An improved approach to understanding social vulnerability and hazard risk

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Introduction

➢ A natural disaster results when individuals, communities and infrastructure are impacted by a natural hazard[1]

➢ The economic and social repercussions of these disasters create a need for improved approaches to natural disaster risk reduction

➢ To do this, we need to understand what makes up hazard risk (Fig.1)

Aim: To develop a conceptual framework that builds understanding of the spatial and temporal influences of social vulnerability on hazard risk

Fig. 1 Hazard Risk Triangle – elements affecting risk[2,3]

Methodology

The framework (Fig. 2) explores hazard risk by assessing hazard, exposure and vulnerability (Fig. 3). Future hazard risk is considered using exploratory scenarios that influence the model inputs (Fig. 4).
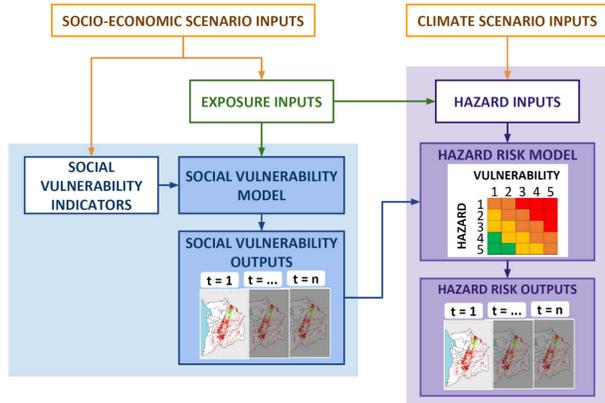

Fig. 2 Conceptual framework for understanding the drivers of social vulnerability and hazard risk
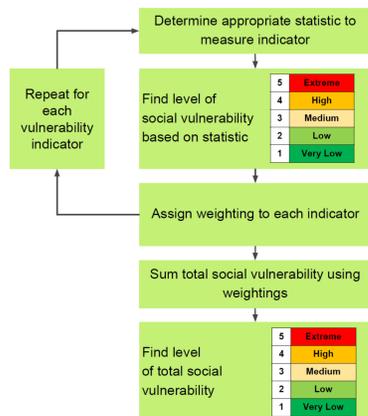

Fig. 3 Methodology for combining social vulnerability indicators to form a single value of social vulnerability
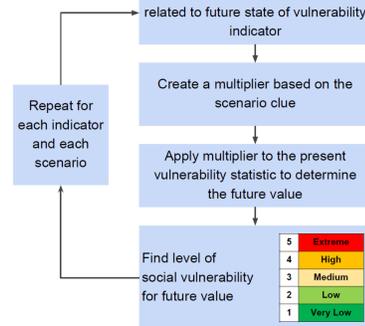
Fig. 4 Methodology for projecting social vulnerability indicators in line with future socio-economic scenarios

Case study

➢ A case study of Greater Adelaide is used to test the methodology (Fig. 5)

➢ The case study uses:

- Social vulnerability data based on a suburb level from Census data

- Bushfire and earthquake hazard models

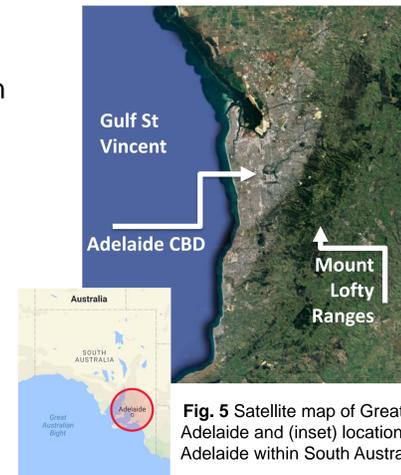- 5 socio-economic exploratory scenarios (Fig. 6)

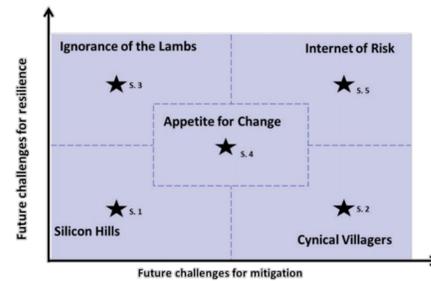**Fig. 5** Satellite map of Greater Adelaide and (inset) location of Adelaide within South Australia

Fig. 6 Exploratory scenarios that have been developed for Greater Adelaide[4]

➢ The case study shows how social vulnerability and hazard risk change with space and time

Results

Greater Adelaide case study | Current time

The results presented for the current situation illustrate the influence of social vulnerability under different hazards.
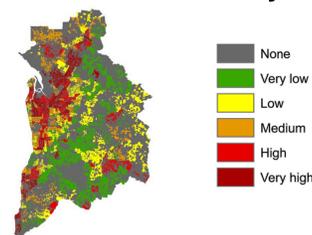
Social vulnerability

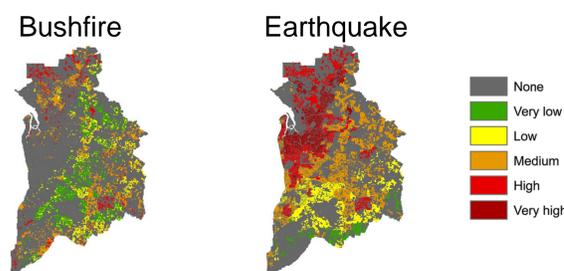**Fig. 7** Social vulnerability of Greater Adelaide for the current time

Hazard risk

Bushfire   Earthquake

Fig. 8 (a) Current bushfire hazard risk, and (b) current earthquake hazard risk

The results presented for the 2050 case illustrate the influence of future scenarios on social vulnerability, and the resulting interaction with the hazard of bushfire.
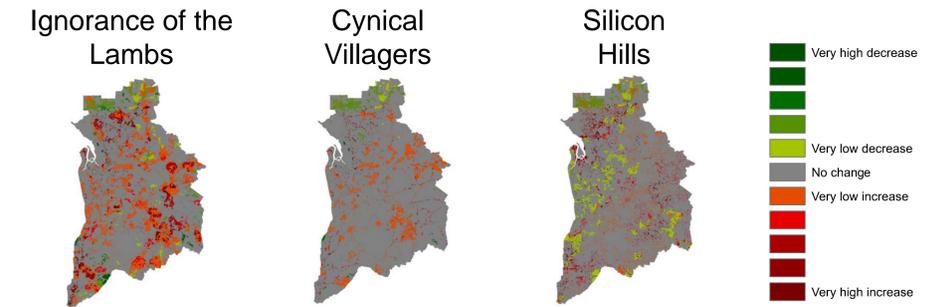
Social vulnerability changes between present and 2050

Ignorance of the Lambs   Cynical Villagers   Silicon Hills

Fig. 9 Changes in 2050 from current social vulnerability for Ignorance of the Lambs, Cynical Villagers, and Silicon Hills scenarios

Future bushfire risk changes between present and 2050

Ignorance of the Lambs   Cynical Villagers   Silicon Hills
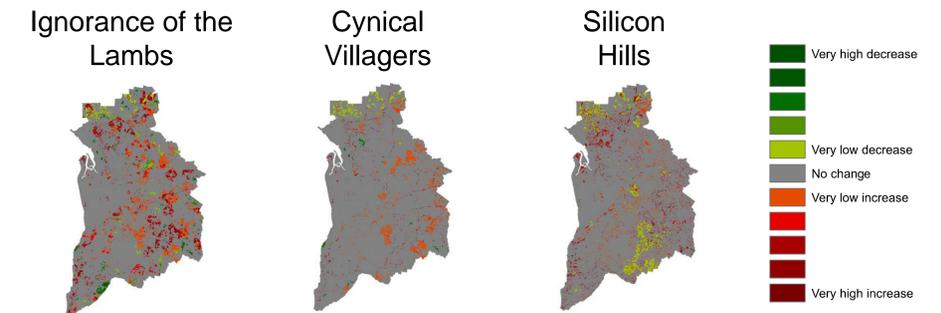

Fig. 9 Changes in 2050 from current bushfire hazard risk for Ignorance of the Lambs, Cynical Villagers, and Silicon Hills scenarios

Conclusion

➢ The conceptual framework details a methodology for understanding the drives of natural hazard risk

➢ The case study results indicates that the social vulnerability and hazard risk changes spatially and temporally

➢ In future applications it would be beneficial to incorporate an assessment of mitigation options developed alongside stakeholders

References

(1) Smith, A, Martin, D & Cockings, S 2016, 'Spatio-Temporal Population Modelling for Enhanced Assessment of Urban Exposure to Flood Risk', *Applied Spatial Analysis and Policy*, vol. 9, no. 2, pp. 145-163.
(2) Frigerio & De Amicis 2016, 'Mapping social vulnerability to natural hazards in Italy: A suitable tool for risk mitigation strategies', *Environmental Science & Policy*, vol. 63, pp. 187-196.
(3) Dwyer, A, Zoppou, C, Nielsen, O, Day, S & Roberts, S 2004, *Quantifying Social Vulnerability: A methodology for identifying those at risk to natural hazards*, Geoscience Australia, Canberra, Australia.
(4) Riddell, GA, van Delden, H, Dandy, GC, Maier, HR, Zecchin, AC, Newman, JP & Newland, C 2015, 'Futures of Greater Adelaide 2050; An exploration of disaster risk and the future.'.