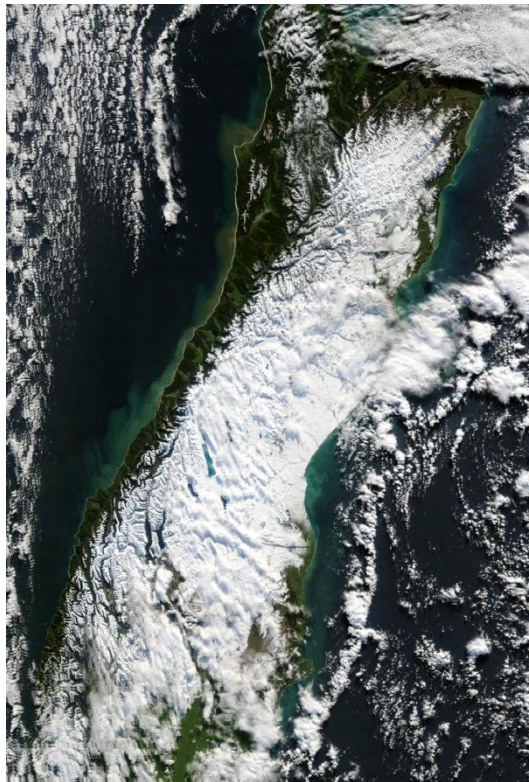


# “DISASTROUS DOCTORATES”

3 DECEMBER 2008

JOINT CENTRE FOR DISASTER RESEARCH  
MASSEY UNIVERSITY  
WELLINGTON



June 2006 South Island Snowstorm (NASA)

## PROGRAMME & ABSTRACTS

EDITOR: Tom Wilson

Supported by:



**Massey University**



# “DISASTROUS DOCTORATES”: AGENDA

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## TUESDAY, 2<sup>ND</sup> DECEMBER 2008

GRASS AREA BESIDE BLOCK 7, MASSEY UNIVERSITY WELLINGTON CAMPUS,  
NEWTOWN, WELLINGTON

**5.30 -7.30 pm**    **BBQ**    (*food and light refreshments provided*)

## WEDNESDAY, 3<sup>RD</sup> DECEMBER, 2008

ROOM 5B14 (EXECUTIVE SUITE), MASSEY UNIVERSITY WELLINGTON CAMPUS,  
NEWTOWN, WELLINGTON

**9.30 - 10.00**    **Arrival**    (*tea and coffee provided*)

**10.00 - 12.15**    **Introduction of Thesis Topics**

5 minute overview of each participant's thesis/research topic

**12.15 – 1.00**    **Lunch**    (*provided*)

**1.00 – 3.00**    **Group Discussion:** challenges, problems and successes (*see next page*)

**3.00 – 3.30**    **Afternoon Tea**    (*tea and coffee provided*)

**3.30 - 4.00**    **Beyond the Thesis**

# DISCUSSION TOPICS

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## FUNDING

Innovative funding of big ticket items (e.g. airfares, equipment)...any creative ideas?

## PRESENTING RESEARCH/NETWORKING

Share any knowledge of up-coming useful conferences.

## DATA

Quantitative vs. Qualitative data and experiences of working with it

Developing a survey: survey design, questionnaires, administering survey, ethical issues involved (especially in post-disaster area)

Processing and analysing data

Strategies on approaching/engaging non-responsive getting agencies or organisations vital to your research

## PUBLISHING

Writing articles for publication in research journals: approach to writing itself, determining where to submit, the scope of a submission i.e., how much, with what focus, for which article, etc.

What should be published? How should it be published? When should it be published?

Impact rating...how important is this and should this be a factor in choosing journals to publish in

What gives the greatest chance of publication success?

What makes the most useful contributions?

What is successful from an interdisciplinary perspective?

## CLOSE TO COMPLETING

If anyone's at the stage of finishing off - how long does it really take? What things cropped up that you didn't account for?

How do you write up a PhD?

What do you get quizzed about in an oral exam?

Time constraints for full time PhDs. Survival is an issue for international students

What to do just after finishing a PhD - overqualified for most jobs and post docs require PhD completion.

What are the opportunities for post doctoral awards in disasters in New Zealand?

When you haven't published yet, writing for publications requires additional time plus living cost, and getting into other job would mean end of publishing PhD.

## LIST OF ATTENDEES

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| Attendee           | Institution | Email Address                     |
|--------------------|-------------|-----------------------------------|
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## ABSTRACTS

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### INCREASING COMMUNITY RESILIENCE TO DISASTERS: UNDERSTANDING HOW INDIVIDUALS MAKE MEANING OF HAZARD INFORMATION, AND HOW THIS RELATES TO PREPARING FOR HAZARDS

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Research has shown that a number of individual, community and societal attributes can be used as indicators of community resilience. These indicators include outcome expectancy, action coping, articulation of problems, community participation, empowerment, social trust and self-efficacy (McClure et al., 1999; Paton, 2007; Paton et al. 2001a,b,c, 2000, 2005, 2006a,b; Ronan et al., 1998). A model of community resilience which incorporates these attributes was recently developed and tested (Paton, 2006; Paton, 2008). This model describes how interaction between person, community and societal (e.g., emergency management agency) characteristics influences people's capacity to adapt to hazard consequences.

To date, as part of the modelling process, research has been quantitative-based, and has focused on identifying predictors and defining the linkages between them to construct a model. However, there has been very little in-depth study on the processes that influence specifically how individual, community and societal factors interact to determine how people render hazard information meaningful, and how this interactive process translates into preparedness actions. This study addresses this gap and uses qualitative research methods to explore aspects of meaning-making preparedness, adaptive capacity and resilience for hazards.

Interviews have been undertaken with individuals in three communities (Napier, Wanganui and Timaru) to explore how people make meaning of hazard information, and the factors behind why these people do, or do not, prepare. As part of future work, these interviews will be complemented by quantitative surveys to test the findings from the interviews.

The ultimate aim of this research is to enhance community resilience to natural hazards. By undertaking qualitative interviews, and follow-up quantitative surveys directly informed by the qualitative work, a better understanding can be gained about the influences and mechanisms that enhance sustained household and community preparation. From this understanding, current models of resilience can be improved and subsequently fed into policy-making for hazard management.

# THE ROLE OF RELIGIOUS INSTITUTIONS IN DISASTER RISK GOVERNANCE: THE CASE OF 2005 EARTHQUAKE IN PAKISTAN

**ABDUR REHMAN CHEEMA**  
MASSEY UNIVERSITY

This research aims to explore the role of religious institutions in improving disaster risk governance. Religion and religious institutions have an important and notable role in social fabric of faith-based societies. Socio-cultural environment has a significant role in disaster governance. There is no natural disaster per se. Disasters are complex phenomenon. Vulnerabilities are generated in everyday life through a host of internal and external factors. Among internal factors, religious institutions play an important role in shaping up people's perception of disaster risk which in turn influences disaster policy and practice in faith-based societies.

This research endeavours to explore the role of religious institutions in the process of disaster risk governance in Pakistan in the aftermath of 2005 earthquake. In particular, the role of an informal civil society religious institution, mosque, which has its presence at the very local level, is investigated in this research. Pakistan, being a 97 percent Muslim population, mosques form a fundamental part of the civil society. Mosque not only serves as a place of worship but also a vibrant community centre to relate and network among the community members. Mosque is a civil society institution managed by community and represented by Imam (the prayer leaders).

The research seeks to investigate the perception of imams who regularly interact and influence public perception on matters of daily life through delivery of public talks such as Friday. It aims to delineate the degree of influence of religion and mosque on affected peoples' views and responses towards the earthquake. During this process, the research seeks to answer how far peoples' perception of any future disaster is shaped by their religious attitudes and the role of mosques in this regard. Ultimately, the research seeks to gauge the potential benefits or otherwise of bringing mosques and imams in disaster management policy arena as in future. The research is likely to have broader implications regarding the role of religious institutions in faith-based societies for disaster risk governance in other parts of the world.

# RESILIENCE AND THE PREVENTION OF WORK RELATED TRAUMATIC STRESS: TESTING AN ECOLOGICAL MODEL.

**IAN DE TERTE**  
MASSEY UNIVERSITY

This research is investigating the resilience of current and former police officers who have been exposed to traumatic experiences. This study is the third phase of a longitudinal study of current and former police officers. The sample were first surveyed when they were police recruits, then were resurveyed 1 year later, and the sample will be resurveyed approximately 10 years after they were first surveyed. This study is investigating the variables of traumatic event exposure, resilience, traumatic stress, psychological well-being, and physical health. In this study, resilience is viewed as a multidimensional construct that consists of an individual's environment, their cognitions, their emotions, their behaviours, and their physical activities. To assess this multidimensional construct of resilience this study will investigate social support, optimistic beliefs, emotional intelligence, and health practices. It is anticipated that those with greater levels of resilience will have lower levels of traumatic stress, psychological difficulties, and physical ill health. This research will have practical implications for the organisational and clinical support of police officers who are exposed to traumatic experiences at work.



## HEALTH SECTOR EMERGENCY MANAGEMENT IN NEW ZEALAND: PROMOTING ADAPTIVE CAPACITY IN EMERGENCY RESPONSE WITHIN HEALTH BOARDS

**DEBRA ELLIS**

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This study will investigate the personal, team and organisational factors that contribute to the adaptive capacity or resilience of the health sector in New Zealand during the response and recovery phase of disasters. It will focus on the competencies, procedures and systems that contribute to the adaptive capacity of personnel, teams and Health Boards during response and recovery to hazardous events such as a flu pandemic, volcanic crisis or earthquake. Methods of research will include the analysis of international literature, policy documentation and statutes. A survey will be conducted to provide an evidence-based model of adaptive capacity in Health Boards. Data will also be collected through semi-structured interviews with those playing key response and recovery roles within Health Boards.

Using the Auckland District Health Board for its case study it utilises the national pandemic influenza exercise - Exercise Cruickshank (May 2007) to provide a realistic context within which to assess the competencies associated with adaptive capacity in staff and systems for the initial analysis. Having an all hazards approach - the methodology will be repeated using the Auckland Regional volcanic Exercise Ruaukoko (March 2008) as a comparative case study for breadth of scope and in-depth analysis of health sector resilience.

The aim of the research is to produce a robust and validated model of stress resilience that can be used to inform the development of evidence-based training and support programs to promote staff well-being and performance when managing the consequences of disasters. In addition, this research will provide base information for supporting the policy developments required to meet the demands of the health sector during and following disaster events whilst enhancing the reduction and readiness phases of its disaster preparedness.

Although focusing on disaster response, the outcomes of this research will provide information that can inform the development of staff well-being programmes that can be used in routine contexts.

# DYNAMIC RESPONSE RECOVERY TOOL FOR EMERGENCY RESPONSE WITHIN STATE HIGHWAY ORGANISATIONS IN NEW ZEALAND

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New Zealand's State Highway Organisations (SHOs) need to work and make decisions in a coordinated and efficient manner to minimize disruptions during emergency events.

This research aims to develop a Dynamic Response Recovery Tool (DRRT) to support decision making activities during emergency response events in New Zealand. It will combine practical emergency management knowledge, response procedures and an Expert System set of rules. SHOs will use DRRT in the allocation of both personnel and physical resources during emergency response and recovery operations. DRRT will be based on practical knowledge in terms of key variables, information needs and SHO interaction patterns, which are all commonly observed in emergency events decision making during simulated exercises and/or real events.

DRRT will be applied in a case study consisting of an experiment in which SHOs operate the system in a simulated emergency response event. We will assess DRRT's efficiency and effectiveness and how SHOs' personnel make use of DRRT during an emergency exercise. DRRT is expected to contribute to savings in time, costs and resources during response activities. We will compare the case study findings with the current practice in New Zealand.

## MEASURING HOW PEOPLE THINK, FEEL, AND ACT: THE CRITICAL PATH TAKEN FOR DESIGNING A DISASTER EVACUATION PREPAREDNESS SURVEY.

**MONICA E. GOWAN,**  
HEALTH SCIENCES CENTRE  
UNIVERSITY OF CANTERBURY

Survey research underway in Wellington, New Zealand, is examining the association between select health-predictive attitudes and evacuation preparedness behaviours. Set in the geologic context of earthquakes and tsunamis, the study (informally known as the “Wellington Disaster Prevention Study”) quantitatively measures and analyses cognitive, affective, and behavioural variables that can influence mental health outcomes following disastrous events.

As stated for the layperson in the survey information sheet, the study questionnaire is divided into four sections, “asking your perspectives on: 1) the potential for disaster in Wellington and how you could be affected; 2) how you approach day-to-day life and your general health and well-being; 3) what you think and feel about preparing for and coping with an evacuation; and 4) what types of preparedness activities you might be considering doing”.

Multitudes of decisions transpire behind the scenes during the survey design process to produce an instrument that scientifically measures these seemingly general types of questions. Weighing the advantages and disadvantages of various methodological approaches – on matters from survey type, format and layout to scale selection, question validity, population sampling and beyond – can present daunting challenges which can be overcome with a strategic focus. Key decision points for establishing this baseline data set are highlighted, addressing the important “who, what, when, where, why and how” questions that must be taken into account throughout the survey design process.

## THE QUANTIFICATION OF IWI DEVELOPMENT & RESILIENCE: *ABSTRACT*

**JAMES HUDSON**  
MASSEY UNIVERSITY

This research will provide iwi with a systematic approach for policy, planning and programme delivery. It will be futures oriented and take into account external goals and objectives, as well as broader Māori development objectives.

The research will result in the creation of a framework capable of measuring cultural aspirations, resilience, distinctiveness, capability, potential and outcomes. The research will highlight the value and role of cultural domains across a range of endeavours including social policy, economic policy, and environmental management.

The research will recognise that Māori perspectives of well-being and environmental sustainability are both dynamic and culturally entrenched and will better elucidate the relationship between culture and well-being and resilience.

The outcome benefits for New Zealand from this research are both conceptual and applied. At one level the research will enable Runanga/iwi, from an evidential base, to rationalise iwi resources and investment, set priorities and measure outcomes. At another level the research will contribute to the overall identity and uniqueness of New Zealand society by assisting with the considered economic and social growth and development of iwi and Māori communities

*The Quantification of Iwi Development & Resilience* is premised on the notion that Maori concepts of development, while often consistent with those of non-Maori, are also different and frequently include cultural aspirations – to have a sense of identity, to embrace cultural practices and institutions, and fundamentally to live as Maori. The research is designed to explore and test these notions and create better systems through which Maori perspectives of development can be integrated into policy, planning and implementation.

# A GEOGRAPHICAL ANALYSIS OF THE HAZARDSCAPE OF WELLINGTON REGION: INFLUENCES ON INTRA-REGIONAL RESPONSE.

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**Keywords:** Hazardscape, Hazards, Susceptibility, Vulnerability, Response, Resilience.

**Justification:** Despite having a tradition of using ecological approach to study natural hazards in Geography, its holistic approach has been compromised for various reasons. Behavioural, Perception, Vulnerability and Resilience models though cover significant aspects of the problem, present a partial reality. A skewed focus on human has further departed Hazard Geography from attaining a holistic view. Even though it has been recognized that natural hazards result through interaction of human and natural systems, the separation of the two fails to explain many complexities that result through ecosystem functioning. Further, the studies on hazards and disasters are predominantly focused on single hazard assessment of an area, and there is a gap in literature which deals with multiple hazards assessment. The research focuses on these issues and looks at the concept of 'hazardscape' for a more holistic framework to study various aspects of hazards at a place.

**Concept:** The hazardscape mirrors the ecological perspective of hazards at a place, which build through a constant, implicit and intricate relationship between human beings and the environment in a particular spatio-temporal context. It displays a dynamic character which builds through changing natural and ecumenical conditions. The hazardscape not only reflects the possible hazards, susceptibility and vulnerability at a place but also the response of the local community to various hazards.

**Aim:** The aim of the study is to define and evaluate the hazardscape of Wellington Region and to ascertain associated variations in the intra-regional hazard response.

**Methodology:** In order to achieve the aim, the study has adopted a mixed method approach, which uses both qualitative and quantitative methods and database. The data has been collected from various sources including pre-existing research, census, newspaper and primary survey. Schedules and questionnaire surveys were conducted with local administration i.e. with civil defence officers and resource planners along with the residents of all eight local territorial authorities in Wellington region. The samples were selected through stratified purposeful sampling method in order to compare and understand the variations of hazardscape in general and hazard response in particular.

## TOURISM AND EARTHQUAKES IN THE ZONE OF THE ALPINE FAULT: RISK, READINESS AND RESILIENCE.

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The islands of New Zealand lie astride two actively deforming tectonic plates, creating a diverse physical landscape with high scenic value, but one which is prone to a range of natural hazards. The Alpine fault is a 450 km-long fault which defines the position of the plate boundary as it runs the length of the Southern Alps in the South Island. Paleoseismic evidence suggests it is overdue for a significant earthquake of magnitude ~ 7.8 - 8. The “footprint” of an earthquake this size would produce severe damage to infrastructure, buildings and roads, and cause lengthy interruption to human activities. Coincident with this area of high seismic potential is a burgeoning tourism industry, which, over the past two decades has shown remarkable growth, capitalising on the region’s international reputation for unique nature-based tourism experiences. Visitor activities occur, at times, in relatively remote and hazardous settings, such as National Parks, alpine or coastal areas. Road access to Milford Sound, the West Coast and Mt Cook is restricted to alpine passes or road ends, which are highly vulnerable to closure from earthquake-induced landslides and avalanches. The likely extent of landsliding following an Alpine fault event will cause an immediate drop in visitation due to road closures, with long-term repair work required to restore access.

To date, there has been a significant gap in our understanding about earthquakes and their potential affects on the tourism industry in New Zealand. This doctoral research project is designed to address the gap in knowledge by investigating tourism operations in the zone of the Alpine Fault with respect to perceptions of seismic risk, business resilience, and preparedness for an Alpine fault earthquake. The field area extends from Milford Sound to Greymouth, including Queenstown, Mt Cook and Arthur’s Pass. Primary data collection involved the distribution of a questionnaire survey to all activity, attraction and accommodation providers, administered in May 2008.

# THE INFLUENCE OF INTERDEPENDENT HAZARDS IN TIME-VARIANT, MULTI-HAZARD EVENTS AND THE DEVELOPMENT OF EFFECTIVE RISK COMMUNICATION STRATEGIES

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The northern Whakatane District, located within the Bay of Plenty region, New Zealand, is located within the most northerly landward expression of the Taupo Volcanic Zone (TVZ). The district, with an area of over 4,442 sq. km and nearly 34,000 residents, is at risk from earthquakes, flooding, landslides and volcanic hazards associated with the TVZ, the most productive and frequently active rhyolitic magmatic system on Earth. These natural hazards not only affect the citizens of the region but also its infrastructure and economy.

This project has been designed to examine multi-hazard risks and effective risk communications and shall include (1) a multi-hazard risk assessment, concentrating specifically on the link between tectonism, volcanism, land instability and flooding in the northern Whakatane District of the Bay of Plenty region. This assessment will be conducted in association with the GNS Science Regional Riskscape Project and it will produce risk-specific fragility functions to be incorporated into the regional Riskscape model; (2) an examination of past multi-hazard events to identify interdependencies between hazards which show that past events can interact with current hazards and add to the complexity, duration, as well as the type and amount of damage incurred; (3) a critical evaluation of risk communication methods will be undertaken to consider the influence of this hazard interdependency within multi-hazard events in order to develop effective risk communication strategies aimed at improving education, preparedness, and response to time-variant, multi-hazard events.

# COMPLEXITIES OF VOLUNTEERISM ASSOCIATED WITH NEW ZEALAND EMERGENCY MANAGEMENT.

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## **Proposed research**

This study will explore the relationships between the community and key agencies (Community First Responders, emergency services and Civil Defence Emergency Management agencies) and how this influences community resilience, social capital and community capacity to deal with and recover from hazard impacts. The study will utilise an intra and inter-sectorial approach from both a membership and organisational perspective. The various linkages that volunteer response organisations have in place within communities and their volunteer ethos will be examined. How does this relationship build or enhance resilience and information transfer? How do remote communities foresee their ability to build resilience? Is it possible that volunteer policies in organisations work against effective volunteerism impacting on building effective community resilience?

Following a literature review, and the selection of a conceptual methodology to work within, two community case studies will be chosen. Interviews and focus group meetings with Community First Responders, emergency service and Civil Defence Emergency Management agencies will occur in Southland and Taranaki. The validity of the research findings will be tested against other volunteer emergency services in New Zealand, especially issues between urban and rural volunteers' recruitment, education and retention of operational staff and the relationship to comprehensive emergency management (including sub themes of integrated emergency management, community partnerships and resilience). A cross-community comparison will test the validity of the findings and to identify the relationship between community characteristics and how their relationship with an organisation influences sustained resilience.

The study framework will use a qualitative methodology and content thematic analysis to discover concepts and theories from the data collected to allow models to be developed. A research outcome is to identify best practice methods to recruit, and more importantly, retain trained operational volunteers within volunteer response agencies that can contribute to the New Zealand emergency response capacity and capability. The research aims to better understand what makes an effective community – emergency service /CDEM milieu, relationship and communication models(s).



# INNOVATIVE LAND USE PLANNING FOR NATURAL HAZARD RISK REDUCTION

**WENDY SAUNDERS**

MASSEY UNIVERSITY, WELLINGTON.

The city planner has an obligation to ensure that urban growth, development and renewal does not jeopardise the safety and security of present or future citizens (Britton & Lindsay, 1995). Land use planning is often described as a tool available for natural hazard risk reduction and mitigation, which can be both structural and non-structural.

So how can the state achieve natural hazard risk reduction through innovative land use planning? To answer this question, a holistic risk reduction framework will be presented based on a risk management framework which incorporates planning and emergency management risk reduction tools. Two case studies are being undertaken, focusing on innovative land use planning initiatives from a state level. The two perils being studied are flooding and tsunamis.

The objectives of the research are to:

1. Define what innovative communities are in a land use planning context;
2. Explore what innovative risk reduction is;
3. Determine how the state drives innovation for hazard mitigation and risk reduction;
4. Determine what is the nature of the roles and relationships of the key players (being the market, civil society, and the state); and
5. Develop a framework for land use planners to consider that integrates the findings from objectives 1-3 above.

## BENCHMARKING THE RESILIENCE OF ORGANISATIONS

**AMY STEPHENSON**

UNIVERSITY OF CANTERBURY

Emergencies and disasters, both natural and 'man-made', appear to be increasing in frequency and severity of impact. Organisations provide critical services to communities, and therefore to address community resilience in isolation is to break down the system and evaluate it only as its component parts. Despite the business benefits of becoming more resilient, organisations still struggle to prioritise resilience and to link resilience to crisis or disaster, with the ability to operate effectively and efficiently during business-as-usual. If organisations are to progress and improve their resilience they need to be able to measure and benchmark their progress. The purpose of the research is to develop a methodology and tool for measuring and benchmarking the resilience of organisations and test it on organisations in Auckland. The research presents four main challenges which will be discussed:

- Defining a complex term in a way that enables measurement - there are many definitions of resilience floating around, yet there is still a consensus that resilience is poorly defined. Is it possible the term has evolved and is now being applied to something different in the context our changing environment?
- Identifying metrics for measuring resilience – disaster researchers tend to take the view that something as complex and culturally based as resilience can't be 'measured'. As a result this research must address some theoretical and cultural barriers in the field.
- Developing a resilience benchmarking tool – if organisational resilience can be measured, then what social and behavioral factors can provide evidence of either high or low resilience, and how do we know if we've got it right?
- Does the ideal resilience profile exist? – there are no right answers for resilience; it is a very contextual concept. This makes it very difficult to identify an ideal resilience or best practise, because what makes one organisation resilient, might not be enough for another.

## CHILDREN IN DISASTERS: CHILDREN'S EXPERIENCES OF NATURAL DISASTERS IN CENTRAL JAVA, INDONESIA

**HEATHER TAYLOR**

JOINT CENTRE FOR DISASTER RESEARCH

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This project seeks to understand the perspective and experiences of children who have felt the effects of natural disasters. Childhood is a unique period of development within which the majority of an individual's physical, mental, emotional and social development occurs. If there is significant damage at this stage in life, it is often extremely difficult, if not impossible, to recover from at later stages in life. Gaps in the current literature indicate that there is a need for studies which take into account the needs, views and capacities of children explicitly and consistently.

The methodology that will be employed in this study is dominantly qualitative in nature. The data collection and analysis will be carried out using a grounded theory approach. This type of approach will gather rich descriptive information of the children's experiences from their own perspective, and allow for the development of theory based on the data. The project will focus on the post-disaster and long-term recovery environment of three different events that occurred in Central Java between 2006 and 2008: Yogyakarta (earthquake), Solo (flooding) and on Mt. Merapi (volcanic eruption). The proposal is to meet with a group of children in the three different locations. Data collection will be done using a mixture of tools: drawing, storytelling, videography, small discussion groups and individual interviews. The fieldwork will take place over the course of 6 months, in order that trust and relationships can be built between the research team and the communities and children.

By learning their concerns and capabilities, it is hoped that development programs, disaster recovery and preparedness programs in particular, that involve children, families, schools and communities can be refined to better suit children's specific needs. The results of the research will be offered to the Indonesia government and disseminated to academic and non-governmental organizations.

# DECISION-MAKING AND MOTIVATION IN SEISMIC RETROFIT IMPLEMENTATION

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Adopting high seismic retrofit standard during rehabilitation of earthquake prone building (EPBs) has been a dilemma to owners of EPBs in New Zealand since the enactment of the Building Act (2004). The Act only seeks to reduce the level of earthquake risk to the communities over time and only targets most vulnerable EPBs, thereby recommending minimum retrofit standard. However, this standard has been found to be inadequate in eliminating the danger associated with EPBs (NZESS, 2005). Building owners has been found to adopt lower seismic standard as well as lower cost options regardless of the recommendations from consulting engineers. Thereby retrofitting to high standard is not always undertaken by building owners because many factors interact to influence retrofit decisions.

Building owners make many decisions about building risks posed by hazards such as fire, earthquake and flood, and the decision about improved seismic performance is just one of them. Seismic performance is usually evaluated along with decisions about maintenance, upgrading, future investment and risks assessment. Examination of many different situations and interviews with a range of building owners made it clear that no two buildings go through precisely the same process. The context in which each decision is made is a major determinant and lots of trade-offs are considered during decision-making process. It is thus necessary to understand how building owners makes decisions about retrofit level they adopt and how they can be motivated to adopt higher seismic standards.

This research aims to understand how improved seismic retrofit implementation can be made attractive to building owners. This study identified various factors influencing retrofit decisions of EPBs, through semi-structured interviews and various suggestions on how building owners can be motivated were evaluated.

# VULNERABILITY OF PASTORAL FARMING SYSTEMS TO VOLCANIC HAZARDS IN NEW ZEALAND

**TOM WILSON**

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Volcanic ash is the most widely-distributed product of explosive volcanic eruptions, with even relatively small explosive eruptions distributing ash hundreds of kilometres from the volcano and commonly impact agricultural land. Volcanic ash can significantly impact soils, vegetation, animals, water supplies and people, due to their unique physical and chemical characteristics.

The full range of impacts from volcanic hazards to agriculture is however not well established and there is often significant uncertainty as to what information emergency management or agricultural authorities should distribute during a volcanic crisis.

This study assesses the likely impacts of an explosive eruption to the agriculture sector in New Zealand, and investigates appropriate mitigation strategies for farmers. It includes:

- Impacts to pastures soils - greenhouse and field trials have been used to investigate damage caused by varying thicknesses of ash fall to pastures and soils and the effectiveness of different rehabilitation techniques (focus on temperate agriculture)
- Agricultural and rural community impacts and recovery from selected overseas explosive eruptions have been used to better understand impacts and management problems
- Impacts to farm water supplies from volcanic ashfall have been studied and limited modelling undertaken to estimate turbidity, acidity and soluble salt toxicity.
- Livestock evacuation has been modelled from around Taranaki volcano using a theoretical volcanic eruption scenario.
- Farm, rural community and rural lifeline resiliency has been analysed following the 2006 Canterbury snowstorm as an analogy to impacts from a volcanic eruption
- Loss assessment methodologies have been developed to assess losses to agriculture, utilising volcanic fragility functions for agriculture.