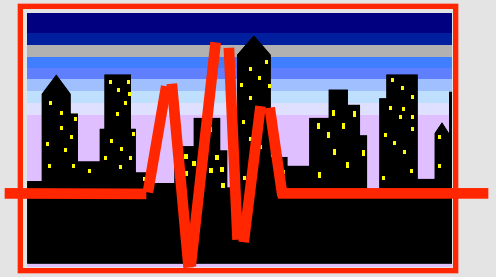
Disaster Risk Reduction: An Engineering Perspective

Workshop on a New Cross-Directorate Program on Disaster Resilience, Vulnerability, and Risk Reduction

Prof. Rachel Davidson
Dept. of Civil and Environmental Engineering
University of Delaware

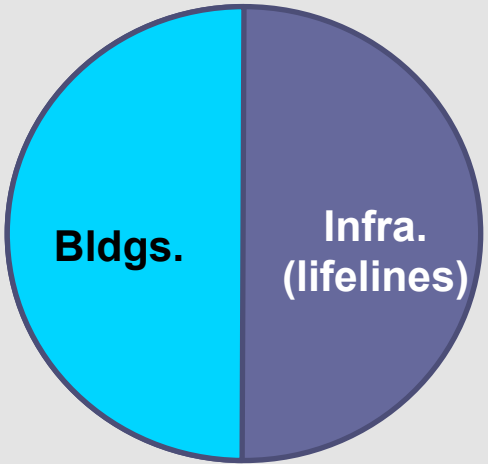
June 1, 2011



Defining the topic

- Risk = function of hazard, exposure, vulnerability
- Engineering largely (not entirely) about reducing vulnerability of physical infrastructure

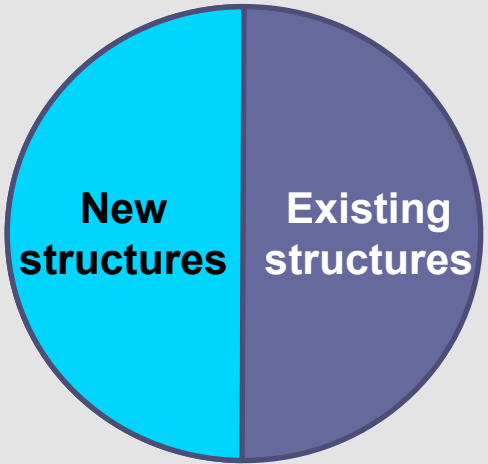
- Physical strategies → **Vulnerability**
- Operational strategies → **Resilience**
- Risk modeling/decision support → **My focus**



Defining the topic

- Risk = function of hazard, exposure, vulnerability
- Engineering largely (not entirely) about reducing vulnerability of physical infrastructure

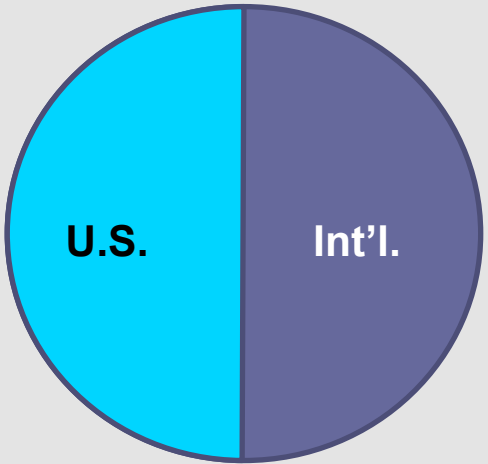
- Physical strategies → **Vulnerability**
- Operational strategies → **Resilience**
- Risk modeling/decision support → **My focus**



Defining the topic

- Risk = function of hazard, exposure, vulnerability
- Engineering largely (not entirely) about reducing vulnerability of physical infrastructure

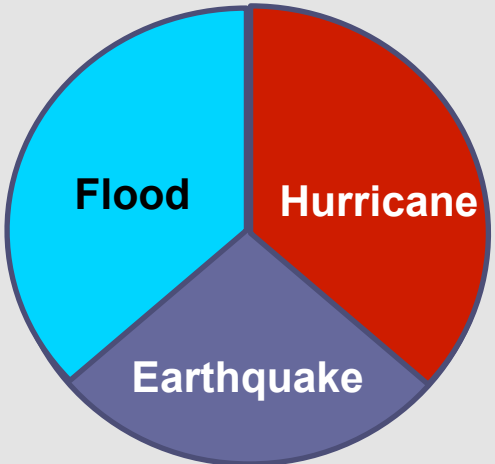
- Physical strategies → **Vulnerability**
- Operational strategies → **Resilience**
- Risk modeling/decision support → **My focus**



Defining the topic

- Risk = function of hazard, exposure, vulnerability
- Engineering largely (not entirely) about reducing vulnerability of physical infrastructure

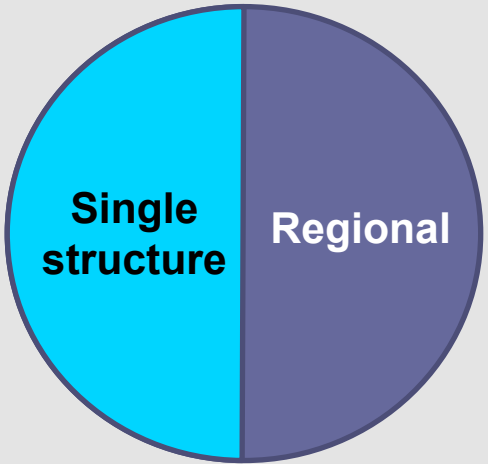
- Physical strategies → **Vulnerability**
- Operational strategies → **Resilience**
- Risk modeling/decision support → **My focus**



Defining the topic

- Risk = function of hazard, exposure, vulnerability
- Engineering largely (not entirely) about reducing vulnerability of physical infrastructure

- Physical strategies → **Vulnerability**
- Operational strategies → **Resilience**
- Risk modeling/decision support → **My focus**



State of science

Assessment (What is risk?)

HAZUS-type approach Loss=P(loss|damage)P(damage|haz)P(hazard)

→ More hazards
→ More types of structures
→ More types of loss

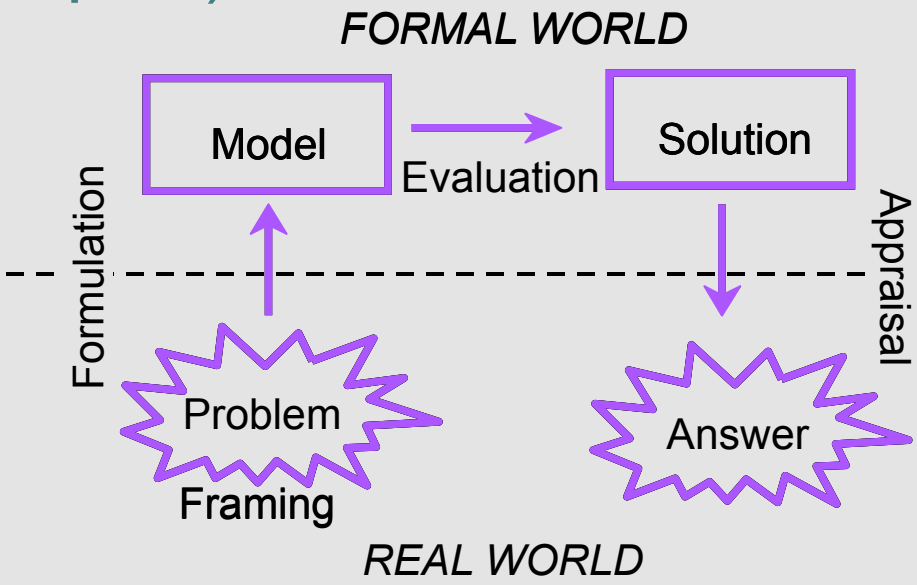
→ Improved modules
→ Improved inventory data

Management (How to reduce it?)

- Calculate benefits (losses avoided) and costs for different alternatives
- Typically static risk assessment, one structure, one hazard, expected hazard, direct loss, normative

State of science

- Hazard → Structures → Society
- Hazard-specific
- More pre- than post-event focus
- Modeling (simple to complex)
- Quantification



Opportunities for interdisciplinary research

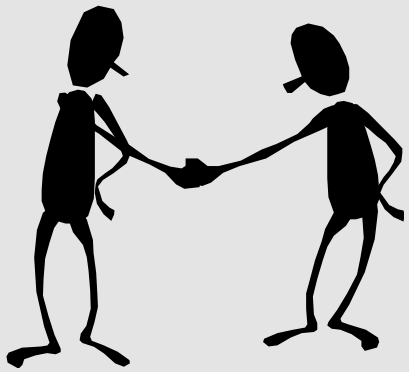
- Regional risk reduction policy design and prioritization
  - Integrate normative and descriptive/behavioral
  - Recognize different stakeholder perspectives
  - Incorporate risk communication, perception
  - Integrate consideration of long- and short-term solutions
  - Demonstrate full effects of risk reduction
  - Address existing infrastructure
- Long-term analyses
  - Root causes of risk, full effects of events, unintended consequences of risk reduction
  - Interactions between risk and development processes
  - Risk as latent characteristic always there, changing

Opportunities for interdisciplinary research

- Identifying important topics to model
  (e.g., PBD, equity)
- Modeling assumptions and inputs (compatibility)
  (e.g., evacuation, service restoration)
- Implementability of model solutions
- Cross-hazard idea sharing

Parallel

Handoff



Integration

Constraints

- Computation → parallel processing/clusters
- Data needs
- Sharing of models and data
- Disciplinary academic structure
- Interdisciplinary vs. disciplinary contribution