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CEC • New Research Illuminating Energy Impacts of Climate Change in California • Sacramento, CA

The Adaptation Blind Spot

Electrical Grid, Teleconnected and Cascading Climate Change Impacts on Community Lifelines in LA

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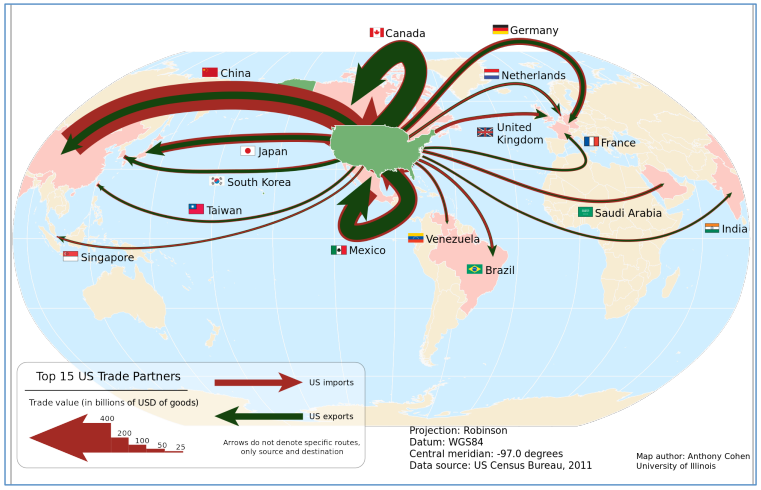
August 30, 2018

Core Concepts: Teleconnections and Cascading Impacts

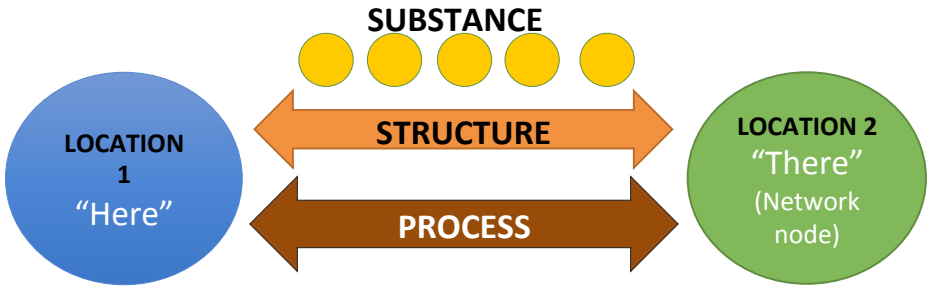


Societal teleconnections

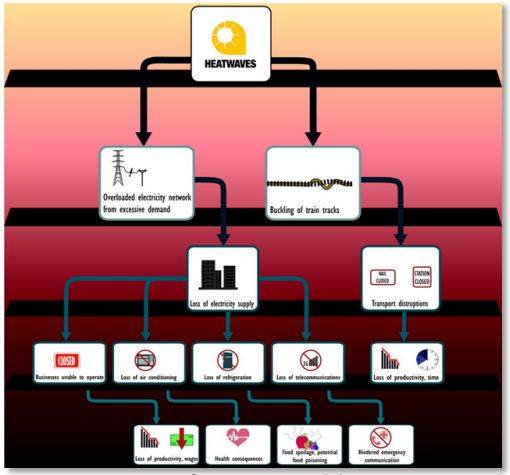
- **Human-created interconnectivity** among systems that transcend local/national/ international boundaries

Cascading impacts

- **Downstream impacts** of an initial event, rippling through a system in hard-to-predict ways



Source: Moser & Finzi Hart (2015) *Climatic Change*



Source: Commissioner for Env. Sustainability, Victoria, Australia

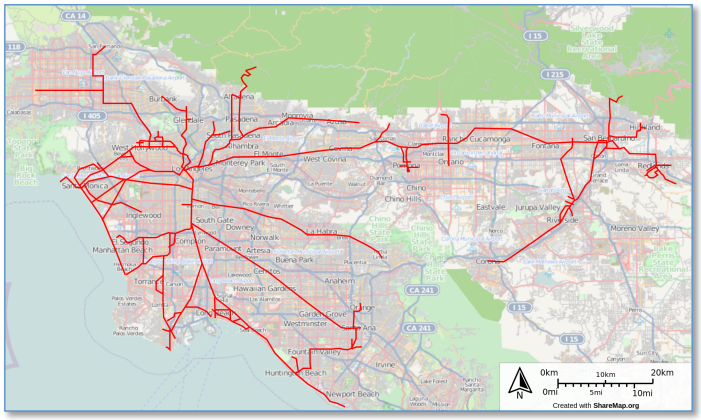
Example; Energy System

- *Structure*
  - Transmission lines connecting power generation and consumption
- *Process*
  - Supply & demand; energy markets, policies & regulations
- *Substance*
  - Electricity, oil, natural gas
- Vulnerabilities > Considerations in Adaptation
  - Energy production & transmission disruptions lead to economic, public health impacts
  - Increased energy use during extreme events can lead to shortages
  - Downstream impacts to critical lifelines

Source: KOMOnews.com; California 3rd Climate Assessment (2012)

A Pilot Project

- Geographic Focus: L.A. Metropolitan Area
- Inter-sectoral Focus: Long-distance and downstream impacts on community lifelines
  - Electricity System
  - Communications, Water, Transportation, Emergency Response and Public Health



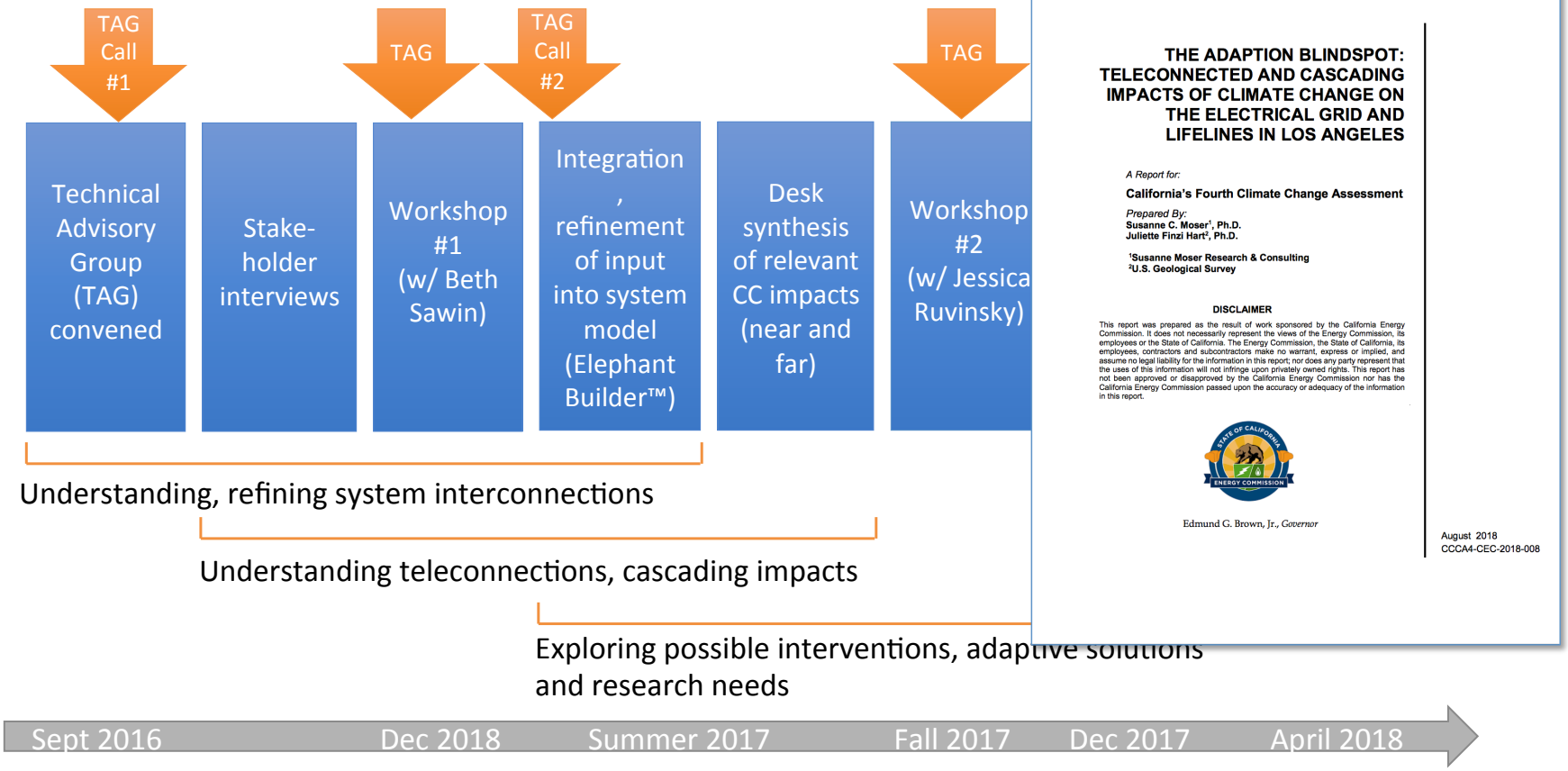
Source: Wikipedia; Rocky Mountain Institute

Project Goals

- **Test the utility of a conceptual framework**
- **Identify research needs and action barriers**
- **Help other metropolitan areas and communities in California**

Pilot Study Approach:

Exploring a complex issue step by step…



THE ADAPTION BLINDSPOT: TELECONNECTED AND CASCADING IMPACTS OF CLIMATE CHANGE ON THE ELECTRICAL GRID AND LIFELINES IN LOS ANGELES

A Report for:

California's Fourth Climate Change Assessment

Prepared By:
Susanne C. Moser[1], Ph.D.
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Edmund G. Brown, Jr., *Governor*

August 2018
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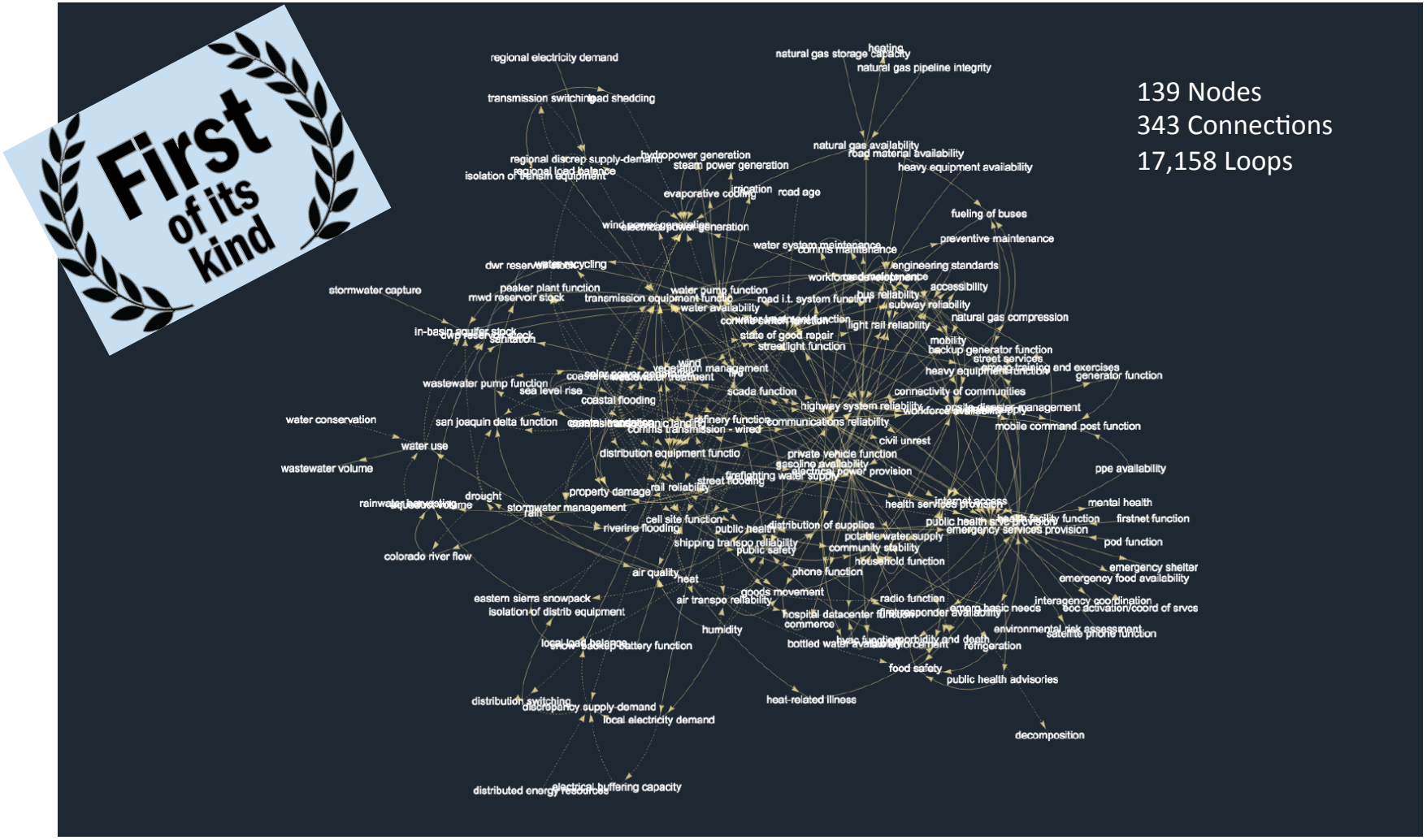
Key Study Insights

Interconnections and Cascades

- No unified map of the interconnected lifeline system until now
- Functioning of the overall system is an emergent property without overarching control
- There are critical mutual dependencies and notable gaps
- Overconfidence in controllability of individual (yet interconnected) lifeline systems

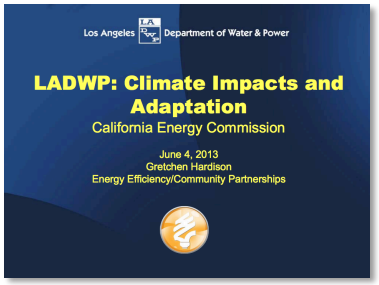


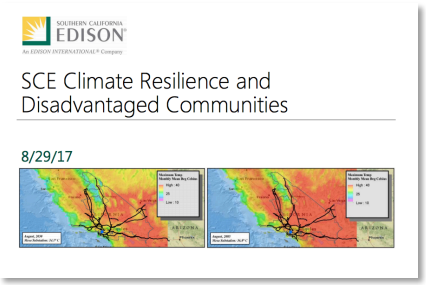
139 Nodes
343 Connections
17,158 Loops

Gaps in the Interconnected Lifeline System

- Cross-sector relations informal and ad-hoc
- Deferred maintenance negatively impacts physical structures
- Staff capacity
- Historical legacies
- Limited experience and attitudes
- Varying degrees of adaptation planning

Discussing Water Rights, A Western Pastime





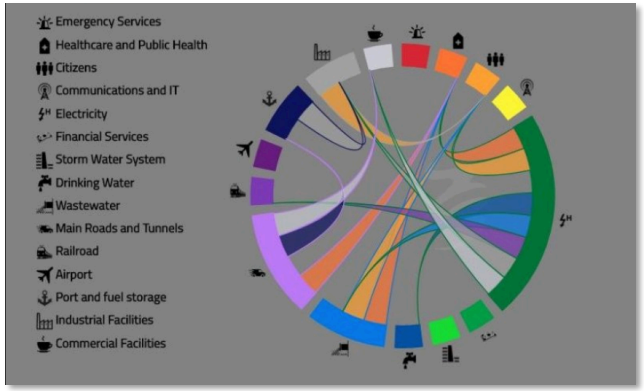
Key Study Insights (cont.)

Climate Change Impacts, Adaptation and Preparedness for Extreme Events

- Significant advances on climate extremes, but still research frontier
- Surprising lack of concern and active efforts to plan for climate change impacts

Assessing Complex Risks in Practice

- Utilities' system models
- Consulting firms/research institutes' networked risk models
- Various boutique approaches

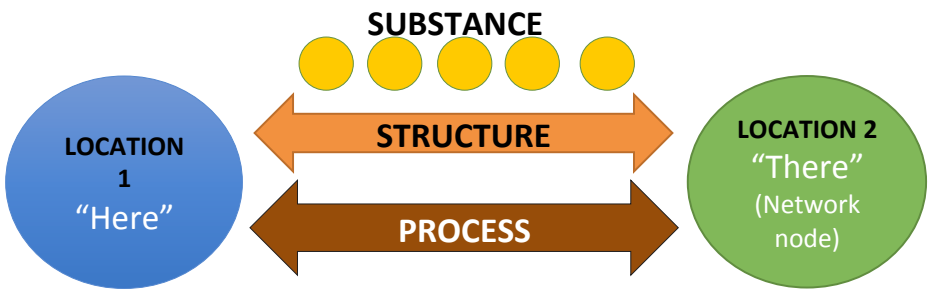


Key Study Insights (cont.)

Teleconnections

- Variable and overlapping geographies
- Significant differences across lifelines
- In some instances, actively used and managed
- “Hardware” and “software” are weakest parts

Key Study Insights (cont.)



Utility of the Conceptual Framework

- Bringing lifeline managers together in a room
- Opening up imagination
- Focusing our research
- Assessing teleconnected (and cascading) risks

Moving Preparedness for Teleconnected & Cascading Impacts Forward

Advancing Understanding

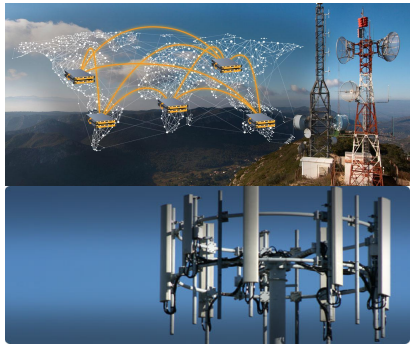
- Extreme Events
- Teleconnections and Interdependent Lifeline Systems
- Legal Context
- Technical/Material Science
- Tools at the Right Scale
- Pilot and Demonstration Projects

Action Opportunities

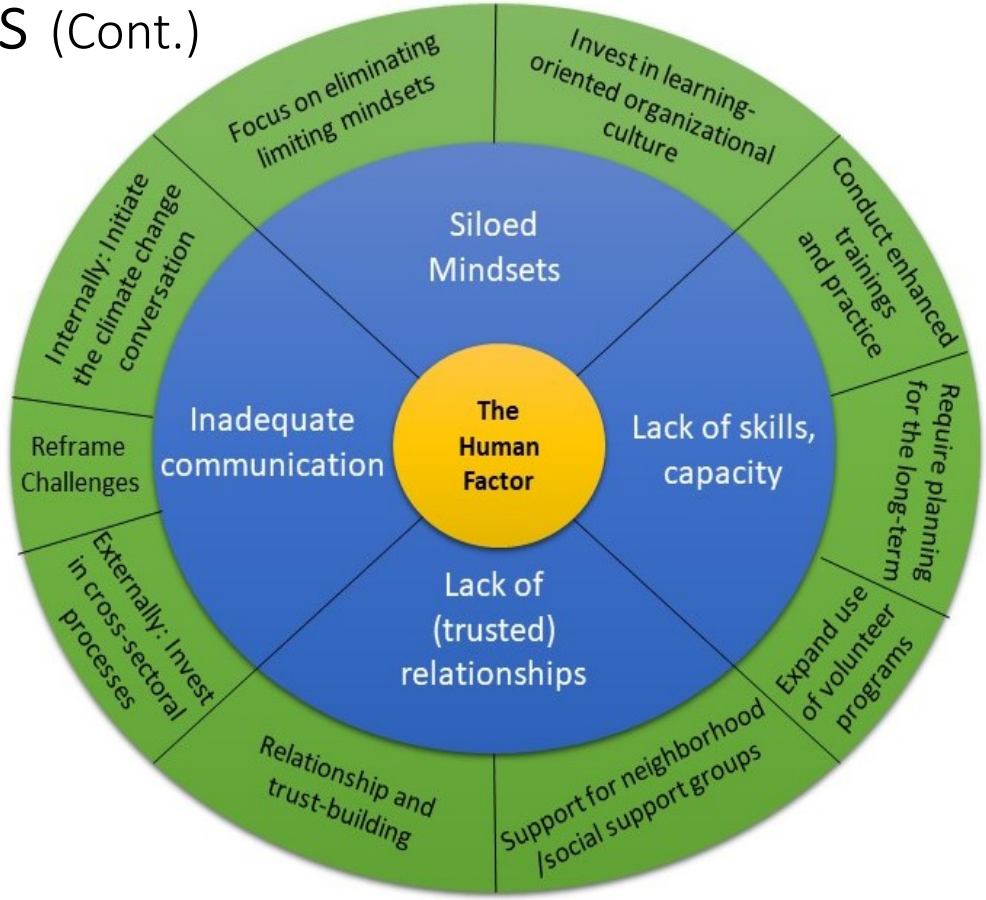
- Governance Gaps and Policy Coherence
- Integrated Adaptation Planning
- Regional Lifeline Scenario Planning Exercises
- Institutional Barriers
- Preparedness Measures at the Utility and Agency-Level

Sample Challenges

- Challenge #1: Building Back Better After Disaster
- Challenge #2: Detrimental Post-Disaster Waivers
- Challenge #3: Common Sequences of Extreme Events
- Challenge #4: Interconnections and Interdependencies
- Challenge #5: Lack of Communication



Action Opportunities (Cont.)



Taking Preparedness Measures at the Utility and Agency-Level

Thank you!

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