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ECONOMICS OF NATURAL HAZARDS

Annual project report 2015-2016

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Cover: Damage caused by Cyclone Yasi in northern Queensland, 2011

Photo: Cyclone Testing Station, James Cook University

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EXECUTIVE SUMMARY

The project tackles from an economics perspective issues relating to non-financial benefit estimation, risk analysis, and development of decision-making frameworks that would help deliver value for money from public investments in natural hazard management. It has a broad scope in terms of natural hazards, including fires, earthquakes, floods, cyclones and tsunamis. It aims to improve the management of bushfires and other natural hazards by delivering the following outcomes:

- Improved recognition of non-financial benefits of management and policy for natural hazards, influencing decisions about budget levels and about management and policy options.
- Improved decision-making about management and policy options considering the full range of relevant factors (technical, social, economic, environmental, policy).
- Improved quality of economic analysis throughout the sector, resulting in stronger and more defensible analyses, and stronger support from Treasury.

The research team has extensive experience in non-market valuation, integrated modelling and the economics of environmental and natural resource management and policy. The team has also recruited four outstanding environmental economists with extensive experience in.

The project has continued to engage well with the end user community and other potential collaborators. Project staff have been keen to help identify research priorities and deliver research outcomes that are based on a broader analysis of the costs and benefits of mitigation options and inform management and policy choices accordingly. The project's major accomplishements for the year include the following:

- A journal article has been written and submitted for review on non-market value in natural hazards management.
- Analysis on mitigation options for flood management in Adelaide (first case study) has been completed and preliminary reports provided. A working paper is being finalised. Results from this analysis will be presented at AFAC 2016 in Brisbane.
- A workshop on 'Economics of natural hazard mitigation' was delivered as part of the 8th Australasian Natural Hazards Management Conference to held in Perth, WA during October 12-14. The feedback on the workshop was very positive.
- Research team members have conducted several meetings with end users and have provided advice to agencies in WA regarding the collection of economic information for hazard management. These include the State Emergency Mangement Committee (SEMC).
- A video describing the project and its relevance to management and policy has been prepared.

END USER STATEMENT

Ed Pikusa, *National Risk Assessment, Measurement and Mitigation Subcommittee (RAMMS), Fire and Emergency Services Commission, SA*

This project has generated a lot of interest among end users, particularly in Western Australia and South Australia.

It is well understood that the impacts from natural disasters can be far-reaching, extending beyond quantifiable financial costs.

The inclusion of non-market values has the potential to improve the assessment of disaster losses to more accurately reflect reality. In this project, the universoty of Western Australia is seeking to quantify and demonstrate the inclusion of so-called 'non-market' costs into traditional benefit-cost analysis.

Integration of non-market costs into the Uni of Adelaide project on planning and optimisation has been discussed, and is a live option for the second stage of the research program

Application of the work to South Australia flood case studies is a useful illustration of the process, which end users can see as a demonstration and seek to apply in their own situations.

The register of non-market costs as a project deliverable has similarly generated significant interest as a fundamental resource for end users seeking to use non-market costs.

INTRODUCTION

Natural hazards have a number of things in common when it comes to planning, decision making and evaluation of public investments. First, they are complex and, therefore, effective decision making and evaluation requires synthesis and integration of many different types of information within a context of high risk and uncertainty. Second, addressing these issues well requires an inherently multidisciplinary approach, often requiring information from biological sciences, physical sciences, social sciences and economics. Third, data requirements for strong decision making and helpful evaluation are extensive, and existing data sources are usually insufficient for this purpose. Fourth, some of the key impacts of natural hazards are relatively intangible, making them difficult to quantify, especially in a way that can feed into decision making. Finally, research into planning, decision making and evaluation for natural hazards is relatively lacking.

In the case of bushfires, for example, decision making requires combining information on physical, biological, social and economic aspects such as: risks of fire occurrence, risks of fire spread, frequencies of fires of different severities, impacts of weather conditions on these things, losses associated with bushfires of different severities, reductions in those losses under different prescribed burning regimes, and costs of different prescribed burning regimes. Experience in a Bushfire CRC project shows that only a minority of the required information is readily available in existing datasets. Intangible benefits of bushfire management include effects on life, health, feelings of safety, biodiversity, threatened species, and water quality. Integrated economic analysis of strategic bushfire decisions has been undertaken in Australia only for two case studies. The knowledge gaps for other hazards, such as earthquakes, floods, cyclones and tsunamis, are similarly significant.

This project aims to fill key knowledge gaps on issues related to values, risks, and decision making to deliver value for money from public investments in natural hazard management.

This is the second annual report written since the project research activities began in earnest in January 2015. In the next section, we provide a summary of the main components of the project. This is followed by a presentation of the projects key activities over the reporting period. The last two sections present a list of presentations made by the project and the current list of members in the research team.

PROJECT BACKGROUND

The project has three main components that are outlined below.

ESTIMATE THE NON-FINANCIAL BENEFITS

End-user organisations have indicated the need for a stronger focus on dollar valuation of non-financial benefits from natural hazard policy and management. The challenge here is that there are so many different contexts within which these values may be needed, and it is not practical or affordable to conduct new studies for each context. Environmental economists have developed a technique called "benefit transfer", which involves attempting to extrapolate from existing studies, but even this is not an ideal solution. It requires a high level of economics expertise, and it relies on the existence of relevant studies to extrapolate from, which is often not the case for natural hazards.

This project will develop an innovative tool for efficiently generating estimates of dollar values for non-financial benefits. The aim is to develop a tool that people with only moderate economics knowledge are able to use, and that people with no economics knowledge can learn from.

INTEGRATED ECONOMIC ANALYSIS OF MANAGEMENT AND POLICY

This component of the project involves integration of technical, social, biophysical and policy information within an economics framework with a decision-making focus. Therefore, it is a study that requires high levels of participation by end users. Strengths of the integrated approach to the analysis include that: it provides a mechanism for bringing research results into decision making about policy and management; it combines economic rigour with stakeholder participation; and it provides information in a form that is useful in discussions about resourcing and policy design. Two case studies will be identified in consultation with the CRC and stakeholders. This study differs from other integrated assessment studies or work on decision support systems (DSSs) in that it takes into account the non-financial benefits of mitigation activities. The project is currently collaborating with an end user to conduct its first case study in Western Australia as described in the next section.

DEVELOP GUIDELINES FOR SOUND ECONOMIC ANALYSIS

This component of the project involves developing an accessible and understandable guide to undertaking economic analysis of natural hazard management and policy. The work will be based on: experience in the research undertaken to address the other project objectives; experience in the Bushfire CRC; relevant research literature and textbooks. The guide aims to be helpful to agencies in:

- formulating its needs for economic analysis,
- knowing what to ask economists (internal or external) to do,
- evaluating the quality of economic analysis that has been conducted,
- understanding the data requirements, and
- supporting economists beginning work on natural hazards.

WHAT THE PROJECT HAS BEEN UP TO

Over the last year, the major activities of the project have include the following: preparation of a project video; rectuitment of additional staff (Morteza Chalak); undertaking team workshops; a workshop on economics of natural hazards; extensive engagement with end users and other researchers; publications and research on non-market valuation in natural hazards; and undertaking a case study on flood management options for Adelaide. Further details are provided below.

WORKSHOPS ON THE ECONOMICS OF NATURAL HAZARDS

The project has done internal (research team) workshops over the course of the year. It had also prepared and submitted a proposal for a Workshop on the Economics of Natural Hazards as part of the 8th Australasian Natural Hazards Management Conference (ANHMC). The proposal was successful and the project was able to deliver the workshop, which aimed to provide participants with an introduction on the application of economics to natural hazards management and mitigation, why it is important, how economics should be used, what questions it seeks to answer and what is required to conduct economic analyses. Attendants came from different backgrounds and regions of Australia and New Zealand. The aim of the workshop was to provide participants with an introduction on the application of economics to natural hazards management and mitigation, why it is important, how economics should be used, what questions it seeks to answer and what is required to conduct economic analyses. The following presentations were given: Economic principles and the management of natural hazards (V. Florec and D. Pannell); Estimation of values for intangible impacts of natural hazards (F. Gibson); Dealing with uncertainty in economics (A. Hailu and D. Pannell); and Putting it all together (D. Pannell).

Workshop participants had the chance to participate in a live non-market value elicitation experiment. The participants seemed quite interested and engaged in the valuation exercise. The immediate feedback from the workshop participants and the organising committee of the conference was very positive.

ENGAGEMENT WITH END USERS AND OTHER RESEARCHERS

The project has actively engaged with its end users over the course of the year.

SEMC

Over the year, the project has had several meetings with the State Emergency Management Committee (SEMC) for WA. These meetings have focused on a possible case study within WA; the applicability of non-market values framework to SEMC decision-making; and the provision of expert advice to SEMC on their State Risk Project. SEMC is interested in resource allocation and prioritization for the numerous hazards that the State of WA may face. Details of these meetings and issues discussed have been provided in the quarterly reports.

University of Adelaide BNHCRC Project Team

The project team met with the Adelaide Project members, led by Holger Maier, on several occasions, including at AFAC 2015 and RAF to discuss opportunities for future collaboration. At AFAC 2015, the two teams presented updates on their respective projects and described what they were focusing on for their case studies. Recently, Fiona Gibson (UWA) met with Holger Maier, Graeme Riddle (UA), Ed Pikusa, Mike Wouters (DEWNR) on 03/05/2016 to discuss synergies between the University of Adelaide decision support system and UWA non-market values project, future joint case studies, and future projects for both research groups.

Meeting with DEWNR (Adeliade)

We have had discussions about both the integrated modeling and valuation components of the project and case studies with staff at DEWNR and others in Adelaide. For the flood case study, on 16/03/2016, we met with Ed Pikusa (Cluster Leader and DEWNR), Bill Lipp (Department of Planning, Transport and Infrastructure, SA) and David Trebilcock (DEWNR) to discuss flood management issues and options in the Brown Hill and Keswick Catchments of Adelaide.

Fiona Gibson (UWA) met with Mike Wouters, Ed Pikusa, Tim Groves, Chrissie Bloss and others at DEWNR on 02/05/2016. Issues discussed include the non-market values project, issues around incorporating NMV in Treasury business case and case study ideas for the NMVs project.

Meeting with CQU project researchers

Several meetings were held with the project leaders, Kevin Ronan and Briony Towers, of the child-centered disaster risk reduction (CCDRR) project funded by BNHCRC. The discussion focused on how the two groups could benefit from collaboration. The groups are working on a one-page project brief to use in engagement with potential end-users. The project proposal, a cost-benefit analysis or cost effectiveness analysis of CCDRR-related initiatives and activities, has received positive feedback from end users so far. In July, Veronique Florec and Atakelty Hailu will give a presentation to the end-users of CCDRR and DFES in WA.

Other end users

Other end users (and potential end users) project staff have meet with include: Tracy Leotta (DFES); Suellen Flint (DFES); Stephanie Bolt (Adelaide Airport); Laura Little (DELWP); and Tim McNaught (OBRM).

VALUATION OF NON-MARKET COSTS AND BENEFITS

A large amount of non-market valuation literature relevant to natural hazards was reviewed in the early phases of this project. A paper (on Non-market Valuation of Natural Hazards) based on this review was published in the School of Agricultural and Resource Economics working paper series. Subsequently, the paper was submitted for review to the International Journal of Wildland Fire.

Recently, the project team has been finalising the set of relevant values that can

be affected by natural hazards, in consultation with Heather Taylor at SEMC and a group of fire and flood managers at DEWNR. The team have been working on a search protocol for identifying suitable non-market value estimates to include in a database, compiling the database of non-market estimates and have scoped the content of the database interpretation guidelines to accompany the database.

Work on the journal paper "Economic methods for valuing non-market impacts from natural hazards" continues. The team has contributed to communication activities, including the RAF presentation and creating a video on our research under the project.

INTEGRATED ECONOMIC MODELLING OF FLOOD MANAGEMENT OPTIONS FOR ADELAIDE

The preliminary report on the first case study was completed and sent to the Cluster leader for comments. This study focuses on flood mitigation options in the Brown Hill and Keswick catchments of Adelaide. A meeting was held in Adelaide with DEWNR and DPTI staff to define the set of options to be analysed. The preliminary report identifies the set of tangible and intangible values that are relevant to the analysis and provided initial estimates of costs and benefits for each of the options. These options include investments in creek capacity upgrades, river diversions and detention dams. They would substantially reduce flood damages resulting from a one in a hundred year probability floods, which are the target of the planned interventions. Morteza Chalak, Veronique Florec and Atakelty Hailu are currently finalising the working paper on the case study.

Veronique submitted her PhD thesis at the end of April. Her thesis is titled "Economic analysis of prescribed burning in the south-west of Western Australia" and is currently under revision.

Currently, the project is finalising its Adelaide flood study and generating a working paper (titled: Economic analysis of flood mitigation options for Brown Hill and Keswick Catchments) for publication. The results will be presented at AFAC 2016.

PROJECT VIDEO

The Bushfire and Natural Hazards CRC project – "The economics of natural hazards" – has prepared a video describing how the project aims to provide natural hazard managers with a better understanding of the costs and benefits of natural hazard mitigation, including the intangible benefits associated with protecting social and environmental values. The video also shows how the project could help managers compare the economic, social and environmental costs and benefits for different mitigation options to determine which options provide the highest net benefit.

PUBLICATIONS/PRESENTATIONS

Gibson, FL, Pannell, D, Hailu, A. 2016. "Non-market values in the economic analysis of bushfire mitigation: A review", Submitted to International Journal of Wildland fire.

Gibson, FL, Pannell, D, Boxall, P, Burton, M, Johnston, R, Kragt, M, Rogers, A, Rolfe, J. 2016. "Non-market valuation in the economic analysis of natural hazards", Working paper, School of Agricultural and Resource Economics, University of Western Australia.

Chalack, M. and Hailu, A. 2016. "Economic analysis of flood mitigation options for Brown Hill and Keswick Catchments: Preliminary results", unpublished Report, April 2016.

Florec, V. 2016. "Economics of Natural Hazards", paper presented at RAF, Hobart, 12 May 2016.

Florec, V. 2016. "An economic analysis of prescribed burning in the south west of Western Australia", paper presented at the 8th Australasian Natural Hazards Management Conference in October 2015.

The project presented the following posters at the BNHCRC/AFAC conference 2015:

1. "Economics of Natural Hazards: Integrated Assessment". The poster described how the project integrates technical, biophysical, and socioeconomic and policy information to address key decision problems relating to natural hazard prevention and mitigation.
2. "Valuing Intangibles". The poster describes why it is important to quantify and measure the different values that natural disasters affect (life, health, belongings, property, essential services and the environment) and also the project's aims to build a tool that would make it possible to estimate values using available information.

CURRENT TEAM MEMBERS

The research team currently includes David Pannell (Professor, UWA), Atakelty Hailu (Assoc/Prof, UWA), Michael Burton (Prof, UWA), Fiona Gibson (Assist/Prof, UWA), Veronique Florec (Researcher, UWA), Abbie Rogers (Assist/Prof, UWA) and Morteza Chalak (Assist/Prof, UWA). Dave, Fiona, Michael and Abbie are responsible for the valuation or value tool component of the project. The value tool group is backed by four outstanding environmental economists with extensive experience and high expertise in valuation to be collaborators in this research: Professor Peter Boxall (University of Alberta, Canada); Professor John Rolfe (Central Queensland University); Professor Rob Johnston (Clark University, USA); and Professor Nick Hanley (University of Sterling, UK). Dave, Atakelty, Veronique and Morteza are responsible for the work on integrated economic modeling of options for hazard mitigation.