Resilience

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Outline

- QUICK Literature Review
  - How social science, government and NGOs view resilience in disasters
- Alternate Definitions and Ways of Thinking
  - Engineering vs Ecological Resilience
- Christchurch and San Francisco
  - Dealing with the current events
  - Planning for the next event

Disaster Related Definitions

- If the simple concept is the capacity to rebound following future disasters
- How do we measure and monitor it?

- Consensus that resilience is a multifaceted concept, with social, economic, institutional, infrastructural, ecological, and community dimensions

Create Baseline, Track Progress, Measure Outcomes 1

- **Baseline Resilience Index for Communities (BRIC)** Cutter et al. (2010)

- Methodology and a set of indicators to measure the present conditions and effectiveness of programs, policies, and interventions specifically designed to improve disaster resilience.

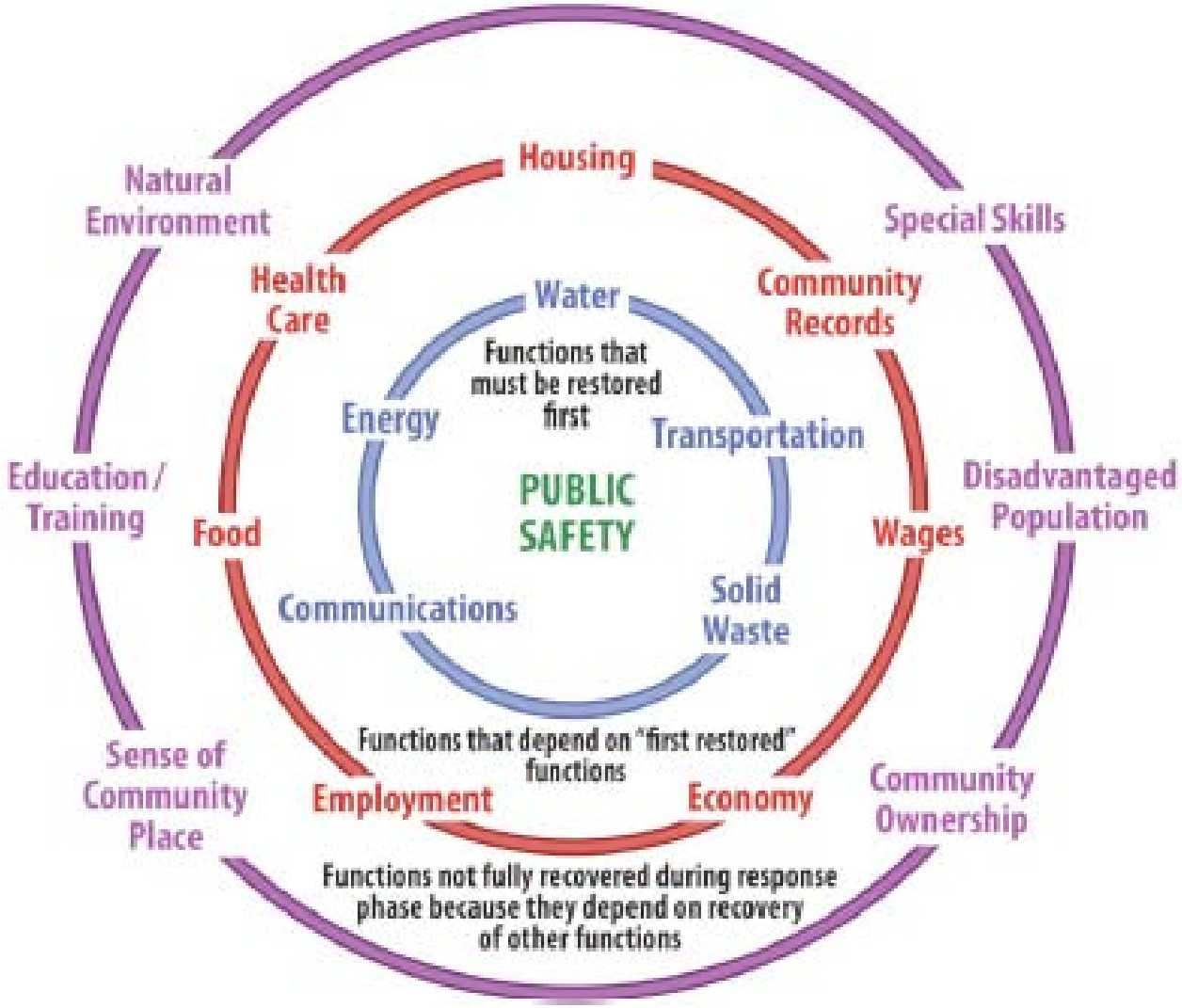
- Uses nationally-available data sources to score 36 variables in 5 dimensions: social, economic, institutional, infrastructure, and community capital.

Create Baseline, Track Progress, Measure Outcomes 2

- **Community and Regional Resilience Institute (CARRI) (**2009)
- DoE's Oak Ridge National Laboratory, in conjunction with a variety of other federal, regional, state, and local partners

- Three categories of community functions – infrastructural, economic, and social –in a time-considered hierarchy of functional recovery

CARI Framework

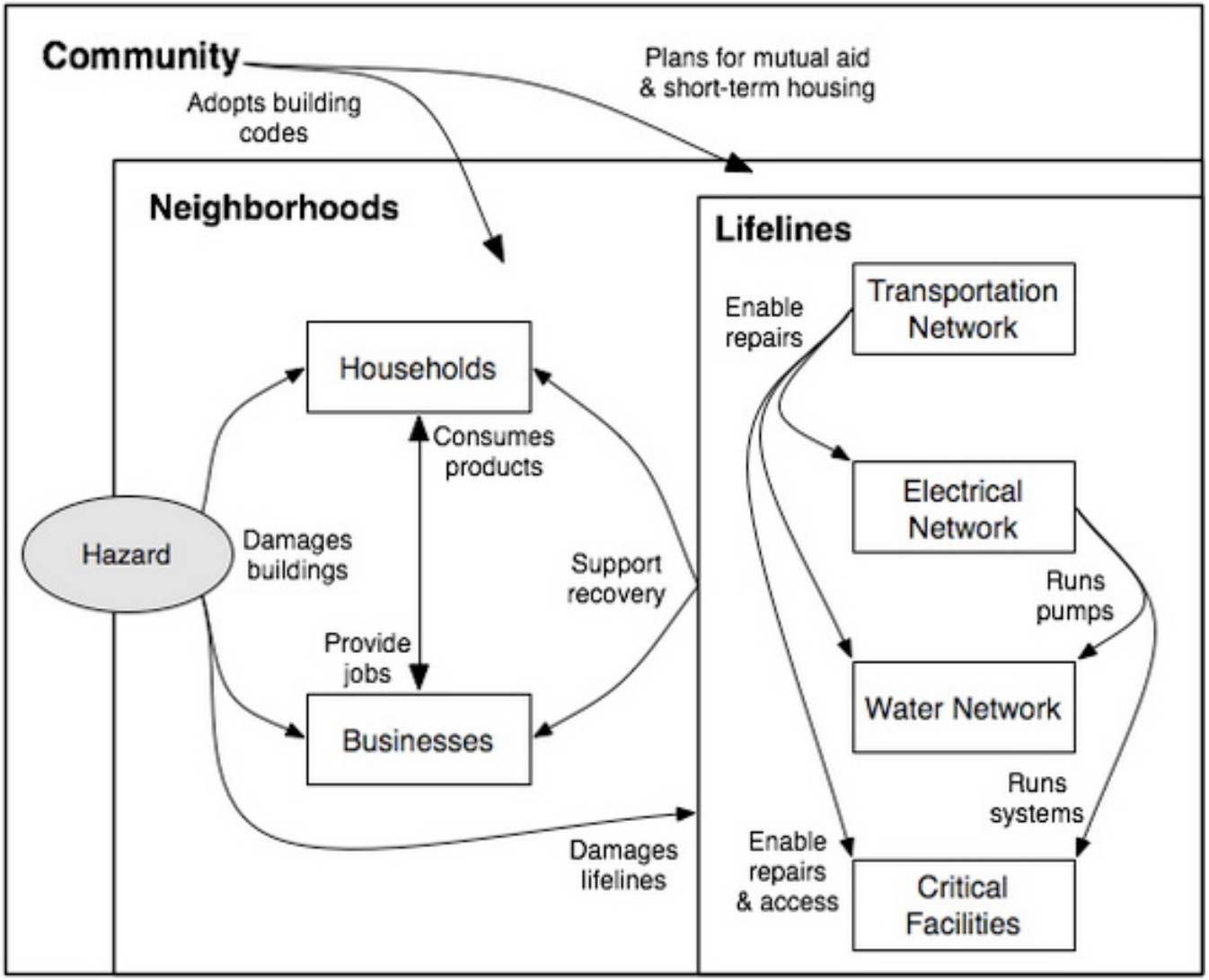


Create Baseline, Track Progress, Measure Outcomes 3

- **ResilUS** Miles and Chang (2006)
- Computer model that simulates the loss and recovery dynamics of socio-economic agents, neighborhoods, and communities before, during, and after a disaster

- Indicators associated with household and business well-being, such as health, employment, productivity, and product demand, and inter-relationships

Conceptual Model: ResilUS



http://www.wwu.edu/huxley/resilience/Research/ResilUS_Model/ResilUS_index.shtml

Create Baseline, Track Progress, Measure Outcomes 4

- **Characteristics of Disaster-Resilient Community** Twigg (2010)
- 167 characteristics of resilience, five thematic areas, measured on 1-5 scale:

  1) Governance;

  2) Risk Assessment;

  3) Knowledge and Education;

  4) Risk Management and Vulnerability Reduction; and

  5) Disaster Preparedness and Response

Two Paradigms on Resilience*

- **Engineering Resilience** focuses on efficiency, constancy, predictability
  - Defined as stability near an equilibrium or steady state
- **Ecological Resilience** focuses on persistence, change, unpredictability
  - Defined as the capacity of a system to absorb disturbance and reorganize while undergoing change

*C.S. Holling, 2009; C. Folke, 2006 and others

Adaptive Resilience in Many Fields

- Anthropology challenge to concept of culture as an equilibrium-based system
- Ecological economics in relation to biological diversity
- Non-linear dynamics
- Modeling of complex systems of humans and nature
- Environmental psychology
- Cultural theory
- Human geography
- Management
- Property rights and common property research
- Other social sciences

Note the absence of disaster specific research in this list

Consequences for Evaluating, and Managing Complexity and Change

- Engineering Resilience is **Recursive** Resilience
  - Moves from reactive to proactive system safety
  - Uses command and control strategies to control variability;
  - Focus on steady-state performance
- Ecological Resilience is **Adaptive** Resilience
  - Requires flexible, diverse, redundant regulation; and capacity for corrective action
  - Requires understanding of process and temporal data;
  - Requires ability to live with surprise

Resilience and Sustainability

- A lot of work on resilience has focused on the capacity to absorb shocks and still maintain function.
- Another aspect of resilience concerns the capacity for renewal, re-organization and development, which is essential for the sustainability discourse

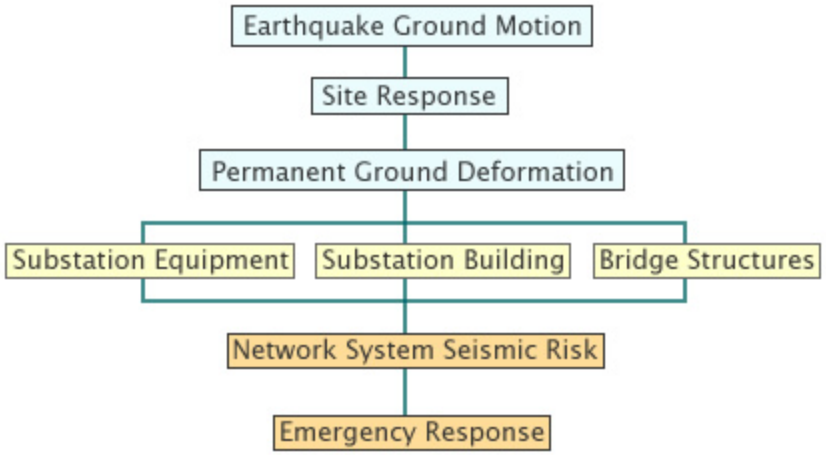
Gunderson and Holling, 2002; Berkes et al., 2003

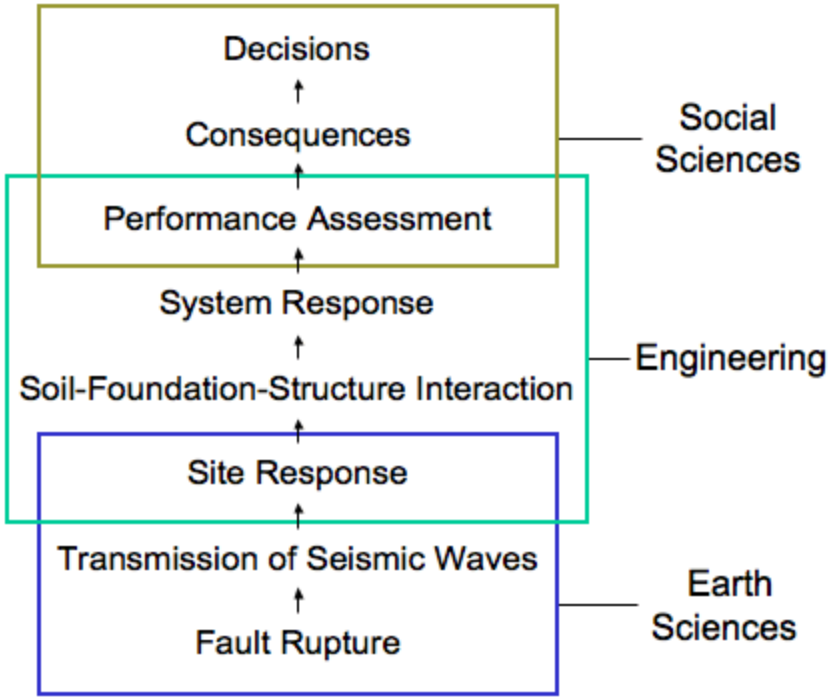
Application to PBEE

- Scholars involved with resilience in relation to complex adaptive systems increasingly avoid the use of recovery and prefer the concepts renewal, regeneration and re-organization following disturbance
- Resilience is an approach, a way of thinking, valuable for analysis of systems and policy for sustainable development

Bellwood et al., 2004

Resilience in PEER Research





-PBEE is an example of Engineering Resilience - one giant step past building codes to targeted performance goals

- Next step to go beyond systems design/evaluation and look at cascading consequences for users/communities

Christchurch Women's Hospital

Is the building resilient?
Is the institution resilient?

Christchurch—After Multiple Events Can the City Create a Resilient Community?

- **Focus on the physical infrastructure and rebuild plans**
  - Set new goals and tasks for livable-sustainable cities
  - Redefine building and planning regulations

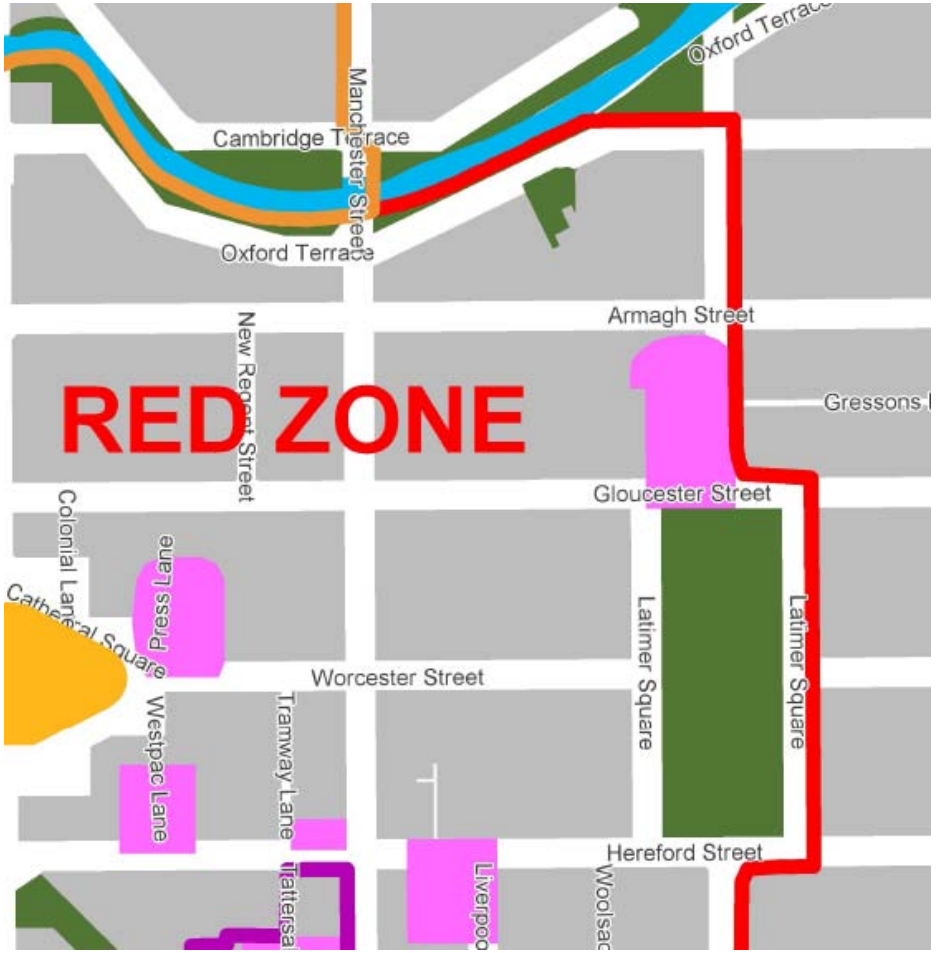
  - Green City
  - Stronger Built Identity
  - Compact CBD
  - Live/Work/ Play/Learn
  - Accessible City

Planning is Only First Step by City

* Create development incentives
* Discourage flight of citizens and business
* Retain and develop resilient organizations/communities

Will Business Rebuild After Demo?

Insurance protects from financial failure but does not provide for renewal

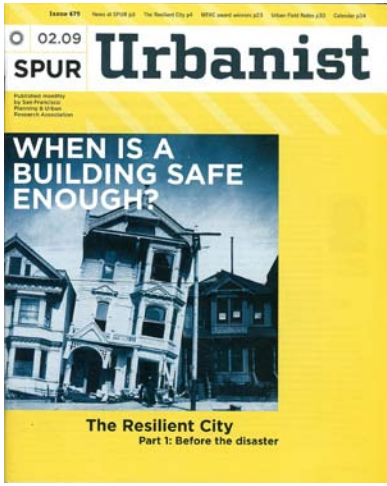


Can the City and Institutions Adapt?

- Are investment priorities of business compatible with those of the city?
- Will population “tip-out” ?
- Will institutions retain stability?
- Will there be a critical mass for growth and development?

SPUR Resilient City Approach

- Define concept of ***resilience*** for disaster recovery
- Establish ***performance goals*** for a M 7.2 earthquake
- Define transparent ***performance measures***
- Recommended ***target states of recovery*** for San Francisco's new buildings, existing buildings and lifelines
- Evaluate goals and standards for ***shelter in place***



Steps to Community Resilience

Link Housing, Jobs, School/Community

Downtown Jobs
250,000 jobs
42% live in San Francisco
38% commute from E Bay
Many Corporate HQ

Critical to Recovery
Utilities
Tourism/Hospitality
Business Services

Shelter and Housing
CAPSS estimates M7.2 EQ
25% of housing not habitable
(85,000 units)
2/3s are 3+ unit wood soft story
If retrofit, could reduce uninhabitable units to 8-10%

Achieving Shelter in Place

- What percent of housing stock needs to meet shelter-in-place standards for the city to be resilient? How much of our housing stock currently meets this standard?
- How does neighborhood resilience affect citywide resilience?
- What should the post-earthquake habitability standards be for residential buildings?
- What engineering criteria should be used to determine, prior to the event, if a residential structure will meet “shelter in place” criteria?

Resilience and Disaster Recovery

- Represents the combination of thousands of individual decisions
- Reflects the capacity of the local/national government to incentivize reconstruction
- Reflects the capacity and willingness to limit damage before an event
- Engineering challenge goes beyond PBEE
- Requires commitment to honesty in design standards
- Requires policy, ongoing processes and public education

Conclusion: Engineering is Necessary but Not Sufficient

- An individual business is not resilient just because it has a base-isolated building
- An organization needs a way to assess whether (and how) predictable damage will interfere with their pre-and post-disaster mission
- A city or community needs to set policies that require pre-disaster building standards and recovery planning to achieve some degree of resilience