815	26	1/23/2006 5:12:41 PM



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

Improve Occupancy Mapping

View Mapping Scheme

Parameters for AR1. Right-click cell for context menu.

Occupancy	Wood %	Concrete %	Steel %	Masonry %	Manu. Housing %	Total
RES1	87	0	0	13	0	100
RES2	0	0	0	0	100	100
RES3A	75	0	0	25	0	100
RES3B	75	0	0	25	0	100
RES3C	75	0	0	25	0	100
RES3D	75	0	0	25	0	100
RES3E	75	0	0	25	0	100
RES3F	75	0	0	25	0	100
RES4	50	0	0	50	0	100
RES5	20	45	0	35	0	100
RES6	90	0	0	10	0	100
COM1	30	10	30	30	0	100
COM2	10	30	30	30	0	100

Yellow= default building type distribution. Green= user-defined building type distribution.

New Madrid-
Default distribution scheme

Edit Mapping Scheme

Parameters for BIT49035100800. Right-click cell for context menu.

Occupancy	Wood %	Concrete %	Steel %	Masonry %	Manu. Housing %	Total
RES1	25	0	0	75	0	100
RES2	0	0	0	0	100	100
RES3A	72	0	0	28	0	100
RES4	0	78	0	22	0	100
RES5	7	40	19	34	0	100
RES6	22	20	27	31	0	100
COM1	0	0	0	100	0	100
COM2	10	7	59	24	0	100
COM3	100	0	0	0	0	100
COM4	0	0	0	100	0	100
COM5	13	12	45	30	0	100
COM6	2	25	55	18	0	100
COM7	24	8	40	28	0	100

Yellow= default building type distribution. Green= user-defined building type distribution.

Print OK Cancel

Wasatch-Revised distribution
based on Salt Lake
County assessor data.



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

Inventory Attributes

Essential Facilities Inventory

Medical Care Facilities | Emergency Response | **Schools**

Table

Replacement Cost (thous. \$)	NumStudents	Be
\$490.00	174	
\$490.00	519	
\$490.00	224	
\$490.00	167	
\$490.00	206	
\$490.00	151	
\$490.00	201	
\$490.00	910	
\$490.00	194	
\$490.00	232	
\$490.00	348	
\$490.00	38	
\$490.00	72	
\$490.00	48	
\$490.00	14	
\$490.00	117	
\$490.00	110	

Close

Indirect Economic Loss Analysis Parameters

Synthetic Economy
Define the current level of employment and income and the composition of the economy

Study region economy:

Total number of employees:

Annual Income (\$millions):

Type of synthetic economy:

- Primarily manufacturing economy
- Service economy with manufacturing being secondary sector
- Service economy with trade being secondary sector

< Back Next > Cancel



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th, 2007

Why Use HAZUS for NMSZ Catastrophic Planning

- *Identify Vulnerabilities and Develop Mitigation Priorities*
- *Avoid Duplication of Efforts*
- *Use Resources for Inventory (GIS) and Hazard Information*
- *Produce Updateable Scenario-Journey not a destination*
- *Nationally Consistent Methodology*



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007

THE END



<http://www.fema.gov/plan/prevent/hazus>



FEMA

ESRI-HAZUS in Catastrophic Planning

June 20th , 2007