Natural Hazards Research Australia

Modelling impacts of natural hazards on interconnected infrastructure networks

The University Of Queensland AUSTRALIA

RISK FRONTIERS

UTS

CYCLONE TESTING STATION

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The project

→ The purpose of this research project is to:

1. Understand the extent of direct and indirect impacts/losses relevant to infrastructure
2. Develop estimation methods to model the impact of natural hazards on interconnected infrastructure
3. Provide a framework to better understand the value of infrastructure resilience investments.

The primary focus of this project is on public infrastructure.

→ Primary Tasks

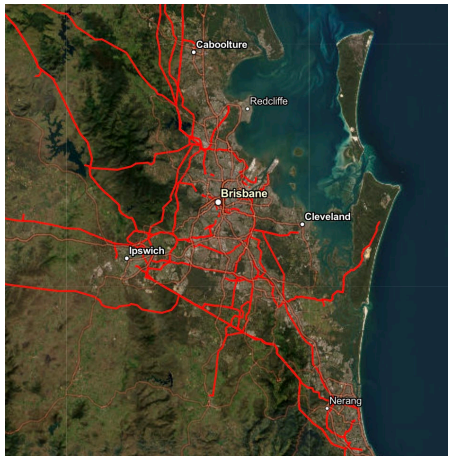
1. Review existing literature, models and data relating to damage estimation (direct and indirect) as it relates to public infrastructure and Australian natural hazards.
2. Develop (or implement) methods to estimate direct and indirect damage to three types of infrastructure and three hazard types.
3. Undertake 'proof-of-concept' case studies to demonstrate any models developed, including CBA for betterment activities.
4. Develop a conceptual framework for dealing with cascading or compounding events (test through case studies).
5. Outline future research needs in this space.

The project

- We have 3 streams of research
  1. Network mapping
  2. Damage estimation
  3. Utilisation case studies
- Hazards & networks
  - Flood, wind/storm, fire
  - Power (transmission & distribution), water, *telecommunication*
- Study region (our sandbox)
  - Develop models/frameworks using SE Queensland networks and data
  - Frameworks (and where possible, models) will be region agnostic – tested through national steering committee (and maybe data)

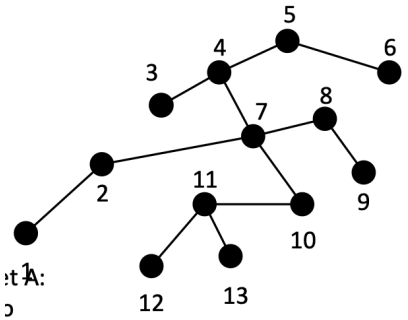
Applying the research

1. GIS layers of infrastructure

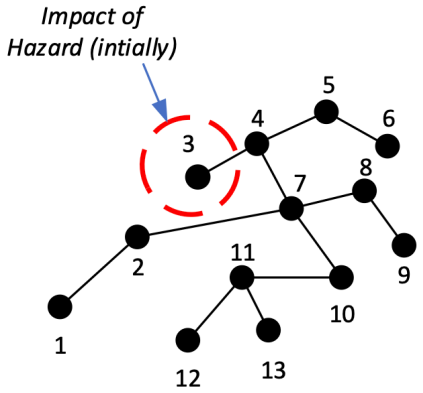


Source: look up and live, ERGON

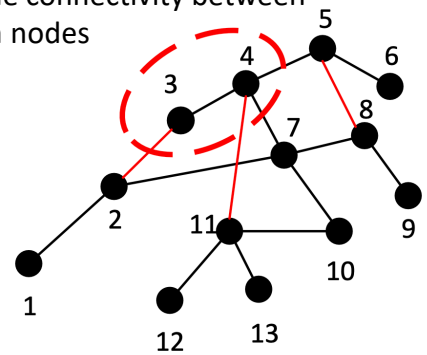
2. Develop network model of infrastructure layers – with connections within and between infrastructure layers



3. Choose a hazard scenario and identify which system nodes are affected first

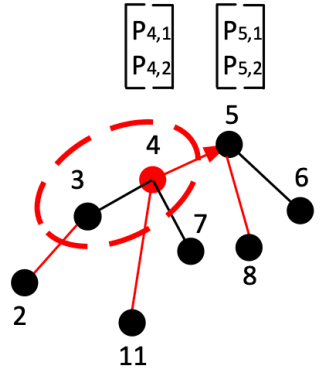


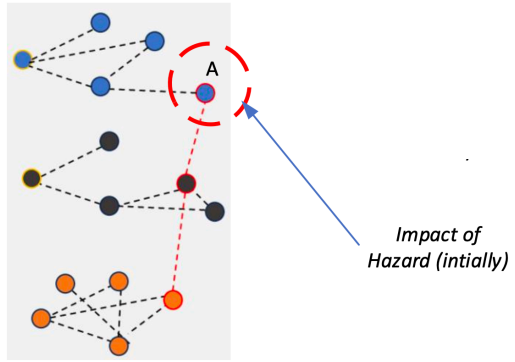
4. Work out how the HAZARD which impacts the initial subset of nodes changes the connectivity between the system nodes



= new connection between system components AS A RESULT of the HAZARD manifesting

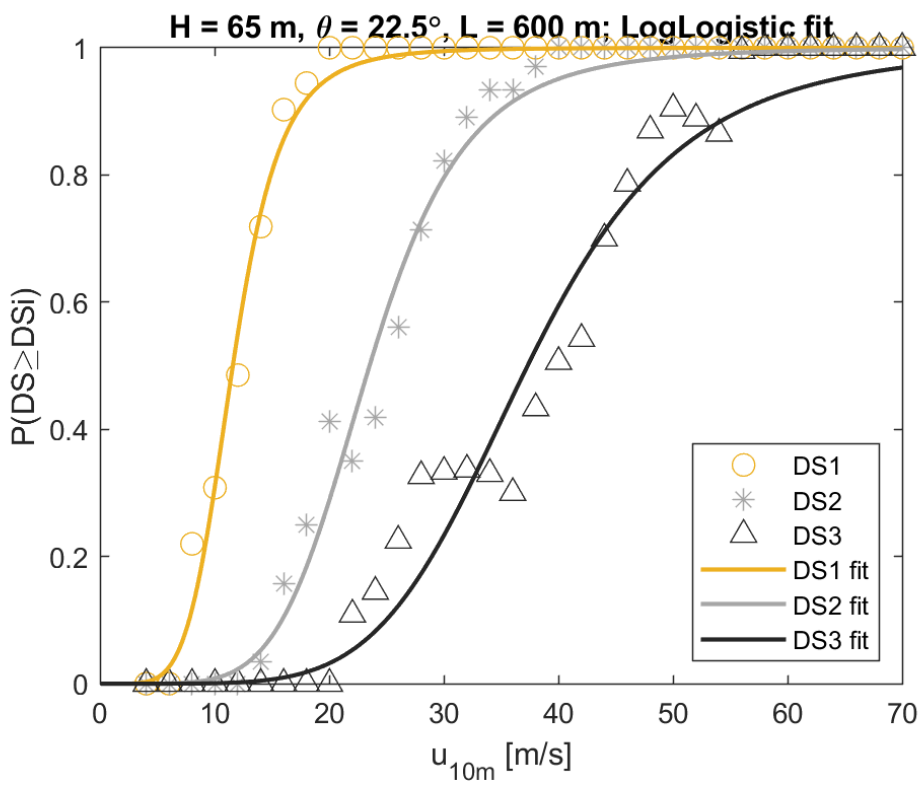
5. Choose a system node that experiences damage (node 4). Build a causal network from the events that flow from this initial node to track the damage flow (from node 4 to 5). Use of Capability Hierarchy Model and Damage models fit
in here.

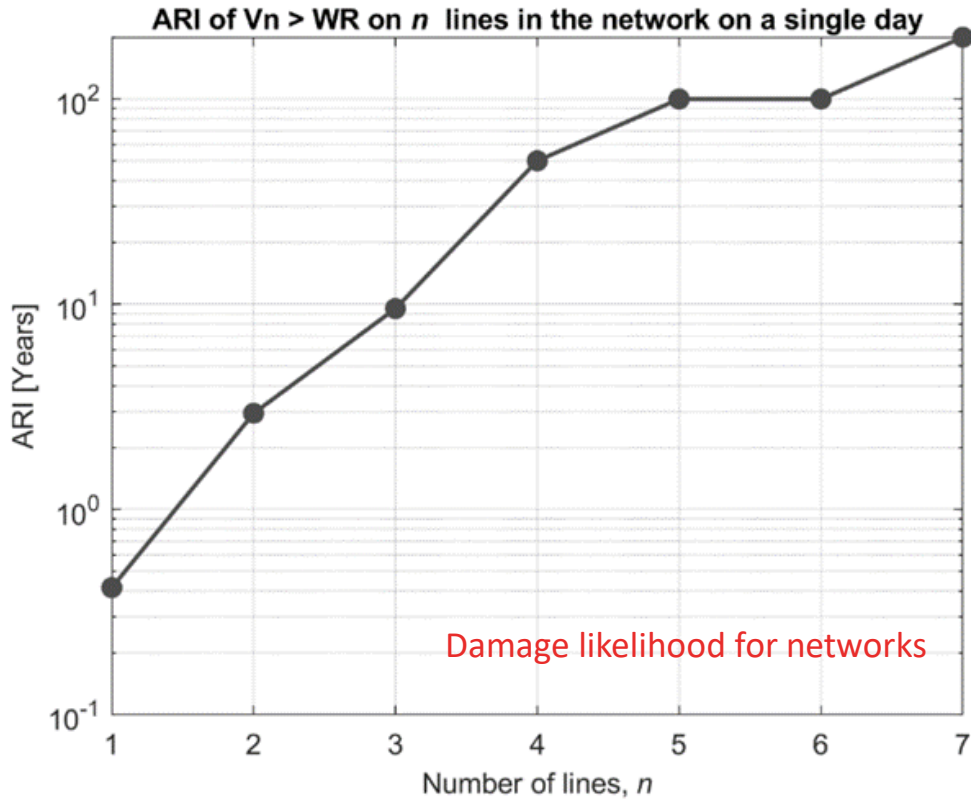




Applying the research

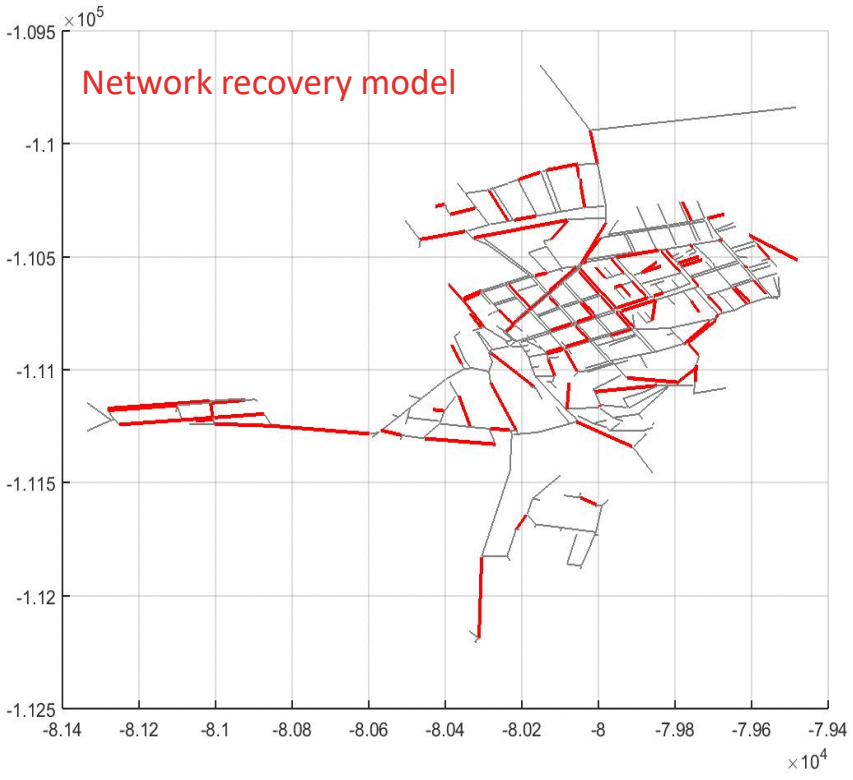
Damage model for network assets

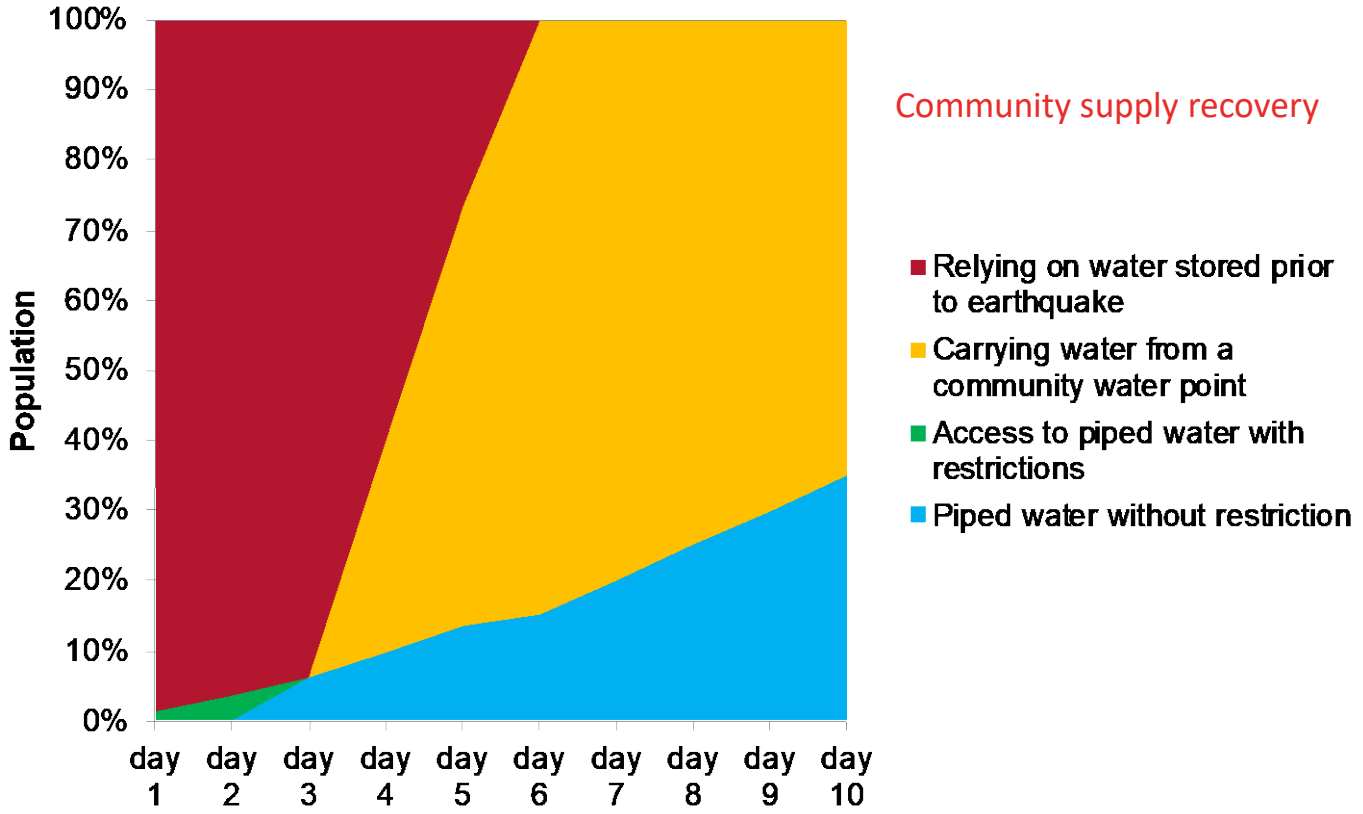




Resilience of power networks

Applying the research





Resilience of potable water infrastructure