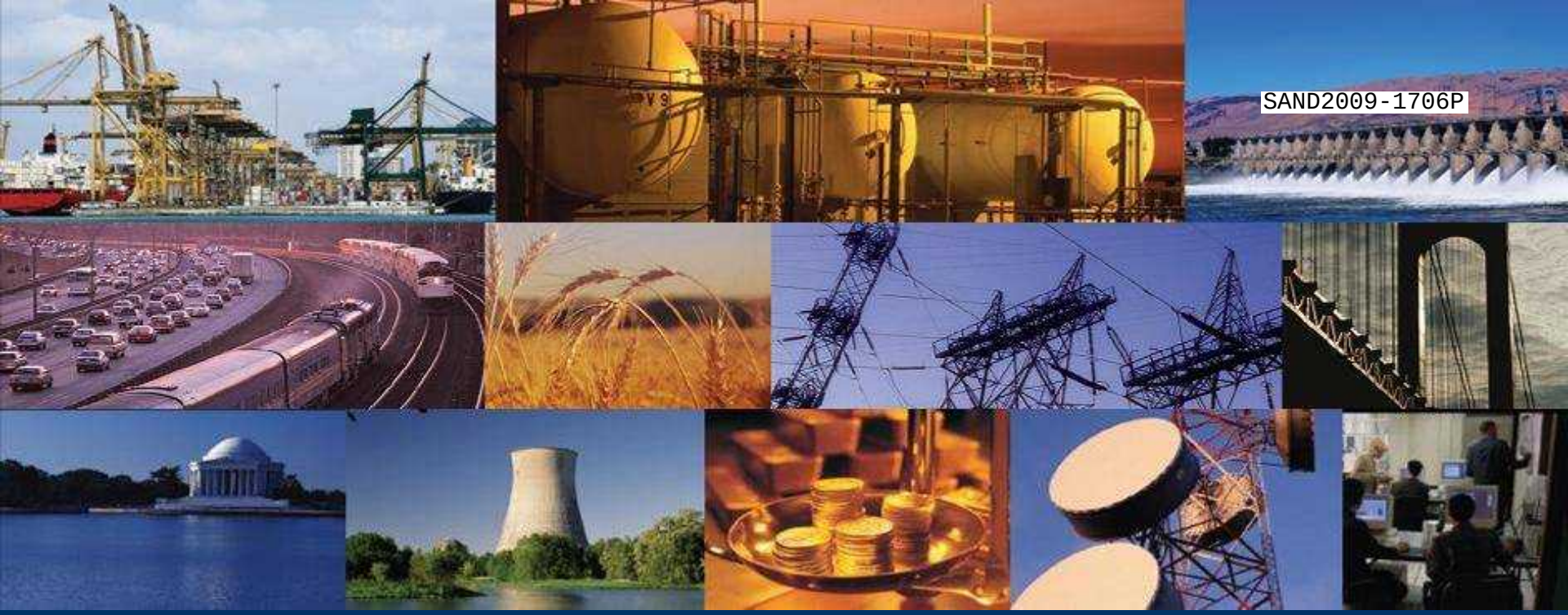

Office of Infrastructure Protection (IP)

National Infrastructure Simulation and Analysis Center (NISAC)

NISAC NMSZ Scenario Analysis Overview, March 24, 2009

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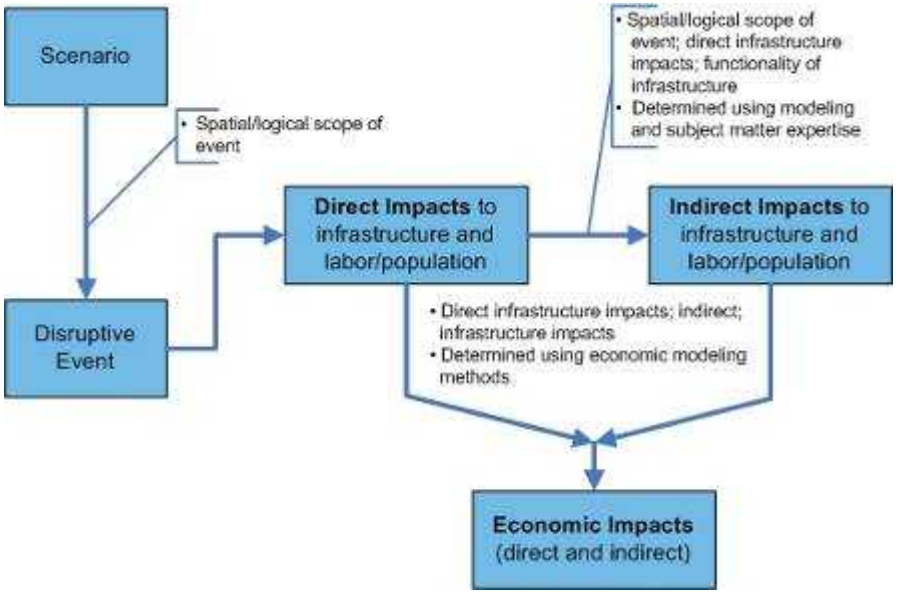
UNCLASSIFIED

Introduction

- Analysis Purpose and Objectives
  - Examine impacts to population
  - Examine impacts and interdependencies of all CIKR sectors
  - Examine economic consequences
  - Identify recommendations for expansion of analysis and/or capabilities
- Methodology
  - Apply NISAC methodology for infrastructure and economic impact analysis utilized for other types of scenario and real-world events
  - Infrastructure, population and economic data from a variety of sources
- Key Assumptions
  - USGS EHP Scenario NM SW Segment M7.7
  - 0400 CST 3 January 2009



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Introduction

- Data Sources
  - Population
    - HAZUS-MH
    - ESRI
    - LandScan USA 2006
  - Economics
    - Bureau of Economic Analysis
    - Bureau of Census
    - Bureau of Labor Statistics
    - Dun & Bradstreet
    - County Business Patterns
  - Infrastructure:
    - Platts (EP, NG, Transportation, Nuclear)
    - FERC (EP)
    - HSIP GOLD (IT, Transportation, Banking & Finance, Chemicals, Emergency Services, Gov't, Nuclear, Postal, Public Health)
    - CERA (NG)
    - ANL (POL)
    - EIA (POL)
    - Telcordia LERG (Telecomm)
    - DOT NTAD (Transportation)
    - EPA SDWIS (Water)
    - USDA (Agriculture)
    - FDIC (Banking & Finance)
    - SRI (Chemicals)
    - Dun & Bradstreet (Commercial, Critical Manufacturing)
    - USACE NID (Dams)
    - DMDC SIAD (DIB)
    - HAZUS-MH (Transportation, Water, Emergency Services, Gov't, Public Health)

Introduction

- Gaps
  - Scenario assumes single seismic event
    - NMSZ usually sees multiple significant events
    - This would impact modeling
    - Consider series of events for future efforts, and for examination of response/recovery planning

Effects on the Man-Made Environment

- CIKR
  - 'Core Service' Sectors
    - Energy
    - Telecommunications
    - Transportation
    - Water & Wastewater
  - 'Response & Recovery' Sectors
    - Banking & Finance
    - Emergency Services
    - Government Facilities
    - Public Health & Healthcare
  - 'Public Hazard' Sectors
    - Chemical Facilities
    - Dams
    - Nuclear Reactors, Materials & Waste
  - 'Supply Chain' Sectors
    - Agriculture & Food
    - Commercial Facilities
    - Critical Manufacturing
    - Defense Industrial Base
    - Postal & Shipping
  - Other Sectors
    - Information Technology
    - Monuments & Icons

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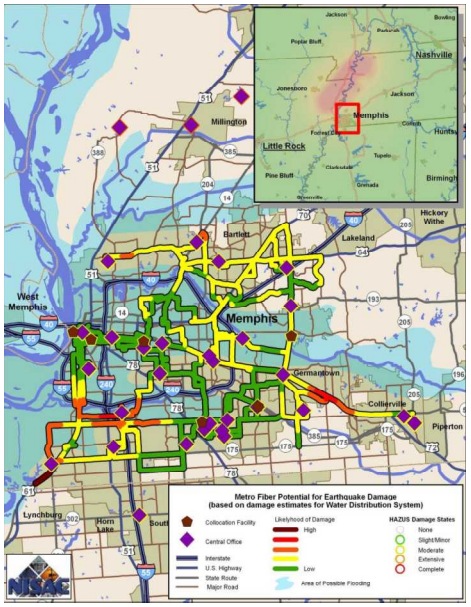
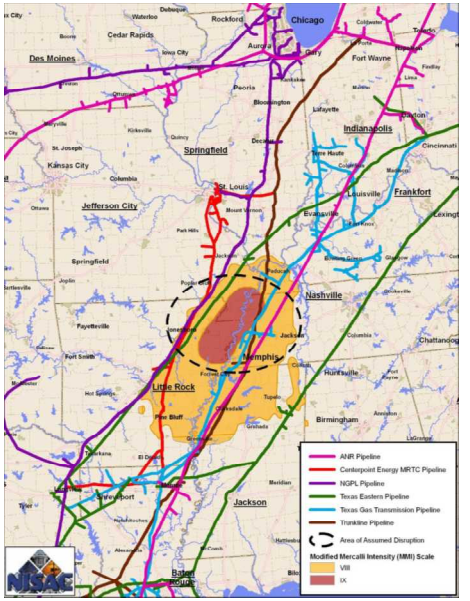
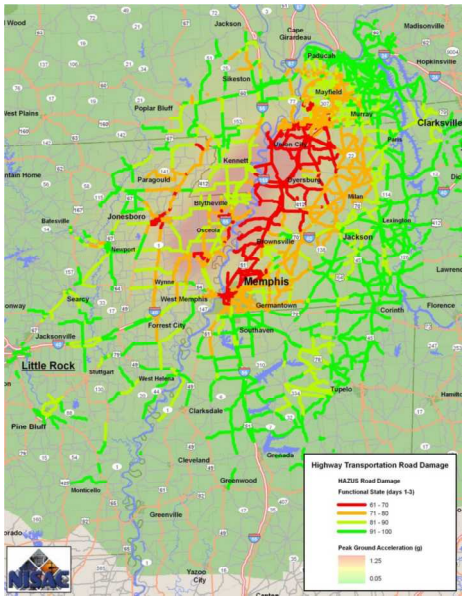
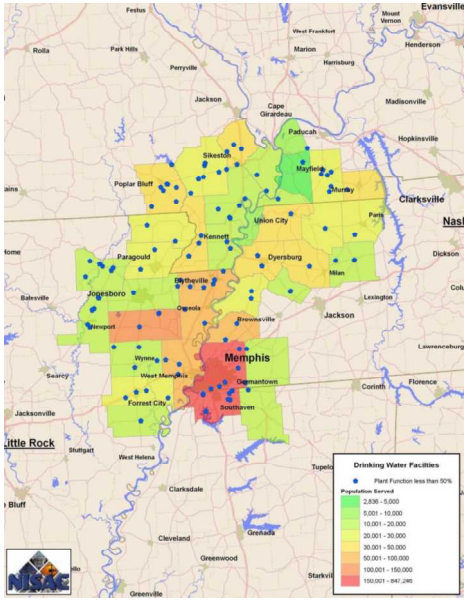
Effects on the Man-Made Environment

- ‘Core Service’ Sectors
  - Extended regional disruptions where physical damage is present
    - Impacts the ability to support other sectors, maintain flow of commerce
  - Potential for cascading disruptions beyond extent of physical damage where infrastructure systems are well-connected
  - Restoration of service requires coordinated action among multiple players with potentially disparate priorities, often in the same location









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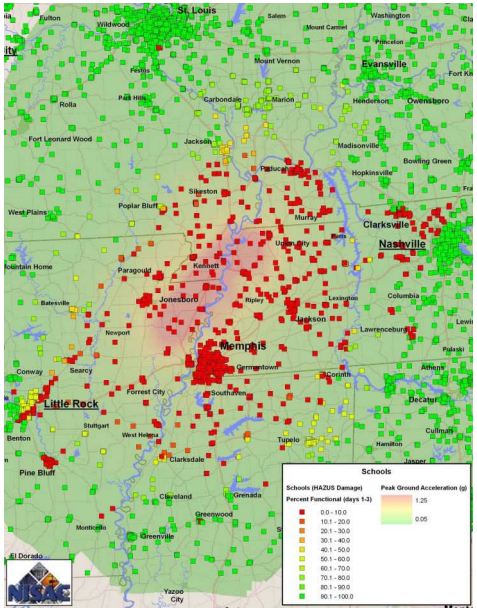
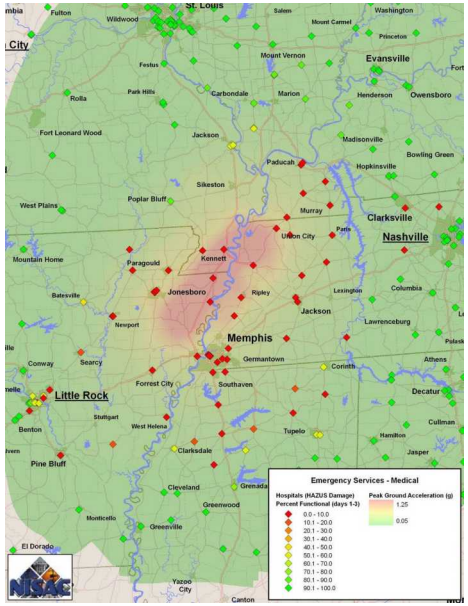
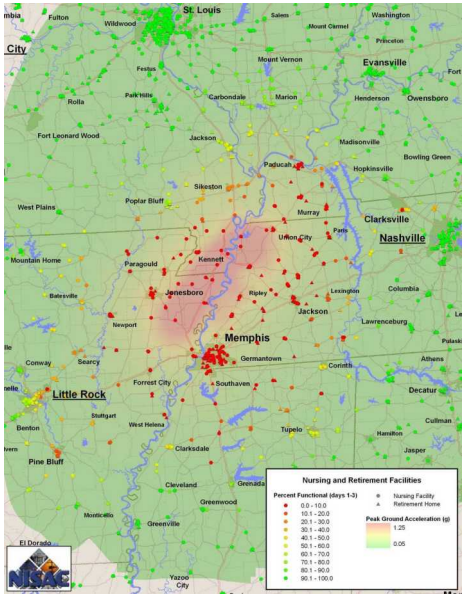
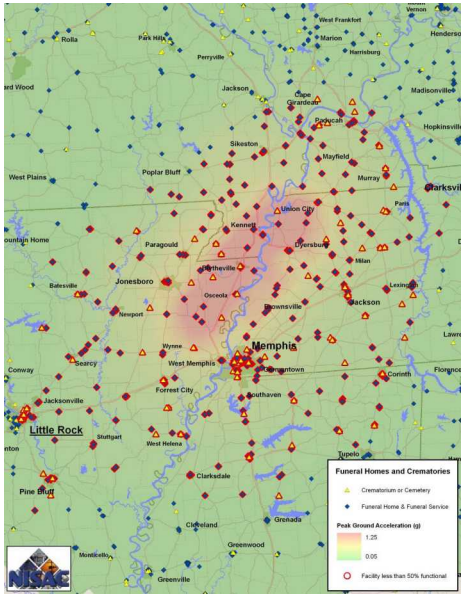
Effects on the Man-Made Environment

- ‘Response & Recovery’ Sectors
  - Systemic insufficiencies due to direct physical damage to each sector and to core service sectors









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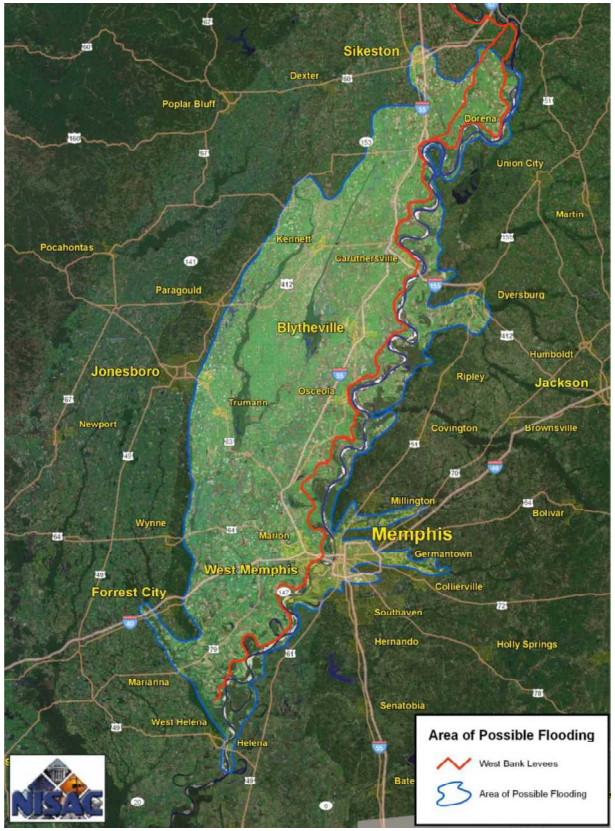
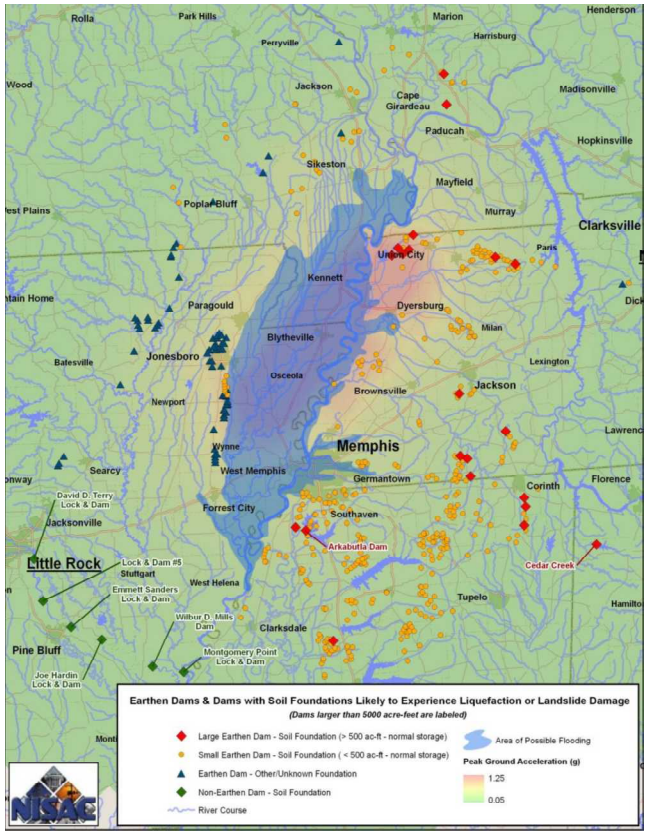
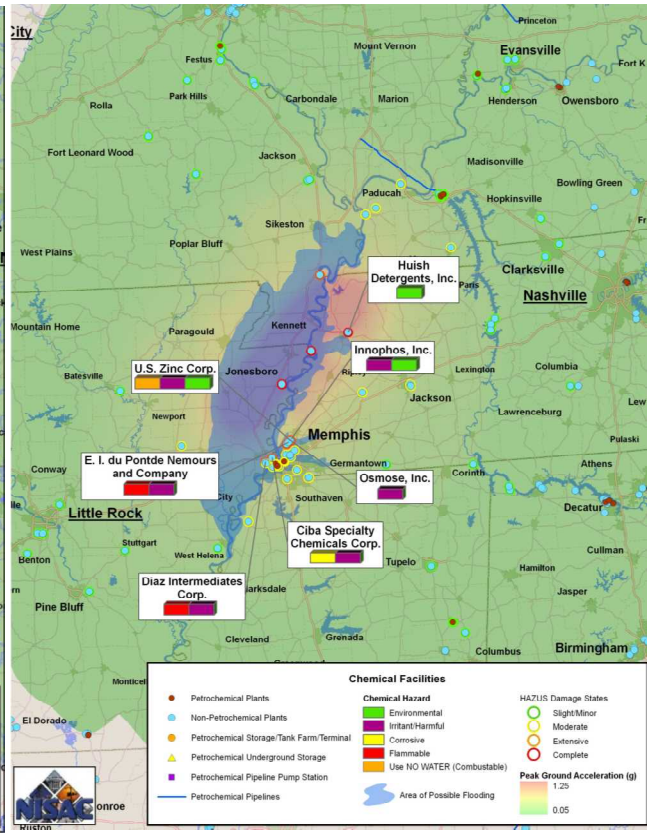
Effects on the Man-Made Environment

- ‘Public Hazard’ Sectors
  - Create potential for increased damage, injury, mortality, casualty







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Effects on the Man-Made Environment

- ‘Supply Chain’ Sectors
  - Where region’s routes or facilities are limiting factors, create significant (potentially insurmountable) supply chain impacts
  - Where alternatives exist, increase cost and create potential for long-run systemic change

2-Digit NAICS	Description	Number of Businesses	Number of Employees
31	Manufacturing: Foods, Textiles, and Clothing	23	2,586
32	Manufacturing: Wood Products, Paper Products, Petroleum/Coal Products, Rubber and Plastics, Nonmetallic Mineral Products	33	5,673
33	Manufacturing: Metals, Machinery, Electronics and Electrical Equipment, Transportation Equipment, Miscellaneous	80	7,861
42	Wholesale Trade	194	11,574
45	Retail Trade	1	74
51	Information	5	176
54	Professional, Scientific, and Technical Services	2	101
Total		**338**	**28,045**

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Effects on the Man-Made Environment

- Gaps
  - Develop infrastructure recovery models that simulate dependencies and outages in multiple infrastructures to improve estimates of recovery time and provide more information for recovery planning
  - Model power grid disruption to provide better estimates of power outage areas and more detailed analysis of impacts on emergency response
  - Work with industry to evaluate the effectiveness of adding multi-directional flow capacity to single direction natural gas pipelines outside the NMSZ and develop incentives for releasing natural gas from storage
  - Work with industry to develop modeling and analysis capability to understand the distribution of impacts in the petroleum fuels sector; identify impacts on recovery and identify effective mitigations
  - Evaluate potential environmental impacts due to pipeline ruptures and releases of hazardous materials
  - Perform modeling of multiple, simultaneous dam failures and landslides to improve understanding of potential damages and population impacts and to evaluate the value of redesign/replacement/removal of earthen and soil foundation dams
  - Work with industry to evaluate the potential damage to public water and wastewater systems and to identify funding mechanisms (that minimize recovery times) for rebuilding public water and wastewater systems in the region
  - Conduct more detailed modeling of telecommunication network impacts and recovery processes to improve understanding of the potential communication disruptions and planning and design of cost-effective mitigations
  - Conduct a more detailed analysis of school structures to evaluate the risks to schools and the need for changes to building codes

Effects on the Population

- Displacement
- Casualties
- Fatalities
- Economics

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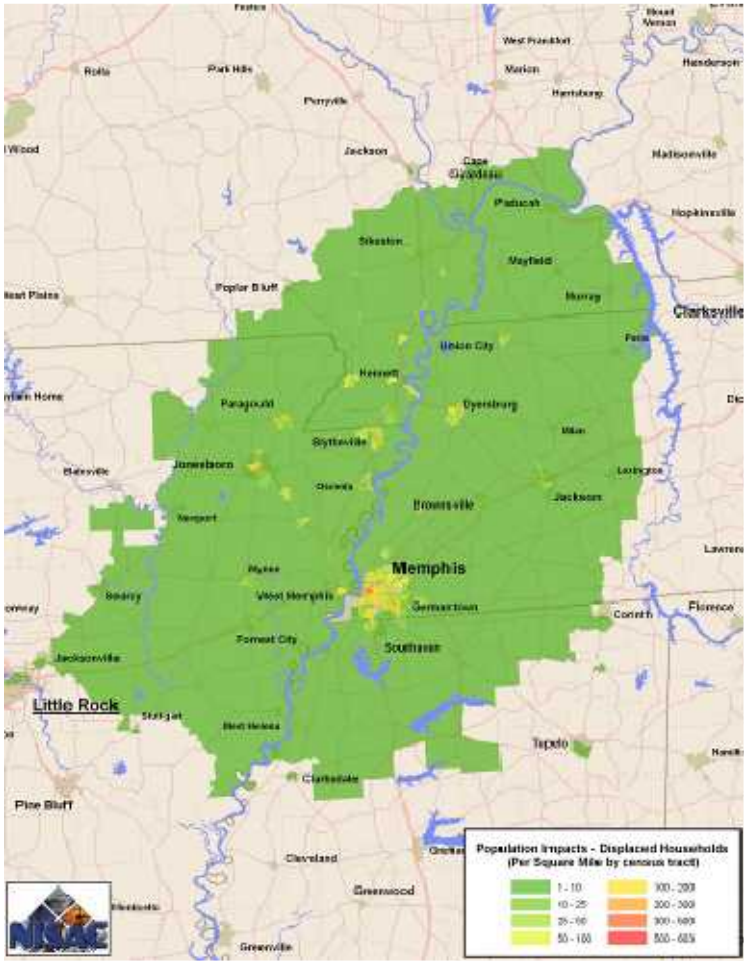
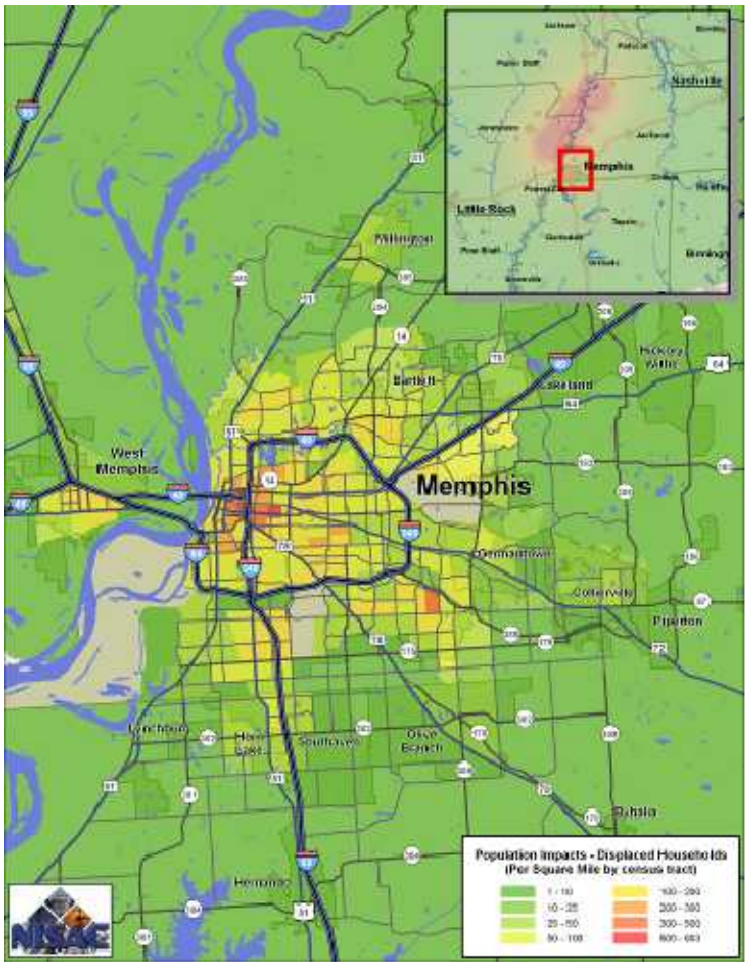
Effects on the Population

- Displacements





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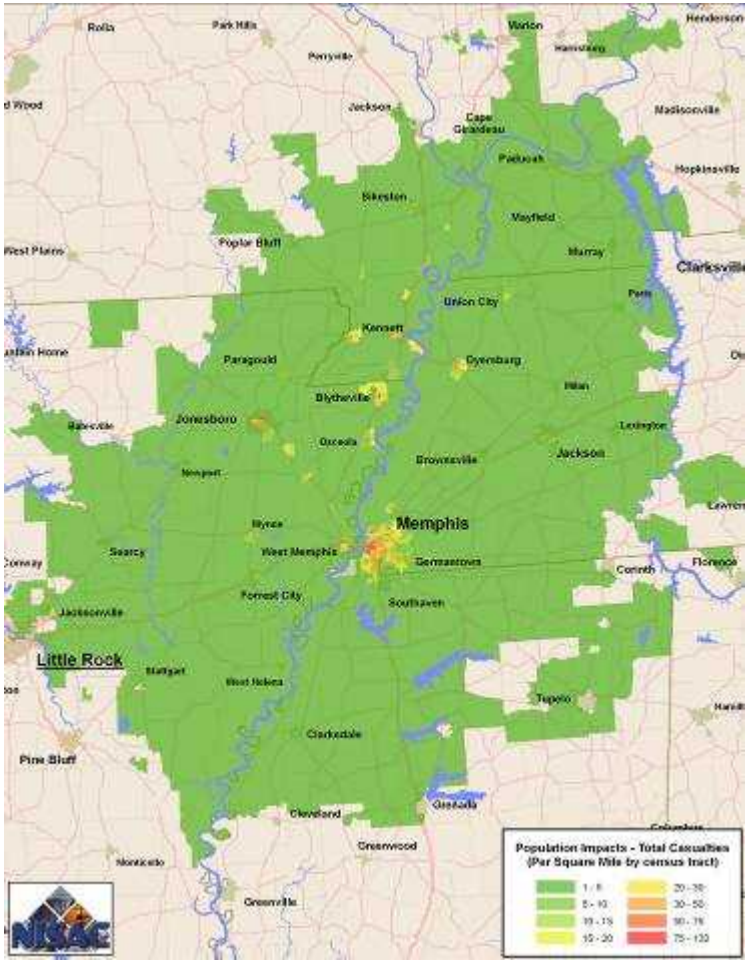
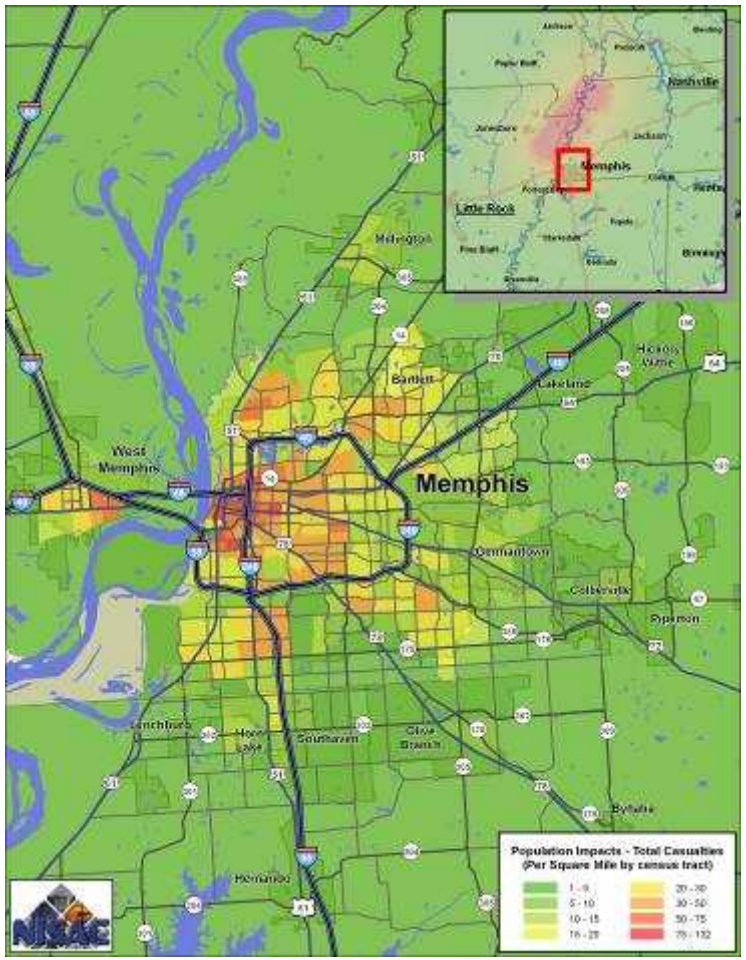
Effects on the Population

- Casualties





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Effects on the Population

- Time of day makes significant difference
  - Night casualties/injuries higher in residences
  - Day casualties higher in commercial facilities, schools

Time of Day[a]	State	Minor Injuries	Major Injuries	Life-threatening Injuries	Deaths
Night time (2 am)	Arkansas	5,137	1,366	163	344
Night time (2 am)	Illinois	58	5	0	0
Night time (2 am)	Kentucky	460	34	3	7
Night time (2 am)	Mississippi	721	120	2	8
Night time (2 am)	Missouri	2,341	658	82	170
Night time (2 am)	Tennessee	8,305	2,020	176	414
Night time (2 am)	**TOTAL**	**16,992**	**4,233**	**426**	**933**
Day time (2 pm)	Arkansas	5,678	1,631	219	450
Day time (2 pm)	Illinois	42	1	0	0
Day time (2 pm)	Kentucky	440	67	3	8
Day time (2 pm)	Mississippi	1,027	201	12	39
Day time (2 pm)	Missouri	1,854	542	74	149
Day time (2 pm)	Tennessee	11,373	2,915	315	695
Day time (2 pm)	**TOTAL**	**20,414**	**5,357**	**623**	**1,341**
Commute time (5 pm)	Arkansas	4,801	1,353	181	358
Commute time (5 pm)	Illinois	38	0	0	0
Commute time (5 pm)	Kentucky	369	54	3	6
Commute time (5 pm)	Mississippi	822	154	10	23
Commute time (5 pm)	Missouri	1,668	473	60	132
Commute time (5 pm)	Tennessee	8,965	2,263	219	504
Commute time (5 pm)	**TOTAL**	**16,663**	**4,297**	**473**	**1,023**

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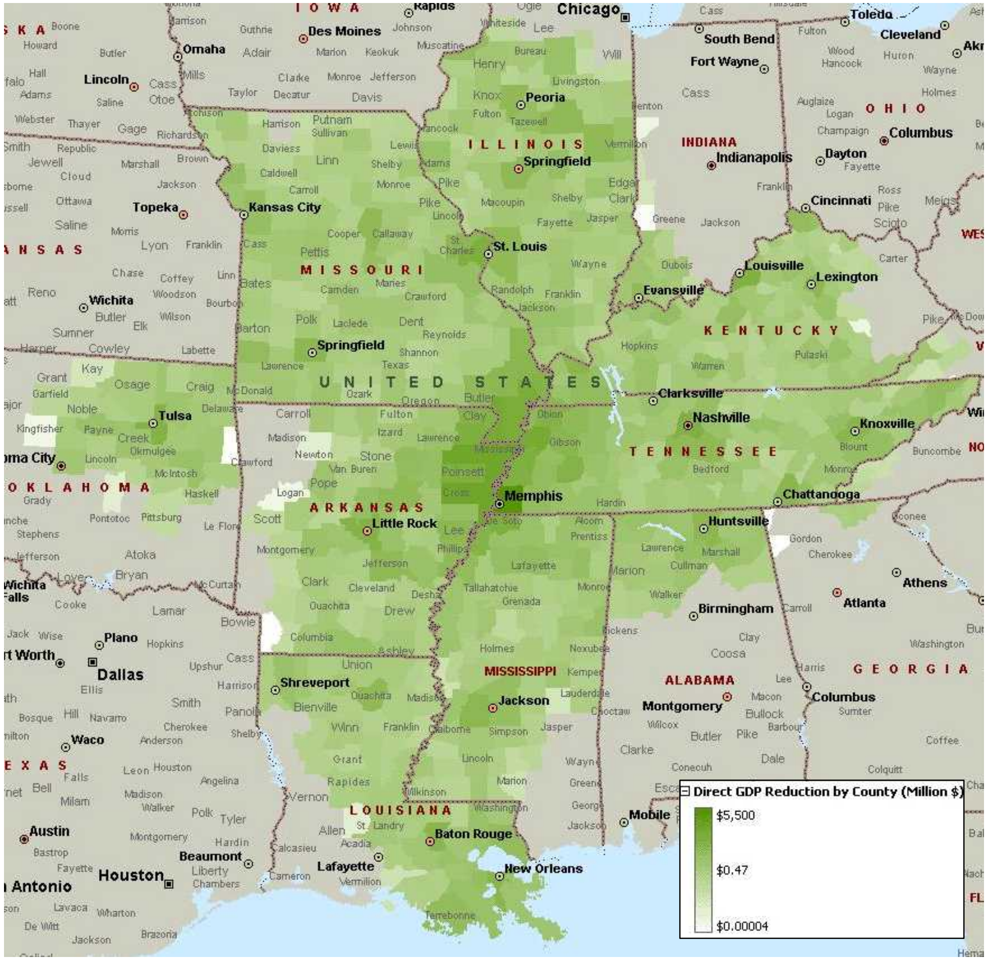
Effects on the Population

- Economic Effects
  - Gross Domestic Product (GDP) Losses
    - due to short-term disruptions (power failures, flooding): $27B
    - due to long-term shocks (property damage, transportation, recovery): $75B/5y
  - Effects on Real Property: $32B/3y

Effects on the Population

- Economic Effects: Short-Term GDP Losses



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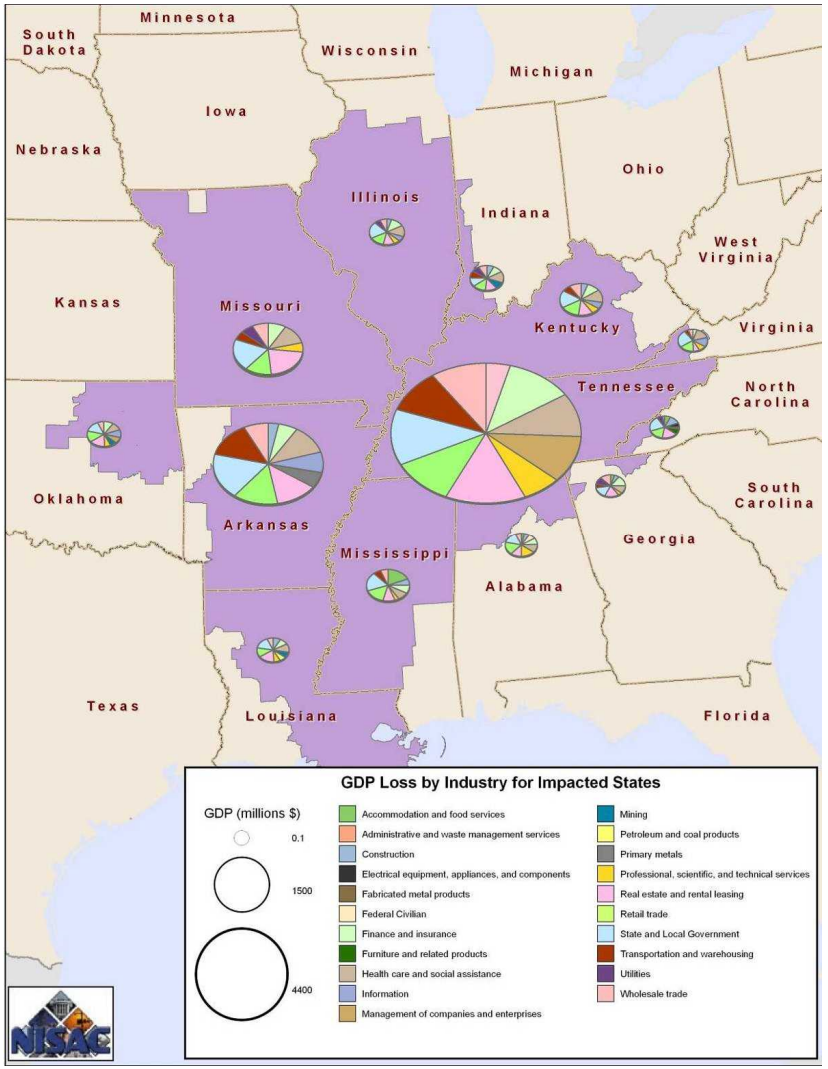
Effects on the Population

- Economic Effects: Short-Term GDP Losses

Industry Sector	Business Disruption Losses (million $)
Finance, insurance, real estate	3,211.5
Wholesale and retail trade	3,048.9
State and local government	1,886.9
Health care and social assistance	1,516.3
Transportation and warehousing	1,370.0
Management of companies	1,164.6
Professional scientific and technical services	933.7
Information	768.7
Construction	729.9
Administration and waste management services	655.2
Total	**15,285.6**



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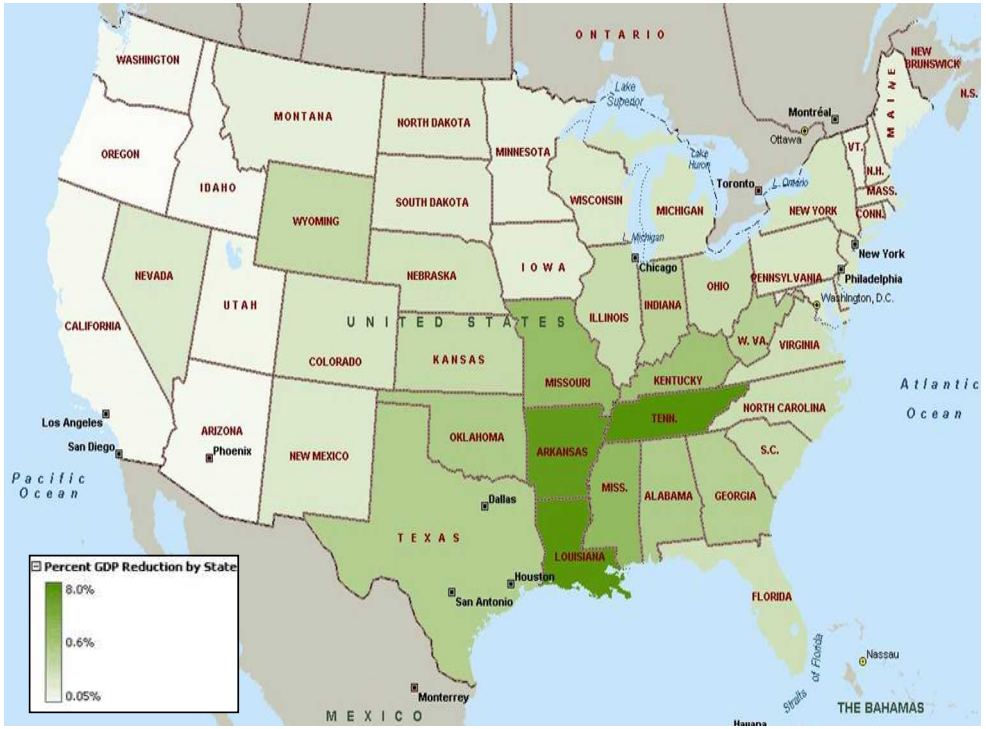
Effects on the Population

- Economic Effects: GDP Losses due to Long-Term Shocks
  - Reductions in
    - industrial output
    - water transportation
  - Increases in
    - construction spending
    - rail transportation
  - Economic Sectors affected
    - Manufacturing
    - Wholesale & retail trade
    - Transportation & warehousing
    - Finance & insurance
    - Real estate rental & leasing



Macro indicators ($ billions)	Year 1	Year 2	Year 3	Year 4	Year 5
Gross domestic product (GDP)	-53.0	-18.1	-3.5	0.5	0.2
Consumption	-19.8	-5.7	2.6	0.2	0.2
Fixed investment	-5.0	-3.6	-1.6	-1.0	-0.7
Government expenditures	-	-	-	-	-
Net exports	-33.0	-10.3	-4.0	1.7	1.7

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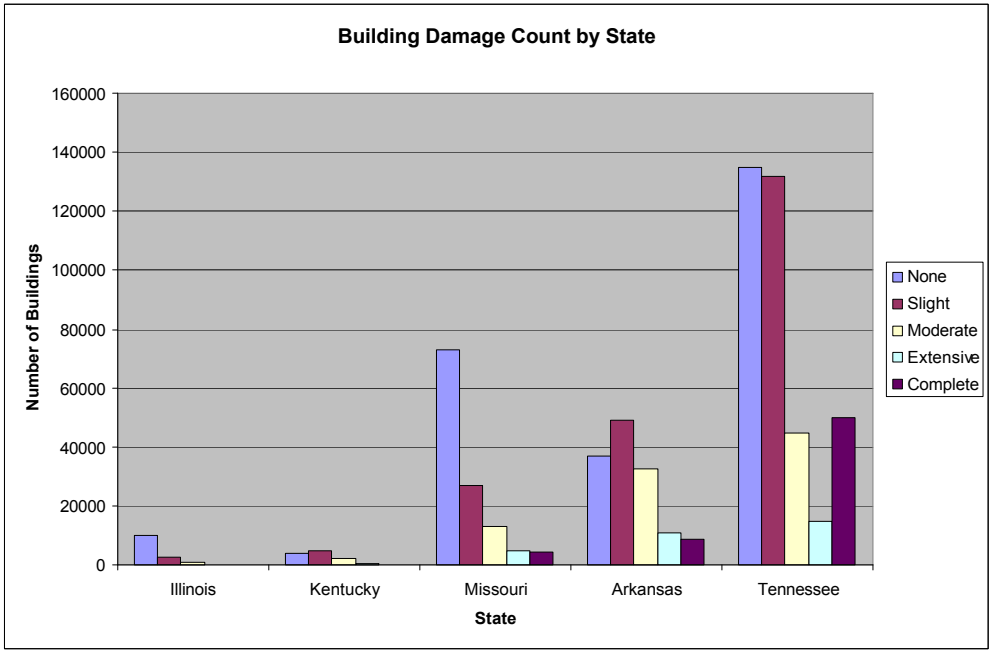
Effects on the Population

- Economic Effects: Effects on Real Property
  - Most significant Loss
    - in Tennessee, Arkansas
    - In Residential, Commercial
  - Residential
    - Largest number of damaged owner-occupied units in Shelby County (TN)
  - Insurance a significant issue
    - Typical homeowner's policy lacks coverage
    - 'Named Perils' policy needed for coverage but not frequently purchased
    - Lack of insurance could lead to mortgage defaults and (additional) strain on the financial sector



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Effects on the Population

- Gaps
  - Enhanced modeling & simulation of infrastructure sectors will enable better estimates of economic consequence

Contact Information

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  - Kevin L. Stamber / 505-284-6073

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