NAS Compounding and Cascading Events Workshop:

Session 3 -- Mitigating Impacts: Solutions and Avoiding Unintended Consequences

Speakers:

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Today: All Hazards Compound/Cascading

Example: Hurricane Striking Louisiana during the Ukraine War, COVID and Climate Change

- Large hurricane hits Louisiana, with significant damage to oil terminals and refineries (hurricane strength increased by climate change)
- Truck transportation nationwide affected by fuel shortage (supply-chain slowdowns, fuel price increases and economy-wide price increases)
- Ukraine War (damage and sanctions) increases world oil prices (further direct and supply-chain price increases economy-wide)
- Nefarious actors take advantage of chaos, conduct cyber-attack on US oil and gas pipelines (further supply-chain issues)
- COVID-19 residual effects (supply-chain shortages exacerbated)
- Ukraine War broader impacts (e.g., food prices/security)

Compound/Cascading Disaster Devastation

- Katrina (Hurricane, Flood, Governance Failure)
  - Property Damage: $100 billion
  - GDP losses: >$125 billion
- Japan 2011 (Earthquake, Tsunami, Fukushima)
  - Property Damage: $271 billion
  - GDP losses: $179 billion

Mitigation and Resilience Save

- Mitigation: actions implemented before the event to reduce property damage, business interruption, other:
  - *Mitigation Saves I*: FEMA Mitigation Grants, BCR = 4:1 (Equal to a 14% rate of return on a 50-year annuity)
  - *Mitigation Saves II*: New building codes, BCR = 11:1
- Resilience: actions taken before the disaster to be implemented once it strikes, in combination with adaptive measures, to reduce BI and other impacts
  - Recent studies by Dormady & Rose, BCR = 4.5:1
- Can cost-effectiveness of mitigation and resilience strategies be maintained/enhanced for C&C events?

Equity Issues

- Long been a step-child in hazard analysis in general, with a few exceptions (e.g., transportation)
- Some issues in analyzing and implementing equity
  - no consensus on the best definition of equity
  - requires extensive disaggregated (micro) data
  - need to examine total (supply-chain) impacts & not just direct
  - need to examine ultimate incidence & not just imposition
  - need to examine environmental side-effects
  - need to consider the breadth of risk reduction strategies
  - need to balance equity and other goals

Initial Panel Questions: Round A

Strategies and investments to improve services and functions, including access & equity, to achieve resilient infrastructure for C & C extreme events

1. How can we best *intercede* on both short and long timescales to *prevent hazards from cascading* further?

2. What *strategies can best help reduce losses* from a broad range of hazards likely to be compounding or cascading, so as to *avoid duplication* of effort?

3. What are the major issues associated with *sequencing recovery* from cascading hazards?

Initial Panel Questions: Round B

Challenges and opportunities within these strategies and investments that may benefit from further investigation and research to facilitate better outcomes

1. How do we assess and address *cumulative socioeconomic burdens* and *lack of human adaptive capacity* in the face of compound & cascading disasters?
2. How can we improve our *ability to evaluate equity and social justice of mitigation and resilience* strategies for compound & cascading hazards?
3. How can we *encourage cooperation* among communities to avoid disasters in one community from *spilling over* into another?
4. What *data* is missing, what *methods* need to be developed, and what *other applied research topics* need investigation to better prepare for and respond to compounding & cascading disasters?

Back-Up Slides

Hazard Mitigation & Resilience

- Resilience broadly defined: "Ability to prepare, plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events" (NRC, 2012)
- Mitigation covers the first two aspects, and is the most well-known and researched
  - Studies have evaluated its cost-effectiveness
    - *Mitigation Saves I*: FEMA Mitigation Grants, BCR = 4:1 (Equal to a 14% rate of return on a 50-year annuity)
    - *Mitigation Saves II*: New building codes, BCR = 11:1
  - Other studies evaluated individual infrastructure BCR
- But only half the story of disaster risk reduction

Resilience Saves Too

- "Resilience" – actions taken *after the disaster strikes*
- Can only prevent property damage before the event, but can reduce *business interruption* thereafter
  - begins when disaster strikes & continues until recovered
  - measured in terms of lost sales revenue, GDP, employment
- *Inherent and Adaptive versions*
  - can *build resilience capacity beforehand* – it's a *process* (inventories, emergency drills, portable generators)
  - but these tactics are *not implemented until system is shocked*
  - can be supplemented by *adaptive resilience tactics*
- Recent studies by Dormady & Rose, BCR = 4.5:1