bnhcrc.com.au

INTEGRATED ECONOMIC ASSESSMENT OF FLOOD MANAGEMENT OPTIONS FOR ADELAIDE

Non-peer reviewed research proceedings from the Bushfire and Natural Hazards CRC & AFAC conference
Brisbane, 30 August – 1 September 2016

Morteza Chalak[1], Veronique Florec[1 2], Atakelty Hailu[1 2], Fiona Gibson[1 2] and David Pannell[1 2]
1. University of Western Australia
2. Bushfire and Natural Hazards CRC

Corresponding author: morteza.chalak@uwa.edu.au

Version	Release history	Date
1.0	Initial release of document	30/08/2016

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

Publisher:
Bushfire and Natural Hazards CRC

August 2016

ABSTRACT

The extent of damages caused by floods can be great. It is estimated that 80 per cent of the overall cost of Australian natural disasters is the consequence of flooding and this, on average, costs approximately $600 million per annum (Gentle et Bureau of Transport Economics, 2001; Productivity Commission 2015). These average figures do not reflect the severity of the impact that some floods can cause. For example, the magnitude and extent of the recent (2011) Queensland floods was vast, with an overall cost estimates above $6.8 billion.

There is a growing recognition that Australia's disaster funding arrangements are not efficient and do not create the right incentives for managing risks (Productivity Commission 2015). There is underinvestment in disaster mitigation and overinvestment in post-disaster interventions. Across Australia, flood maps have become a major mitigation strategy. Other mitigation strategies include structural solutions such as levees, dams, diversion channels, floodgates, and detention basins as well as non-structural solutions such as early warning and evacuation systems and community education programs. The structural solutions are typically capital intensive and costly. On the other hand, the assessment of flood mitigation benefits generally tends to be partial and focused on tangible and direct benefits. As a result, investment decisions can be suboptimal.

For optimal and equitable investment in mitigation, it is important to understand the full range of costs and benefits and also how these costs and benefits are distributed among different segments of the community. Therefore, it is important that cost and benefit assessment methods depict an adequate picture of the costs and benefits of possible risk mitigation measures. Otherwise, even simple option evaluation procedures such as cost-benefit analysis are not precise. A panel of experts convened under the European Union's 'Costs of Natural Hazards' (CONHAZ) project identified key areas for improvement in cost/benefit assessment and these include the need for more focus on non-structural measures, and indirect and intangible costs (Meyer et al. 2013). Intangible values, normally excluded from benefit cost analysis, can be significant or even the most dominant set of values in some cases.

The purpose of this presentation is to address the shortcoming in relation to intangible values in the context of flood mitigation option analysis for the Brown Hill and Keswick catchments in Adelaide. The catchments include both rural and urban areas and involve local government councils for Adelaide, Burnside, Mitcham, Unley and West Torrens. This analysis focuses on a set of flood mitigation options that are currently under consideration following a public consultation. Previous analysis done on these options suggests that the benefit-cost ratios appear unfavourable. However, the analysis was done without the inclusion of intangible values. In this presentation we argue why intangible values should be included and provide estimates that show how our understanding of the costs and benefits of mitigation options would change with the inclusion of intangible values to account for the health, environmental and social impacts of floods. Intangible values relevant in the context of natural hazards in general are shown in Table 1.

Health	Environment	Social
Mortality, morbidity, injury, stress/anxiety, pain, trauma, grief, increased vulnerability among flood survivors	Wildlife loss, ecosystem degradation, water quality problems, invasive species	Recreation values, amenity values, safety, social disruption, cultural heritage, animal welfare, loss of memorabilia

TABLE 1: INTANGIBLE VALUES IMPACTED BY NATURAL HAZARDS

Health effects range from loss of life (or mortality), to physical injuries and psychological distress, all of which are direct intangible impacts. There is research evidence showing that floods cause numerous psychological effects that are adverse to health. A study conducted by the UK Department of Environment, Food and Rural Affairs (Defra 2005), indicates that a large proportion of flood-affected respondents (80 per cent) suffer from anxiety when it rains while two thirds (65 per cent) have reported increased stress levels. More than half have reported sleeping problems (Defra 2005). Other effects include morbidity, trauma and loss of trust in authorities (Merz 2010).

Floods can also have direct and indirect impacts on natural assets and ecosystem services; and these effects generally lead to the loss of intangible values. In some cases the effects of floods can be beneficial. These effects also depend on the speed of flooding and whether wildlife has the chance to escape. For example, the Queensland floods of 2010/11 had adverse impacts on marine and terrestrial biodiversity, including some threatened species such as the cassowary, but had positive effects on freshwater systems such as those on the Murray River (Reid 2011). Water quality problems generated by floods include water contamination and hypoxic blackwater events that are detrimental to fish (Whitworth et al. 2012).

Even small floods can cause disruptions to traffic in urban environments, and these disruptions can add up to significant damages especially if the floods occur regularly (ten Veldhuis and Clemens 2010). Larger floods can cause massive population displacement causing prolonged social disruption. Other social intangible costs include: loss of recreational opportunities and amenity values; increased risk of loss of life; loss of cultural heritage and memorabilia; and harm to animals.

In the context of flooding the study catchments, the relevant intangible values are the following: mortality; morbidity and other health related problems; social disruption; recreational values; and cultural heritage. Estimates for these intangibles are generated and used in the analysis of mitigation options.

The mitigation options considered are based on alternatives identified in the current Stormwater Management Plan (SEM 2016), which is the result of collaboration among the councils and involves mitigation works in the four major watercourses serving the catchments, namely, Brown Hill, Keswick, Glen Osmond and Parklands Creeks. The options all provide protection against100-year ARI floods.

We show that the inclusion of intangibles changes the cost-benefit ratios and the attractiveness of options greatly. Further, as results depend on cost and benefit estimates, we undertake sensitivity analysis to provide a sense of the dependence of proposed best choices to the variability in both cost and benefit estimates. The presentation concludes by drawing recommendations for improving the choice of flood mitigation options.

REFERENCES

Bureau of Transport Economics, 2001. Economic costs of natural disasters in Australia. Canberra: Common Wealth Government of Australia, 2001. Web. 21 May 2015.

Defra, 2005. The Benefits of Flood and Coastal Risk Management: A Handbook of Assessment Techniques, London: Flood Hazard Research Centre.

Merz, B., Kreibich, H., Schwarze, R., and Thieken, A. 2010. Assessment of economic flood damage: Review article. Natural Hazards Earth Systems Science, 10, 1697-1724.

Meyer, V., Becker, N., Markantonis, V., Schwarze, R., van den Bergh, J.C.J.M. , Bouwer, L.M., Bubeck, P., Ciavola, P., Genovese, E., Green, C., Hallegatte, S., Kreibich, H., Lequeux, Q., Logar, I., Papyrakis, E., Pfurtscheller, C., Poussin, J., Przyluski, V., Thieken, A.H. and Viavattene, C. 2013. Assessing the costs of natural hazards – state of the art and knowledge gaps: Review article, 13, 1351-1373.

Reid, K. 2011, Flooding expected to be beneficial to river ecosystem, ABC online news, http://www.abc.net.au/local/stories/2011/01/25/3121051.htm

Productivity Commission, 2015. Natural Disaster Funding Arrangements, Inquiry Report no. 74, Canberra. JEL code: H77, H84.

SEM, 2016. Stormwater management plan. Brown Hill Keswick Creek catchment. The cities of Adelaide, Burnside, Mitcham, Unley and West Torrens.

ten Veldhuis, J.A.E, Clemens, F.H.L.R., 2011. Flood risk modelling based on tangible and intangible urban flood damage quantification, Water Science & Technology, 62 (1) 189-195.

Whitworth, Kerry L., Baldwin, Darren S., Kerr, Janice L. 2012. Drought, floods and water quality: Drivers of a severe hypoxic blackwater event in a major river system (the southern Murray–Darling Basin, Australia), Journal of Hydrology, Vol. 450-451, pp.190-198.