



Civil Systems Engineering
Pūnaha Metarahi

Urban risk & resilience



Overview

- Community & urban resilience
 - Interdependent infrastructure
 - Transport resilience
 - Equity and equitable facility location
 - Impacts on communities
- Smart land-use planning

Urban Resilience

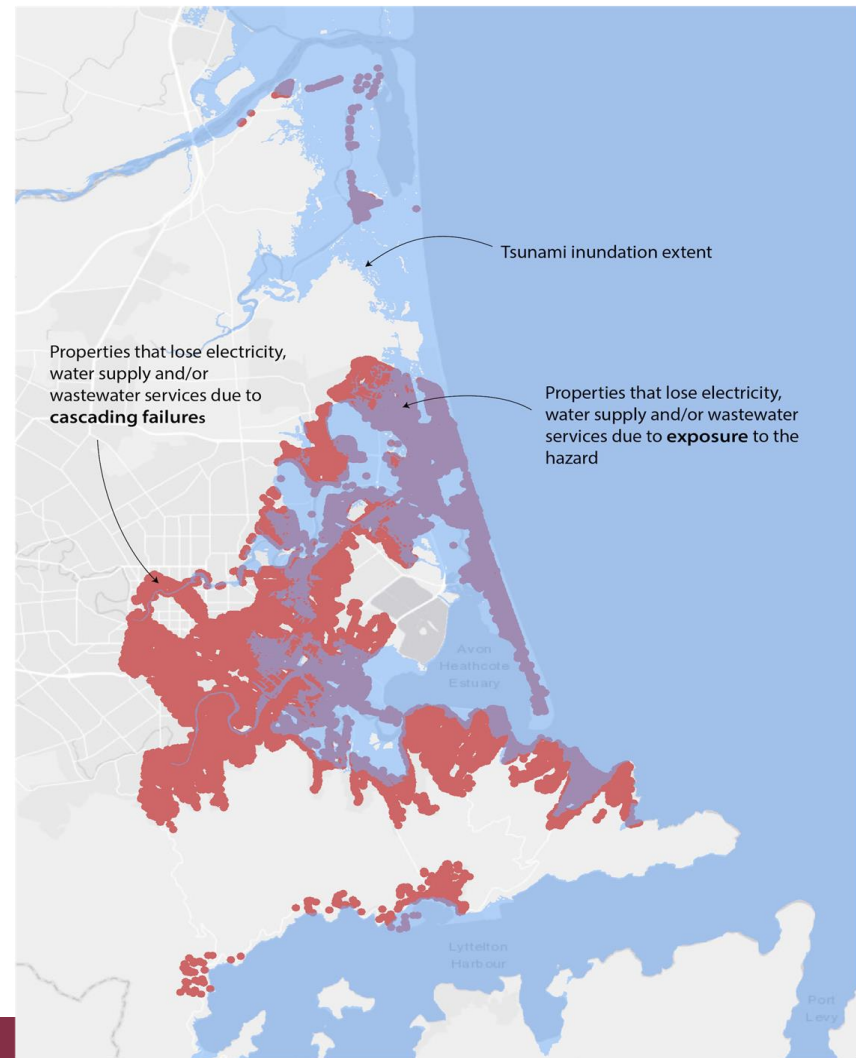


What do communities need?

- Basic lifelines: water, electricity, communications
- Short-term: Access to food, healthcare
- Long-term: Access to education, employment, entertainment
- For long-term community cohesion this needs to be *equitable*

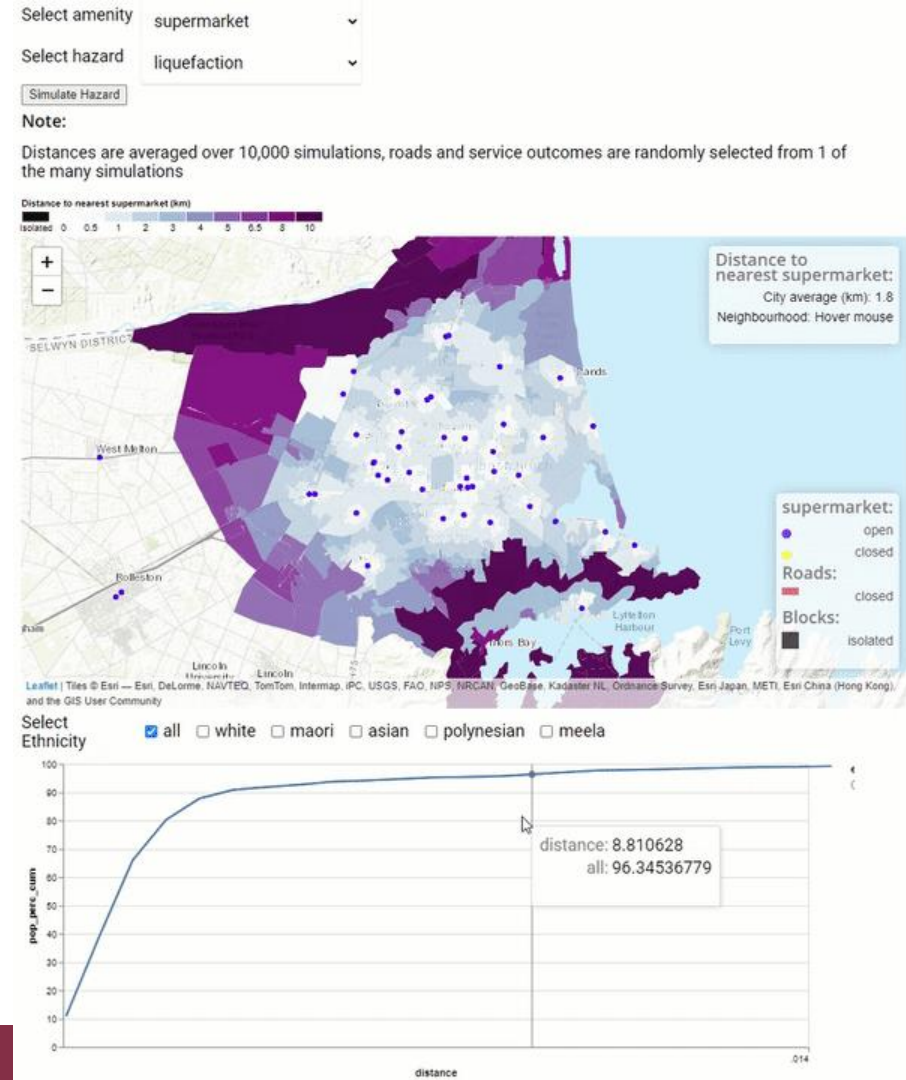
Cascading failure through interdependent infrastructure

- Simulated tsunami (or any hazards)
- So far: electricity, water supply, and wastewater
- Identify homes/areas indirectly impacted
- Evaluate criticality



Transport Resilience

- Interactive dashboard: <https://qrgo.page.link/LTGij>
- Simulate a hazard
- Simulate road and amenity closures
- Evaluate change in access (by sociodemographic groups)
- Identify *isolated communities*

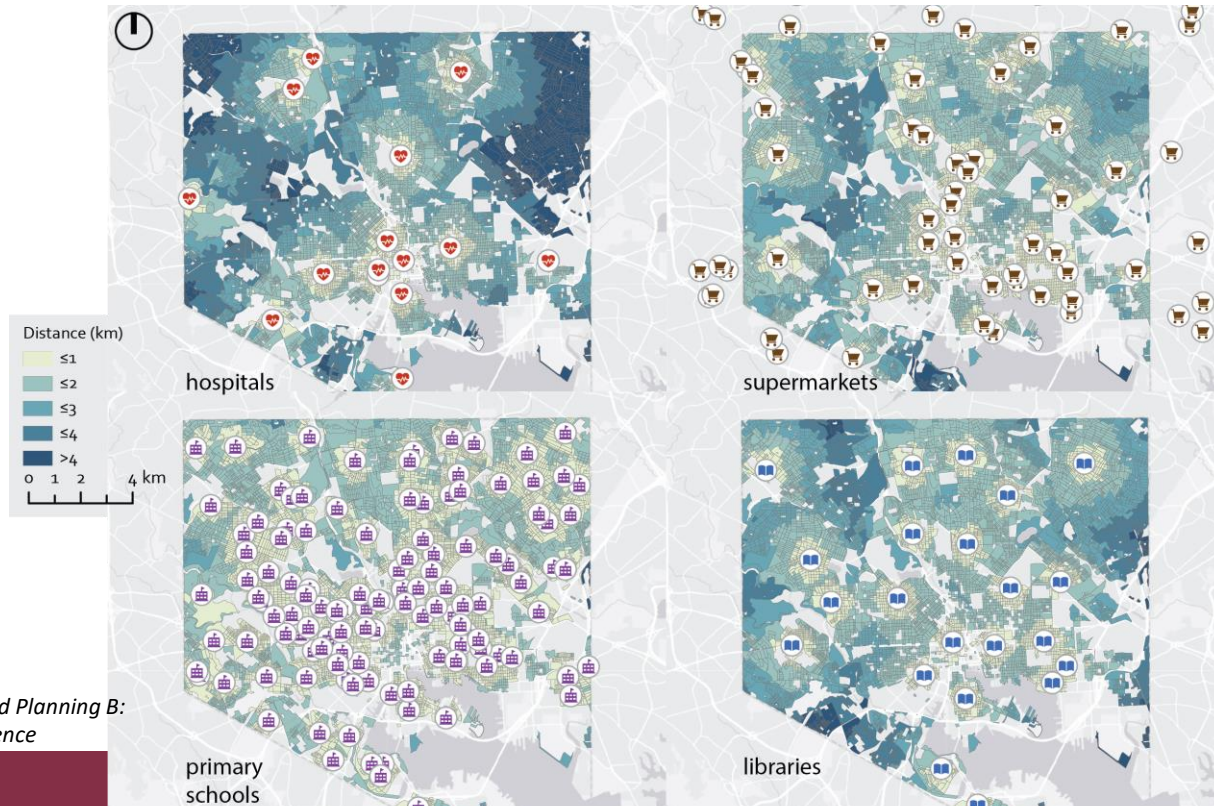


M. Anderson, D. Kiddle, & T. Logan (under review). The Resilience of Access to Urban Services: Hazard vulnerability, recovery, & equity. *Transportation Research Part D: Transport and Environment*

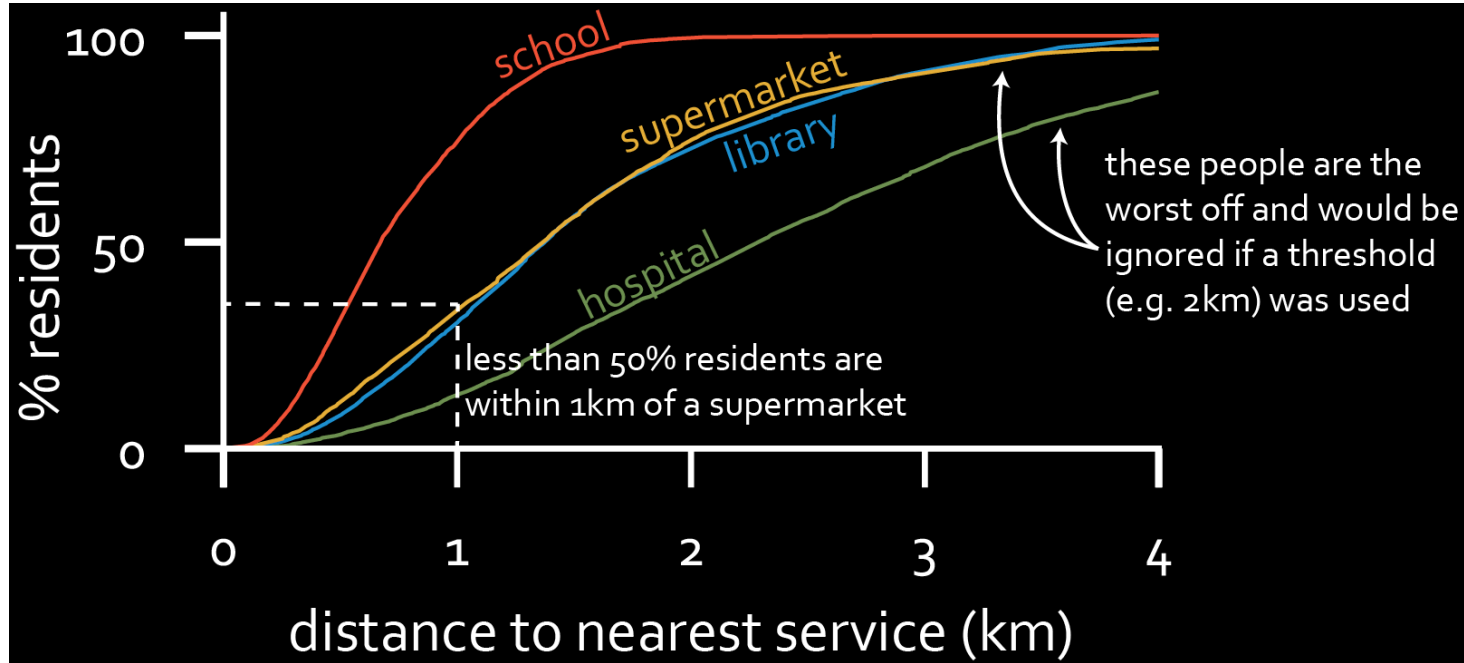
Logan, T. M., & Guikema, S. D. (2020). Reframing Resilience: Equitable Access to Essential Services. *Risk Analysis: An Official Publication of the Society for Risk Analysis*



Access: We calculate the distance from every household to every service within a city



Using census data (to start with) we calculate the city-wide distribution for access to services





Equitable Facility Location

Collaboration with US Naval Academy and University of Colorado:

1. After events where closures of facilities occur, how do we prioritise reopening facilities?
2. Under 'normal' circumstances where should we build the next facility to improve access and equity?
3. If we wanted to decrease inequality in access, how many facilities do we need and where should we build them?



Partnerships

- WREMO – Levels of service
- Christchurch City Council – Coastal Hazards Adaptation Planning
- Christchurch City Council – Transportation team: 10-minute city

Smart Land-Use Planning



Multi-Criteria Spatial Optimisation of Urban Development

- Where should future development and intensification be directed?
- Where should it not be?
- Essential that we don't retreat people from the coast only to expose them to other hazards...

Objective



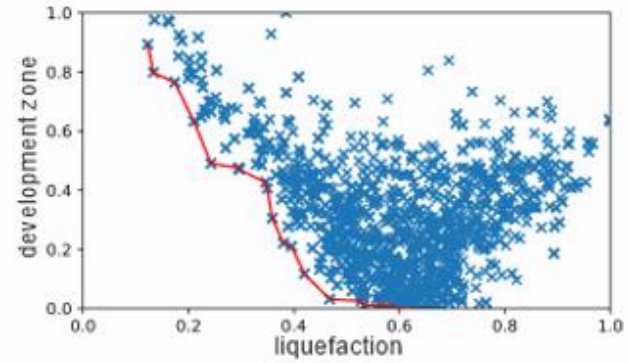
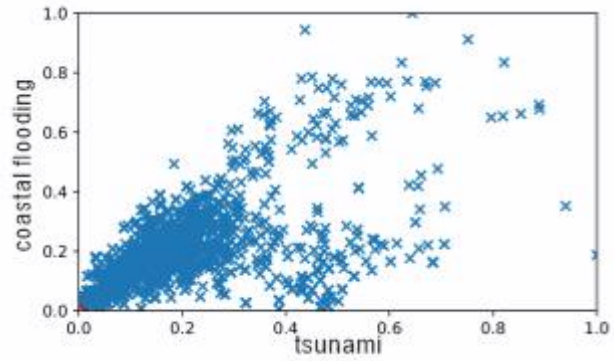
PROMOTE ROBUST URBAN
ENVIRONMENTS



DEVELOP A FRAMEWORK FOR
ASSESSING OBJECTIVES



MANAGE TRADE-OFFS AND
PROMOTE SYNERGIES
BETWEEN OBJECTIVES





Partnerships

- Invercargill City Council

UC CURE

cluster for community and urban resilience

Interdisciplinary group involving community partners and academics at UC from all colleges: from public health to business, humanities and arts to engineering

Annual conference: 7 September

“Partnerships towards resilience: Breaking silos and building resilience”

<https://www.canterbury.ac.nz/resilience/>

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