

Society for Risk Analysis ANZ

Annual Conference 2025

Navigating Uncertainty



Welcome

We live under a condition of global uncertainty characterised by political upheaval, social unrest and climate anxiety. Some look to meaning, others look backward, and some frantically search for any semblance of safety. In all of this, risk exists as an underlying component. When it comes to uncertainty and risk, no facet of our lives remains untouched. As a result, you will find such a wide variety of topics at this conference, from healthcare, music, environmental studies, gambling, and more. Risk in different contexts does not necessarily remove the way that humans interact with it, so we implore you to explore sessions that you may not consider otherwise, you may be surprised how much can be transferrable to your discipline.

We wish you a happy risk conference!

Your SRA ANZ Committee

Dr Anna Kosovac (Conference Chair), Dr Tom Logan (President), Dr Sandra Seno-Alday, Logan Brunner, Chantelle Chalmers and Erica Kecorius.

Locations

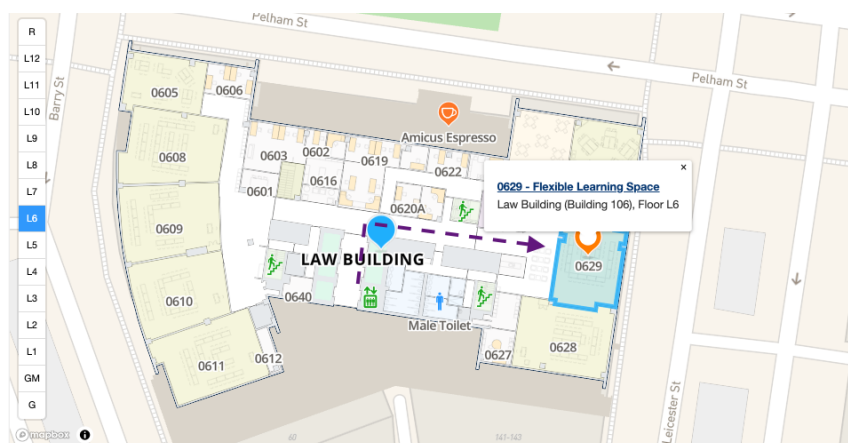
The conference is held on in the Woodward Centre (University House) at the University of Melbourne. This is on Level 10 of the Law Building (185 Pelham Street, Carlton).

The keynote speeches will be held in the Woodward centre (room 1 and 2 joined). There will be three conference streams: Woodward 1, Woodward 2, and Room 0629.

Level 10: Woodward Rooms 1 and 2



Level 6: Room 0629



Need help? In a life-threatening emergency call **000**, then call University Security on **834 46666**.

We would like to thank our sponsors for the event: the Centre for Excellent for Biosecurity Risk Analysis at the University of Melbourne. CEBRA has been a supporter of the Society for Risk Analysis ANZ for several years, and without CEBRA, SRA ANZ could not happen.

Keynote speakers

Professor Felicia Wu

Felicia Wu is the John A. Hannah Distinguished Professor of Food Safety, Toxicology, and Risk Assessment at Michigan State University in the USA; and President of the Society for Risk Analysis. Recently, she was appointed by Governor Gretchen Whitmer as a Commissioner of Agriculture for the state of Michigan, and named as one of ten University Distinguished Professors at MSU. Professor Wu works at the nexus of agriculture, food safety and nutrition, and public health to improve global human health outcomes. Currently she has nine extramural grants across the USA, Africa, and South Asia; with topics ranging from climate change to transgenic crops to reducing risks of mycotoxins, heavy metals, and pathogens in foods. Professor Wu is a Member of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), an elected Fellow of the Society for Risk Analysis, and an invited member of the WHO Food-Based Dietary Guidelines Committee. Professor Wu earned her PhD in Engineering and Public Policy at Carnegie Mellon University, and AB and SM in Applied Mathematics/Medical Sciences at Harvard University.



Global Food Safety and Security in a Changing Climate: Navigating Uncertainties in Risks and Benefits

Worldwide, nearly 700 million people suffer from malnutrition, while every year, nearly 800 million people also suffer from food poisoning from contaminated food. How will our changing climate affect food security and food safety worldwide? This talk will describe the complexities of these questions as we navigate an uncertain future. While certain crops in certain world regions will likely experience food loss, others may benefit from warmer weather, including more crop cycles per year. Food safety will become ever more important, as warmer climates generally increase viability of microbial pathogens. This talk will give an overview of potential risks and benefits, ending with policy recommendations for a safer and more food -secure world.

Professor Sarah Bell

Professor Sarah Bell is City of Melbourne Chair in Urban Resilience and Innovation and Director of The Retrofit Lab at the University of Melbourne. She works with community groups and local governments to co-design resilient urban infrastructure. She is currently leading the *Re-Imagining Streets* project funded by Horticulture Innovation Australia. She is co-author of the recent book [Co-designing Infrastructures](#), published open access by UCL Press. She is a Fellow of Engineers Australia and a member of the Australian Research Council College of Experts.



Navigating Uncertainty and Resilience with Urban Communities

Cities face complex, intersecting risks arising from climate, economic, social and environmental change. Risks of such as flooding and overheating are increasing due to climate change in many cities and are strongly influenced by the nature of the built and natural environments. Individual and collective vulnerability to the impacts of these hazards are influenced by social and economic factors. These interactions give rise to high levels of uncertainty in designing and managing urban environments. Urban resilience provides a theoretical framework and policy agenda to improve preparedness and recovery from diverse and uncertain urban hazards. Community resilience has also emerged as an important factor determining how well people are prepared for and recover from disasters. Resilience actions in cities, such as implementing green infrastructure and building community networks, have the potential for multiple benefits, beyond hazard reduction and disaster preparedness. This keynote talk will

present case studies and future research co-designing resilient urban infrastructures with local communities in London and Melbourne. It shows the potential and the limitations of community-based approaches to building resilient cities under conditions of uncertainty.

Professor Michael Siegrist

Michael Siegrist is a Professor for Consumer Behavior at the Institute for Environmental Decisions (IED), ETH Zurich, Switzerland. He studied psychology, economics and mass communication at the University of Zurich. He worked as a research assistant at the Psychology Department of the University of Zurich. In 1994 he wrote his dissertation at the University of Zurich. During 1997-1998 he worked as a Project Manager at the Swiss Association of Milk Producers, Department of Marketing Research, and during 1998-2000 he was a visiting researcher at Western Washington University, WA, USA.



Dr. Siegrist's research focuses on risk perception and risk communication, on acceptance of new technologies, and consumer behavior in the food domain. He has published more than 350 peer reviewed articles. Dr. Siegrist is an area editor for the journal Risk Analysis and serves on the editorial boards of several journals. He has received several awards for his research and has been a highly cited award recipient for the past four years (Institute for Scientific Information, Clarivate).

Romantic perception of nature and biased risk perceptions

In Europe, the Romantic era had a major impact on our perception of nature. The literature and paintings of this era portrayed nature as mysterious and peaceful in contrast to cities and technology. The Romantic era was in stark contrast to the Enlightenment. We hypothesized that the Romantic perception of nature leads to a biased perception of natural hazards, and that the moral component of action is of particular importance above and beyond the mere efficacy of the action. We conducted a survey in Germany (N=531), a country where romanticism was very strong and still influences, for example, the perception of forests. The study shows that individuals with a Romantic worldview tend to perceive greater risks associated with climate change than those without such a view. Additionally, those with a Romantic view of nature are more likely to support measures aimed at reducing climate change risks, even if they are not effective. Finally, the study found a significantly stronger positive correlation between Romantic views of nature and risk perceptions of man-made compared with risk perception of natural hazards. The results suggest that ideas developed during the Romantic era continue to influence hazard perception in Germany. In conclusion, a Romantic view of nature may lead to biased hazard perceptions.

Reading “Killing Murray Darling” with Seth Robinson

Seth Robinson, creative writer and lecturer, will do a live reading of his prize-winning short story “Killing Murray Darling”. This piece of speculative fiction, written together with Dr Anna Kosovac, responded to the writing prompt “What are the roles and responsibilities of the media towards reporting on climate change?” Bringing together Anna's research on media reporting in the Murray Darling Basin, Australia's most contested area for water resources, Dr Erin O'Donnell's work on legal personhood of waterways, and a fiction lens, this writing asks the question “What would the river say if it could talk?”



Bring your afternoon tea with you to Woodward 1 to hear this narrated on Day 2 of the conference.

Program Day 1

Date: Thursday, 6 February 2025 **Time:** 8:30am – 5:30pm

Venue: University House, Woodward Centre

Registration: Please find the registration table on entrance to the Woodward Centre

| | |
|---------------------|---|
| 8:30 – 9:00 | Registration |
| 9:00 – 9:30 | Welcome to Country |
| 9:30 – 10:15 | Professor Felicia Wu – Michigan State University Global Food Safety and Security in a Changing Climate: Navigating Uncertainties in Risks and Benefits |
| 10:15– 10:45 | Morning Tea |
| 10:45 – 12:15 | Session 1 – Woodward 1, 2 and Room 0629 |
| 12:15 – 1:00 | Lunch |
| 1:00 – 2:30 | Session 2 – Woodward 1, 2 and Room 0629 |
| 2:30 – 3:00 | Afternoon Tea |
| 3:00 – 3:45 | Professor Sarah Bell – The University of Melbourne Navigating Uncertainty and Resilience with Urban Communities |
| 3:45 – 4:40 | Session 3 – Woodward 1 and 2 (joined) and Room 0629 |
| 4:40 – 6:00 | Poster Session and Networking Drinks, Woodward Lobby |
| 5:00 – 5:30 | Joint Book Launch, Woodward 2 <ul style="list-style-type: none">- <u>Biosecurity: A Systems Perspective</u>, ed. Susan M Hester, Lucie M Bland, Edith Arndt, Sana Bau, James S Camac, Evelyn Mannix, Raphael Trouve, Andrew P Robinson- <u>Risk Management for Water Professionals: Technical, Psychological and Sociological Underpinnings</u>, Anna Kosovac |

6:00pm Conference Dinner*, University House Professors Walk

*Additional ticket required to attend the Conference Dinner

Program Day 2

Date: Friday, 7 February 2025 **Time:** 9:15am – 5:00pm

Venue: University House, Woodward Centre

Registration: Please find the registration table on entrance to the Woodward Centre

9:15 – 9:30 **Welcome – Woodward 1 and 2**

9:30 – 10:15 **Professor Michael Siegrist** – ETH Zurich
Romantic perception of nature and biased risk perceptions

10:15– 10:45 **Morning Tea**

10:45 – 12:15 **Session 4** – Woodward 1, 2 and Room 0629

12:15 – 1:00 **Lunch**

1:00 – 2:30 **Session 5** – Woodward 1, 2 and Room 0629

2:30 – 3:00 **Afternoon Tea – Reading with Seth Robinson in Woodward 1**

3:00 – 4:30 **Session 6** – Woodward 1 and 2 (joined) and Room 0629

4:30 – 5:00 **Closing Remarks – Woodward 1 and 2**

Concurrent Sessions | Day 1

Presentation titles and presenters listed. Abstracts can be found on the SRA ANZ conference webpage
Session 1 | 10:45 – 12:15

| Woodward 1 | | Woodward 2 | | Law School Room 0629 | |
|---|-------------------------------|---|--------------------------|--|----------------------------------|
| 1A: Climate Adaptation and Uncertainty | | 1B: Risk Assessment and Planning | | 1C: Music and Risk | |
| How can we improve climate adaptation planning? | <i>Ivan Villaverde Canosa</i> | Spatial Risk Analysis Integration in Climate Risk Assessments: A Global Review of Methodologies and Practices | <i>Mitchell Anderson</i> | The perceived risks of a basic income pilot for the arts from the Australian contemporary music sector | <i>Olivia Hally</i> |
| The World Will Not Achieve Net Zero by 2050: The Challenge of Meeting Emissions Reductions Targets in a Global Energy and Trade Model | <i>Tom Kompas</i> | A multidisciplinary approach to biofouling risk management | <i>Susie Hester</i> | Evaluating the Impact of Music on Hurricane Preparedness in the Caribbean | <i>Emiliano Rodriguez Nuesch</i> |
| Scenarios: using our capabilities for counterfactual thinking to reduce uncertainty | <i>Lynette Smith</i> | The rhetoric and reality of adaptation planning to climate risk: A case study of Buller District | <i>Alyssa Ryan</i> | Singing Death: Butcher Choirs and Voices of Resistance among Meatworkers in Australia | <i>Evelyn Lambeth</i> |
| An optimised recovery approach for interdependent infrastructure | <i>Logan Brunner</i> | Navigating Choppy Waters - why are we always arguing about risk and uncertainty in marine multi-use environments and what can we do about it? | <i>Paula Blackett</i> | | |

Session 2 | 1:00 – 2:30

| Woodward 1 | | Woodward 2 | | Law School Room 0629 | |
|---|---|--|-----------------------|--|----------------------|
| 2A: Risk Perception and Psychology | | 2B: Artificial Intelligence | | 2C: Governance, Policy and Economics | |
| Take the money and run: understanding the decision to cash out of a risky bet | <i>Daniel Bennett</i> | Risk elicitation to identify research and policy gaps at the intersection of climate change and cyber-physical systems | <i>David Johnson</i> | "Air pollution as a 'black swan': The comparative analysis of children's particulate air pollution (PAP) protection governance between Indonesia and Nepal." From the lab to the industrial park: lessons for the energy transition from past technology policy failures | <i>Erwin Nugraha</i> |
| Measuring individuals' understanding of risk: From risk literacy to risk know-how | <i>Olivia Jensen</i> | Quantifying AI Risk: Adapting cyber risk methodologies to AI security | <i>Harriet Farlow</i> | | <i>Jan Hayes</i> |
| Integrating behavioral heterogeneity into models of climate risk and resilience | <i>Robyn Wilson</i> <i>Anna Kosovac,</i> <i>Seth Robinson</i> | Likelihood of AI Security Risks: Analysing public AI security incidents. | <i>Tania Sadhani</i> | Physical and Mental Health Conditions among 51 Deceased Leaders of Nuclear Weapon States | <i>Nick Wilson</i> |
| Climate Risk Perceptions and Speculative Fiction | | Operationalising AI Governance in Practice | <i>Michal Chorev</i> | Avoiding Disaster: Safe Returns on Investments in Biosecurity Measures | <i>Tom Kompas</i> |

Session 3 | 3:45 – 4:40

| Woodward 1 | | Woodward 2 | | Law School Room 0629 | |
|--|------------------------|------------|--------------------------|---|-------------------------|
| 3A: The Pacific and Risk | | | 3B: Food and Risk | | |
| Chair: | | | | | |
| Sociocultural impacts of climate-induced relocation in Fiji: Vunidogoloa case study and its broader implications | <i>Lisa Neamati</i> | | | Island Risk and Resilience: New Zealand and the Unthinkable Consequences of Nuclear Conflict | <i>Sam Ragnarsson</i> |
| Exploring climate migration in Pacific Small Island Developing States through a victimological lens | <i>Astrid Vachette</i> | | | Enhancing Global Resilience to Catastrophic Risks: Local Biofuel Production and Convertible Food Oil Facilities for Essential Services – An Aotearoa New Zealand Case Study | <i>Mike Hodgkinson</i> |
| Assessing public valuation of coastal protection solution for floods: an experimental study | <i>Tra Thi Trinh</i> | | | Biosecurity risk calculator: Tracking biosecurity risk of export fruit along the cold supply chain | <i>Himali Ratnayake</i> |
| Investigate the atmospheric river risk to water supply in the Pacific Region | <i>Kilisimasi Latu</i> | | | | |

Concurrent Sessions | Day 2

Presentation titles and lead authors listed. Abstracts can be found on the SRA ANZ conference webpage.

Session 4 | 10:45 – 12:15

| Woodward 1 | | Woodward 2 | | Law School Room 0629 | |
|--|-------------------------|--|-------------------------------|---|----------------------------------|
| 4A: Biosecurity | | 4B: Misinformation and Risk | | 4C: Fire | |
| Modelling biosecurity risk at the Tasmanian border via interception data and expert elicitation | <i>Nicholas P Moran</i> | (In)civility, disinformation and risk | <i>Darrin Durant</i> | Amplifying Wildfire Risk Preparedness in Southeast Australia: A Creative, Community-based Approach | <i>Emiliano Rodriguez Nuesch</i> |
| The methodology of biosecurity system evaluation – the New Zealand case study | <i>Julia Polak</i> | Future risky: misinformation and the challenge to temporal order | <i>Philip Pond</i> | Wildfire Risk Communication Website | <i>Hamish Clarke</i> |
| Integrating resilience thinking into biosecurity risk management | <i>Edith Arndt</i> | Bubbles, Silos, and Echo Chambers | <i>Mark Colyvan</i> | Reframing the concept of shared responsibility: identifying expectations for action to build more efficient dialogues | <i>Lucas Hovart</i> |
| Damages to environmental and ecosystem services: The large missing piece in the economics of biosecurity | <i>Lu-Yi Wang</i> | Strengthening the management of systemic risks during geopolitical rivalries | <i>Ivan Villaverde Canosa</i> | Bushfires and Road Safety Risk | <i>Tom Beer</i> |

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|--|--|--|--------------------------------|--|--|
| | | Resistance in the regions: harnessing local knowledge and leadership in climate risk assessments | <i>Alison Floyd</i> | | |
|--|--|--|--------------------------------|--|--|

Session 5 | 1:00 – 2:30

| Woodward 1 | | Woodward 2 | | Law School Room 0629 | |
|--|------------------------|--|-----------------------------|--|----------------------------|
| 5A: Sociological and Cultural Understandings | | 5B: Risk Perception | | 5C: Flooding | |
| Who fears what and why? Cultural worldviews and the perception of natural hazard risk in Australia | <i>Melissa Parsons</i> | Incentivized personal carbon scores lower the carbon intensity of urban mobility and spill over to pro-science climate attitudes | | Towards Open Science for Climate Risk: Identifying Combined Heat and Flood Exposure | <i>Carolynne Hultquist</i> |
| The Butterfly Effect: Identifying pathways for sustainability transformation through social processes of disaster resilience | <i>Belinda Davis</i> | Weather hazard risk perception, outdoor activities, and decision-making under uncertainty | <i>Victoria J. Heinrich</i> | A Monte Carlo Approach to Representing Flood Risk Uncertainty for Decision-Making | <i>Clevon Ash</i> |
| Risk and Innovativeness Perception of Emerging Technologies: Cross-cultural Differences in Evaluating Improvement Potential | <i>Jasper Teow</i> | Risk Perceptions of Climate Buffer Infrastructures | <i>Sandra Seno Alday</i> | A comprehensive framework for the multi-scale modelling of flood hazards in Aotearoa New Zealand | <i>Joe Pelmard</i> |
| Beyond the Hero Narrative: Exploring Women's Roles and Resilience in Disasters | <i>Loriana Bethune</i> | Government response to global catastrophic risks: What do the New Zealand public think? | <i>John Kerr</i> | Modelling urban development scenarios for assessment of future flood risk | <i>Katherine Booker</i> |

Session 6 | 3:00 – 4:30

| Woodward 1 | | Woodward 2 | | Law School Room 0629 | |
|--|----------------------|---|--|--|--------------------------|
| 6A: Disaster Planning | | 6B: Risk Communication in Action | | | |
| Predicting road blockages caused by rainfall- and earthquake-induced landslides in New Zealand | <i>Amelia Lin</i> | | | Community Risk Perception and Adaptive Strategies for Climate Change and Natural Hazards: A Case Study of Henderson-Massey, Auckland | <i>Iresh Jayawardena</i> |
| Evaluating the Resilience of Emergency Medical Services Following an Earthquake | <i>Chi-Hao Lin</i> | | | Exploring Inter-Professional Communication in Climate Adaptation: Challenges and Opportunities in Aotearoa New Zealand | <i>Nohah Forde</i> |
| Primary care access in the face of climate change | <i>Darcy Glenn</i> | | | Meeting people where they are: Four phenotypes for risk communication | <i>Leonard Lee</i> |
| Predicting Emergency Medical Service Capacity and Distribution in Urban Areas During Seismic Disasters | <i>Xing-Yi Huang</i> | | | Co-Designing Disaster Preparedness: Tools of Engagement | <i>Brandy Alger</i> |

Titles and Abstract (in alphabetical abstract title order)

(In)civility, disinformation and risk

Darrin Durant

School of Historical and Philosophical Sciences, Faculty of Arts, University of Melbourne

We know that when disinformation is used to polarize or sow doubt, incivility can be an accompanying stratagem to leverage in-out group antagonisms. We also know that incivility is perceived as the norm of online communication, but civil online interaction can have a positive effect on trust. Without dismissing these findings regarding the virtues (for democratic deliberation) of civility, can calls for civility have a masking effect? Civility may lessen disinformation problems in controversies turning on identity or consensual technoscientific knowledge, but mask more systemic structures of power? Civility may lessen disinformation problems framed by cost-benefit risk analysis, but mask catastrophic risk? To warrant these speculations, we can differentiate between civility as politeness and civility as political, and ask whether surface level civility (politeness) applied to disinformation and risk research needs to go further to consider political civility?

A comprehensive framework for the multi-scale modelling of flood hazards in Aotearoa New Zealand

Joe Pelmar, Alice Harang, Cyprien Bosserelle, Emily Lane, Ryan Paulik, Conrad Zorn

Department of Civil and Environmental Engineering; University of Auckland, The National Institute of Water and Atmospheric Research, Christchurch

In February 2023, ex-tropical Cyclone Gabrielle struck Aotearoa New Zealand, causing unprecedented floods responsible for 11 loss of life, over 2000 damaged buildings, widespread disruptions to supply and communication networks, and recovery timed in years. With the increasing frequency and intensity of extreme weather events, it is now essential to assess flood risks at a national scale to support communities, councils, and stakeholders in developing preventive and mitigation strategies. In collaboration with flood and climate experts from councils and research institutes, we have developed a comprehensive framework for the multi-scale modelling of flood responses to extreme weather events. This framework integrates the production of:

- Hydraulically conditioned DEMs and roughness maps from LiDAR and topographical datasets
- Calibrated rainfall data from gauges records and synoptic rain forecasts
- River flow injections using the hydrological model TopNet;
- Hydrodynamics modelling using the 2D solver BG-Flood.

We present here some of the latest applications of this framework. After a first calibration phase against field observations – including gauge records, aerial/satellite imagery, and high-water marks surveys – across 15 flood plains severely impacted by Cyclone Gabrielle in the Hawke's Bay and Tairāwhiti regions, the framework is now being deployed to generate a nationwide database of flood maps. The flood maps cover return periods ranging from 10 to 1000 years and will be used as part of object-level risk assessments of flood hazards across New Zealand.

A Monte Carlo Approach to Representing Flood Risk Uncertainty for Decision-Making

Clevon Ash, Matthew Wilson, Iain White, Carolynne Hultquist, Martin Nguyen

University of Canterbury; University of Canterbury; University of Waikato; University of Canterbury; University of Canterbury

Flood risk uncertainty is a growing problem in Aotearoa-NZ, and decision-makers are faced with increasing uncertainty when planning for future events. Growing population centres, increased cost of living and the resulting increased exposure to these natural hazards are just some of factors they need to consider in planning. Climate change predictions represent a large part of the uncertainty present in future flood risk assessments that are used for decision-making. Variables such as rainfall intensity and duration are likely to change significantly with increased temperatures which would result in potentially larger and more frequent flood events. To better understand the range of uncertainties associated with climate change, a Monte Carlo framework was applied to flood frequency data for the Waikanae region of New Zealand, which has a long history of flood events, with the most recent in August 2024. Modelling hundreds of potential scenarios using the hydraulic modelling software LISFLOOD-FP, these simulations were used to create

probability flood maps for various return periods. These uncertainty outputs and other assessment variables such as, building and infrastructure damage were then mapped using different visualisations and presented to New Zealand planners to determine the influence that they would have on decision-making. Uncertainty visualisations and the initial results from the decision-making consultations will be presented.

A multidisciplinary approach to biofouling risk management

Susie Hester, Gary Stoneham, Arthur Campbell, Rui Zhao, Peter Wilkinson, Dan Kluza

CEBRA, University of Melbourne; UNE Business School, University of New England; Centre for Market Design, University of Melbourne; School of Economics, Monash University; Centre for Actuarial Studies, University of Melbourne; Department of Agriculture, Fisheries and Forestry, Canberra; Ministry of Primary Industries, NZ

Most biosecurity systems and agencies responsible for mitigating threats are founded on a deep understanding of pest and disease biology and spread, with insufficient consideration of human behaviour and risks associated with strategic behaviour. Important fields of economics and actuarial science have not yet been applied to improve the design of the biosecurity regulatory regimes; both have much to offer biosecurity risk management. We detail how science, actuarial science and market design economics have been combined to manage biofouling risks efficiently, fairly and financially sustainably. The approach offers an alternative to current biosecurity risk management methods.

Addressing Uncertainty in Climate Change Adaptation: Challenges and Solutions

Tom Logan, Pat Curran
University of Canterbury

Climate change risk assessments face significant challenges in decision-making due to the unpredictable nature of future conditions. This study explores how uncertainties are represented in these assessments, focusing on sea level rise and associated hazards. We reviewed 70 climate change risk and vulnerability assessments, categorizing uncertainties using the Walker (2003) and Kwakkel (2010) framework to determine their level, nature, and source.

Our analysis reveals that many assessments fail to adequately consider the location and nature of uncertainty. There's a tendency to rely on scenarios, treating them as definitive future states rather than exploratory tools. Consequently, Level 4 uncertainties (large ranges of possibility) are often misrepresented as Level 3 uncertainties, creating a false sense of certainty.

This misrepresentation leads to the neglect of Decision-Making under Deep Uncertainty (DMDU) techniques, crucial for addressing complex uncertainties. Proper characterization of uncertainty is essential for selecting appropriate risk mitigation strategies. For instance, epistemic uncertainties can often be reduced through research, while aleatory uncertainties require different management approaches.

Our research aims to improve the understanding and representation of uncertainties in climate change assessments. By doing so, we can enhance decision-making processes, ensuring they are more robust and adaptable to the complexities of climate change. This work contributes to the development of more effective and resilient climate adaptation strategies.

Air pollution as a 'black swan': The comparative analysis of children's particulate air pollution (PAP) protection governance between Indonesia and Nepal.

Erwin Nugraha
Durham University

Despite the significant risk and impacts of airborne fine particulate concentrations, known as PM2.5, in Southeast Asia, its governance is poorly understood. The Southeast Asian region also bears most of the burden of non-communicable diseases (NCDs) and deaths in adults related to particulate air pollution (PAP). More specifically, the attributable death rate of children under five years of age in this region who are exposed to PAP during their childhood and through their life course has risen to ~75 per 100,000. In this context, how is the risk of air pollution perceived across different governmental agencies? How is air pollution protection governed? What are the institutions and management's goals in providing public advice and promoting protective behaviours regarding air pollution

exposures, especially for children? The presentation identifies and compares evidence on how the Indonesian and Nepalese governments and non-government organisations (NGOs) manage air pollution exposures, provide public advice and promote protective behaviours, especially for children. This presentation argues PAP as a “black swan”, a non-focusing event that is rarely examined but which can have major implications for public health, especially for children. Further, air pollution as a policy problem is contested among different risk priorities in the context of environmental health, especially between the dichotomy of “air/environment” and “pollution/health” issues.

Amplifying Wildfire Risk Preparedness in Southeast Australia: A Creative, Community-based Approach

Emiliano Rodriguez Nuesch, Caitlin Symon, Olivia Jensen, Hamish Clarke, Evelyn Lambeth
Pacifico Risk Communications; University of Melbourne; Institute for the Public Understanding of Risk, NUS; University of Melbourne; University of Tasmania

The risks associated with bushfires in Victoria are compounding as demographics change, community trust shifts, and anthropogenic-induced climate crises intensify and elongate fire seasons. Particularly, as the number of residents in the wildland-urban interface (WUI) increases, more people are exposed to wildfire risk, but do not undertake the preparedness actions recommended by public authorities. As fire seasons elongate, trusted risk messengers retire, and new forms of risk messaging emerge, it is important for risk communication to adapt. Trusted scientists, practitioners, and volunteers through the Country Fire Authority and community depots are often overworked and underfunded. In this context, this paper reports on a collaborative intervention by researchers and practitioners to design creative forms of risk communication to support informed decision-making under uncertainty. Can engaging bushfire survivors to share their testimonies and insight impact affective and emotional responses in a way that operationalises uncertainty to improve message effectiveness? Can aligning with celebrity community members such as AFL players who have large social followings to disseminate a seasonal message of responsibility incentivize hazard preparedness? Does a catchy jingle as part of risk messaging raise and sustain public engagement on seasonal risks that lose salience over time? With an impetus on learning alongside people facing these risks, and frontline risk managers, this research will shed light on how people respond to different types of risk messaging in relation to wildfire preparedness.

An optimised recovery approach for interdependent infrastructure

Logan Brunner; Daphne Skipper; Tom Logan
University of Canterbury; United States Naval Academy; University of Canterbury

Our infrastructure is increasingly interconnected, which offers many benefits to society yet also brings complexity and vulnerabilities. Natural hazards regularly threaten these connected infrastructure systems, causing widespread outages in dependent utilities. After severe events, infrastructure operators often must instinctively prioritize repairs based on initial impacts or the volume of complaints. In the intense post-disaster timeframe, it is also unclear what other utilities are non-operational due to a dependence on upstream services, such as electricity or water. Building on an existing interdependent infrastructure network model, we have developed an optimization model that addresses the complexities of our interdependent infrastructure and provides a recovery strategy based on realistic constraints experienced by infrastructure operators. We apply the model to a real-world test case of severe flooding on electrical power, water supply, and wastewater networks. For this scenario, the model maximizes the number of households that have service for all three utilities, including constraints such as the number of repair crews for each utility per timestep. We initially map the direct and cascading outages, followed by the recommended optimized strategy for repairing the interconnected systems over time. This model provides insight into the objective prioritization of repairing assets for emergency management and utility operators. Its flexible constraints and objective function allow for broader application across different scenarios, aiding in

emergency planning and guiding investment decisions to address infrastructure weaknesses in a changing climate.

Assessing public valuation of coastal protection solution for floods: an experimental study

Tra Thi Trinh, Olivia Jensen
Institute for the Public Understanding of Risk, National University of Singapore

Flooding is one of the most financially devastating natural hazards, affecting millions globally. In Asia, approximately 600 million people face coastal flooding risks, a number expected to rise as sea levels increase. Singapore is particularly vulnerable, and in response, the government is planning the “Long Island” land reclamation project, which integrates coastal protection, flood resilience, and land development.

This study, part of a broader project on coastal flood risk and adaptation in the Asia, aims to provide insights to decision-makers by examining public preferences and trade-offs related to different attributes of the coastal protection solution. Using a choice experiment, we will evaluate four key attributes: flood risk reduction, recreational opportunities, negative impacts on wildlife, and inconvenience, along with a cost attribute to estimate willingness to pay. Additionally, we will investigate the roles of flood risk perception and risk tolerance in influencing public decision-making. While risk perception has been widely studied, its effect on policy support has shown mixed results. In contrast, the role of risk tolerance in response to flood risk remains largely underexplored.

Preliminary research and a pilot survey (n=500) conducted in Singapore in 2023 provided insights into flood experience, risk attitudes, risk perceptions, and existing protection measures. These findings have informed the design of the upcoming choice experiment and survey. The main survey will explore (i) public valuation of long-term coastal protection, (ii) the influence of risk perception and risk tolerance on decisions, and (iii) preference dynamics across flood scenarios and subpopulations.

Avoiding Disaster: Safe Returns on Investments in Biosecurity Measures

Tom Kompas, Andrew Robinson
University of Melbourne

There is a well-established economic trade-off between the cost of biosecurity measures and the potential avoided damages from pests to the environment and plant and animal health from those measures. Spending more on biosecurity measures implies less damage, but the biosecurity measure itself is more expensive. On the other hand, spending less on biosecurity measures may incur more considerable damages. The optimal point of spending is somewhere in between, minimising both the damages potentially incurred and the cost of the biosecurity measures themselves through an appropriate change in a control variable. However, we show that the optimal point invariably occurs in a very ‘flat range’ for many pests and biosecurity measures because the cost function is linear and the loss function is hyperbolic. Local changes in spending thus result in little, if any, variations in rates of return. Instead, the best risk-mitigating approach is to effectively ignore the optimal point and focus on avoiding the more extreme risk and overall costly ranges. Even though the modelled risk-adjusted rate of return may be lower, the ability to avoid a disastrous outcome is more efficacious. This also helps allow for allocations of otherwise optimally used investment funds to other concerns and to account for considerations that are harder to quantify.

Beyond the Hero Narrative: Exploring Women's Roles and Resilience in Disasters

Loriana Bethune, Graham Dwyer
Gender & Disaster Australia, University of Melbourne

Fires, floods and other natural hazards are increasing in frequency and intensity with climate change. These natural hazards often affect communities and society in Australia in ways that exacerbate existing inequalities. While disaster management studies have provided many important insights into improving emergency management arrangements, gender and the role it plays in planning for, responding to and recovering from natural hazard events remains underexplored. Ultimately, scholarly works have overlooked the role of women in emergency management before, during, and after natural hazard events – particularly when they become disasters. While the role that men play in responding to disasters is often revered

with individuals often being referred to as heroes for their efforts, the critical work that women in leadership roles do after such events (either as career professionals or volunteers) is often ignored. We find that women and the work that they do after a disaster is likely to see them face vulnerabilities and threats to their well-being that are unique to recovery roles after a disaster event. We develop a model which theorizes the vulnerabilities faced by women in disaster recovery which we use to offer recommendations we hope will be carried forward by policymakers to address the inequalities (not to mention dangers) faced by women in disaster management. By doing so, our study opens up important pathways towards improving the ways in which government and society plan for, respond to and recover from future natural hazard events.

Biosecurity risk calculator: Tracking biosecurity risk of export fruit along the cold supply chain

Himali Ratnayak, Ross Darnell, Brent Henderson, Rieks Van Klinken
CSIRO

Phytosanitary regulations for imports and exports are typically prescriptive, requiring businesses to meet rigid entry criteria, which can be costly and lead to excessive treatment requirements. This approach often overlooks the role commercial systems and technologies can play in reducing risk and does not reward good industry practices. There is growing interest in adopting a more risk-based approach, leveraging sensor and digital technologies to provide continuous assurance and streamline compliance.

To support this shift, we have developed a prototype 'Biosecurity Risk Calculator' that uses data analytics to monitor infestation risks as consignments move through production and supply chains. Our initial focus was on the impact of cold storage on infestation rates in horticultural produce, as cold temperatures are commonly used for disinfection and storage. We analysed data from 28 studies on fruit fly mortality at various temperatures in different fruits. Using a flexible statistical model, we predicted the time needed to reach a required mortality rate for different species, fruits, and temperature combinations. This allows us to quantify the mortality effect of exposure to variable temperatures across the supply chain.

Our findings suggest that mandated cold treatment may not always be necessary to meet acceptable biosecurity standards, as residual risks can be low. The calculator could enable regulators to base decisions on real-time risk analysis, optimizing resource use, while also helping businesses maintain quality and reduce pest management costs. This has the potential for broader application beyond fresh produce, including assessing biosecurity risks for shipping vessels, grains, and seeds.

Bubbles, Silos, and Echo Chambers

Mark Colyvan
University of Sydney

Epistemic bubbles and echo chambers are routinely thought to be undesirable. They provide environments for conspiracy theories to propagate and they stand in the way of having a well-informed citizenry. At least, that's the standard story about what is bad about epistemic bubbles and echo chambers. I will argue that this is the case for some epistemic bubbles but there are many benefits of being in an epistemic bubble of the right kind. The problem, I will argue, is not with epistemic bubbles, per se, but, rather, with certain kinds of epistemic bubbles. Moreover, from the inside, at least, it is very hard to tell the difference between the good and bad kinds of epistemic bubbles. There is an insidious species of uncertainty at work here: an uncertainty about the reliability of our information network.

Bushfires and Road Safety Risk

Tom Beer
Safe System Solutions Pty Ltd

The risk due to climate change of bushfires has become well known. In 1988 my CSIRO colleagues and I produced the first scientific examination of bushfire danger under climate change. The paper, based on a scenario for the year 2030, stated that the fire danger every year on average would be larger than the fire danger during the Ash Wednesday bushfires year. This 2030 prediction has already occurred.

Science has advanced to a stage where we can mathematically determine fire spread, the likelihood of fire occurrence, calculate air quality implications and even publicise the dangers that low visibility causes because of bushfire smoke.

Though air pollution – including the risk of possible dioxin inhalation - may be an issue in hazard reduction burns, during serious bushfires the major road safety risk arises from the lack of visibility on the roads. This can become a life-threatening issue and there are many instances of crashes when those fleeing a fire are unable to see debris on the road, or crash off the road due to poor visibility.

The 2009 Victorian Bushfire Royal Commission in its recommendation number 62 requested VicRoads to implement a state-wide program of bushfire risk assessment for all roads for which it is responsible.

In December 2013, Safe System Solutions Pty Ltd evaluated VicRoads' Bushfire Management Program and the recommendations in our report eventually led to the Road Bushfire Risk Assessment Guideline and Risk Mapping Methodology Guideline.

Climate Risk Perceptions and Speculative Fiction

Anna Kosovac, Seth Robinson, Robyn Wilson
The University of Melbourne; The University of Melbourne; Ohio State University

This presentation considers the extent to which fiction plays a role in amplifying or attenuating risk perceptions related to climate change. We survey 63 people who are provided with a speculative fiction text to read. We analyse the findings of risk perceptions both before and after reading the text to determine whether the text sways their perceptions of climate change. This study is unique in the way that it considers fiction as a tool to help amplify risk perceptions in communities, and potentially promote climate action. This has not been undertaken in this way before and represents a gap in the research on risk perceptions.

Co-Designing Disaster Preparedness: Tools of Engagement

Brandy Alger, Matthew Hughes, Julia Becker, David Johnston
University of Canterbury; University of Canterbury; Massey University; Massey University

According to the United Nations Disaster Risk and Resilience agency, 90–100 medium to large-scale disasters occurred annually between 1970–2000, but since 2001 the number has increased to 350–500 on average. However, despite the increase in disaster events, there has not been an associated increase in community preparedness and mitigation including in places and communities who have experienced previous and repeated disasters. Historically, disaster risk reduction efforts in Aotearoa New Zealand have predominantly followed a top-down, expert-driven approach to communicating preparedness with limited impacts on preparedness, resulting in 25–50% of the public suggesting they are prepared. Additionally, these initiatives have employed fairly traditional one-way methods for guiding communities on disaster preparedness and response. Co-design is often cited as an approach for long-term sustainable change and could be applied to the preparedness context. Currently, co-design is not widely used in Disaster Risk Reduction contexts and little research has been done locally on this aspect. While some examples exist, many have used elements of co-design, but could not be defined as co-design or have not undertaken evaluation to understand the effectiveness of co-design on preparedness. Therefore, this proposed research will investigate the ability to use co-design as a method of increasing community preparedness within a specific Aotearoa New Zealand hazardscape, and the benefits and challenges of this method. The city of Invercargill in Southland New Zealand is chosen as a case study to determine if preparedness can be improved by using a co-design process and which elements influence change.

Community Risk Perception and Adaptive Strategies for Climate Change and Natural Hazards: A Case Study of Henderson-Massey, Auckland

Iresh Jayawardena, Sandeeka Mannakkara, Sarah Cowie
University of Auckland

New Zealand is significantly vulnerable to natural hazards, having suffered substantial loss of life, widespread social and economic disruption, and damage from earthquakes and extreme weather events in recent years. This study explores how community perceptions of climate change and natural hazard risks influence risk mitigation behaviours and strategies, aiming to enhance coping mechanisms for these threats. This investigation is particularly relevant in the context of Auckland's recent experiences with severe flooding and landslides following the Auckland anniversary floods and Cyclone Gabrielle. These events emphasised the need for a nuanced understanding of societal risk perceptions. Using a mixed-methods approach, the research combines in-person and online questionnaire surveys across the Henderson-Massey Local Board area. This methodology captures diverse community perspectives on risk perception and their implications for risk mitigation. Preliminary findings reveal a complex interplay of cognitive and social factors shaping these perceptions, which in turn influence community decision-making and behaviour regarding risk mitigation. This study contributes new developments and fresh perspectives to the field of risk management by integrating these insights from community viewpoints. It offers valuable implications for both local and international contexts in mainstream climate change adaptation. The findings significantly impact the development of local and regional risk management strategies and provide feedback on the recent National Policy Statement for Natural Hazard Decision-making. Moreover, this study lays a solid foundation for future policy and planning initiatives aimed at improving urban resilience and adaptive capacity.

Damages to environmental and ecosystem services: The large missing piece in the economics of biosecurity

Lu-Yi Wang, John Baumgartner, Anca Hanea, Nicholas Moran, Andrew Robinson, Tom Kompas

The Centre for Environmental and Economic Research, The University of Melbourne; The Centre of Excellence for Biosecurity Risk Analysis, The University of Melbourne
Environmental and ecosystem services are intergenerational treasures provided by nature, yet susceptible to significant damage from invasive pests. To understand the impact of invasive species, quantification in monetary values is a useful approach to compare different sectors and types of damages. However, most of the reports to date focus on damages to agriculture, industry, and public health, whilst the losses on environmental and ecosystem services are largely under-reported. This in turn leads to an illusion that the costs of environmental damages are negligible. To capture more comprehensive impacts, particularly environmental damages, we modified the standard Value of Biosecurity Model (VBM) developed by the Centre of Excellence for Biosecurity Risk Analysis (CEBRA), which can estimate both market and non-market value losses in monetary units for sixteen different assets vulnerable to biosecurity hazards. Using the red imported fire ant (RIFA), one of the most notorious invasive pests in Australia, as an example, we show that after accounting for the losses from environmental damages more correctly, over a broader range of environmental assets, the cost of RIFA in New South Wales increases by at least twice larger over 30 years compared to the VBM, and by many multiples over existing standard results including that contained in the InvaCost database. Our refined model is a promising tool to fill the gap in quantifying losses to environmental and ecosystem services from invasive pests. The outcomes of the model can serve as important reference points for improving biosecurity budget allocation across both portfolio and environmental assets.

Drivers of Water Pollution Risk Perception in the Ganges Basin: A Social Network Analysis

Anjali Yadav
Indian Institute of Technology Kanpur and La Trobe University
This study investigates the antecedents of risk perception of water pollution in the Ganges River. It employs social network analysis (SNA) to examine how different communities based on their socio-economic status (SES) perceive the risks of poor

water quality in the Ganges River basin. Using cross-sectional survey data collected from 305 respondents across three proximity categories (0-1 Km, 1.1-3.0 Km, and 3.1-5 Km) in two districts of Uttar Pradesh, India, the research examines the drivers of risk perception, including SES. Key SNA metrics such as degree centrality, betweenness centrality, and community detection algorithms are utilized to analyze network structures within each proximity category. Spatial analysis techniques, including geographical mapping and regression models, are employed to explore how geographical proximity influences risk perception and network dynamics. The findings reveal intricate relationships between socio-demographic factors, spatial proximity, and community responses to water pollution, offering insights into effective strategies for effective communication and environmental management. This research contributes to understanding the role of social networks in shaping environmental risk perception and behaviors.

Enhancing Global Resilience to Catastrophic Risks: Local Biofuel Production and Convertible Food Oil Facilities for Essential Services – An Aotearoa New Zealand Case Study

Mike Hodgkinson, Nick Wilson, Matt Boyd
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Global catastrophic risks (GCRs) like major wars or severe pandemics could disrupt international trade for months or years, halting fuel supplies critical for food production, healthcare, emergency services, and basic societal functions. This study examines local biofuel production to mitigate such risks, using New Zealand as a case study with implications for global preparedness. We analysed post-catastrophe essential fuel needs, focusing on shipping. While currently a small portion of national fuel use, shipping's importance may grow due to its efficiency compared to land transport and necessity for international trade. Our analysis covered fuel requirements for critical vessels, including coastal container ships, bulk carriers, roll-on roll-off ferries, and naval vessels. Findings indicate that maintaining essential shipping operations would require millions of litres of biodiesel a month, in addition to other critical biofuel uses (e.g., for a single coastal container ship: 10 million L/year derived from 8145 hectares of land in canola crop). New Zealand, like most nations globally, currently lacks substantial biofuel production capacity. This study identifies a potential short-term partial solution: the conversion of existing food oil facilities to biodiesel production. A proposed resilience framework includes: 1. Further research, pilot studies and international cooperation on converting food oil plants to biodiesel. 2. Integration of local biofuel production into global emergency preparedness plans, including short-term emergency conversion and mid- to long-term marine and aviation biofuel production for decarbonization and fuel security. This approach addresses GCR scenarios and aligns with sustainability goals, enhancing global resilience to trade disruptions while maintaining critical services."

Evaluating the Impact of Music on Hurricane Preparedness in the Caribbean

Emiliano Rodriguez Nuesch
Pacifico

The musical campaign. In several campaigns with the World Bank, I experimented with the use of music and video to disseminate important information to be used in preparation for hurricane season. Several artists participated in the creation of the music messages. Collaborators included Caribbean musicians and sports personalities from different countries. The musical message tried to overcome the identified barriers: lack of trust, lack of risk internalization, lack of self efficacy, and the need to reach more people across countries in the region. The campaign reached millions in the region. The behavioral study (my masters thesis at LSE). During the implementation of the campaign, in this study I conducted a randomized controlled experiment and tested the connection between risk communication messages through music and text and their effect on risk perception, self efficacy and trust. Results show that music increases message liking, helps build trust, and lends relevance to the message. After listening to the music, the response of message recipients—when compared to those who received the text or placebo message—also indicated

that they felt they could do more to reduce the effect of hurricanes. Their intention to act is also significantly higher."

Evaluating the Resilience of Emergency Medical Services Following an Earthquake

Chi-Hao Lin, You-Xuan Lin, Xing-Yi Huang

National Center for Research on Earthquake Engineering, Taiwan

After a major earthquake, a sharp increase in the number of earthquake casualties, as well as hospitals that may have been damaged by the earthquake, can lead to a shortage of emergency medical services (EMS). According to information provided by Hualien Tzu Chi Hospital in Taiwan, within two hours after the Hualien earthquake in 2018, more than 100 injured patients poured into the emergency department (ED). In order to understand the medical needs and congestion of EDs, this study uses discrete event simulation to model the medical treatment process of injured patients in EDs. Taking the 6.6 magnitude earthquake caused by the Shanchiao fault rupture in the Taipei metropolitan area as the scenario event, this study focuses on the five administrative districts in Taipei City with the highest casualty rates, along with the eight first-aid hospitals situated therein. The total count of injured patients post-earthquake stands at 2,361. These patients were sent to eight hospitals using a diversion strategy. The critical waiting time index for Evaluation to Operation (CI_ETO) indicates a 24-fold increase compared to standard values, underscoring the congestion in operation services attributable to damaged operation rooms. The findings indicate that utilizing just the eight emergency hospitals in the study area for EMS would be insufficient for them to resume normal operations within a week following the earthquake. According to the patient flow analysis, the results can provide guidance to medical management departments and government agencies for disaster mitigation planning in earthquake defense.

Exploring climate migration in Pacific Small Island Developing States through a victimological lens

Astrid Vachette, Amber McKinley

Australian Graduate School of Policing and Security, Charles Sturt University

Small Island Developing States (SIDS) are uniquely vulnerable to the impacts of climate change, and climate migration seems inevitable for certain communities. Kiribati and Tuvalu are two particular examples of the complexity of the climate migratory imperative in the Pacific SIDS. We conducted a risks analysis of these two countries using a victimological lens to better grasp the different pressures from social, political, and environmental conditions from the Pacific community's perspective. Our framework utilises the theory of conditional vulnerability which offers a different understanding of the Pacific communities position facing climate migration pressures.

Exploring Inter-Professional Communication in Climate Adaptation: Challenges and Opportunities in Aotearoa New Zealand

Zita Joyce, Tom Logan

University of Canterbury

Climate adaptation in Aotearoa New Zealand presents a complex landscape where professionals from various sectors must collaborate to manage evolving risks. This research investigates the inter-professional communication dynamics within this field, focusing on how professionals share information, coordinate efforts, and address the uncertainties inherent in climate adaptation. Effective communication is essential for translating national adaptation strategies into local action, yet this process is often hindered by fragmented governance structures and unclear role definitions. Using a mixed-methods approach, this study includes a document analysis of key climate adaptation policies and semi-structured interviews with professionals across a variety of sectors. Preliminary findings reveal that communication gaps between central and local governments, as well as among different professional groups, contribute to delays and misalignments in climate adaptation efforts. These challenges are amplified by the lack of standardised processes for sharing knowledge and responsibility across professional boundaries. By focusing on the communication ecosystem of climate adaptation professionals, this study offers novel insights into how inter-professional communication influences the

effectiveness of adaptation strategies. The research contributes to the fields of risk communication and governance by identifying barriers to communication and proposing strategies for enhancing collaboration and coordination among climate adaptation stakeholders. These findings have potential implications for improving the implementation of climate adaptation policies, not only in New Zealand but also in other regions facing similar governance challenges.

From the lab to the industrial park: lessons for the energy transition from past technology policy failures

Jan Hayes, Sarah Maslen

RMIT University; University of Canberra

Production, distribution and use of natural gas in commercial and domestic settings is a well-established industry with an excellent public safety record in Australia despite the inherent risks. The industry faces a significant challenge in maintaining this in the escalating energy transition. Emerging technologies for hydrogen and other future fuels will move rapidly from bespoke, experimental, lab-based facilities to full-scale, manufactured, process plant with the necessary resources (both physical and human) stretched to the limit. A large effort in engineering research is targeting solutions to the myriad of technical issues that must be addressed, but too often we overlook the sociotechnical risks to public safety that must also be managed for the transition to be successful. This paper addresses such risks.

Sociotechnical risks arise at all levels from government policy, through regulation, organizations, projects to individuals. Drawing on the concept of epistemic accidents, we address how high levels of uncertainty and serious time pressures have impacted past technology roll outs. The loss of the space shuttle Challenger and the Chernobyl nuclear power plant disaster are linked by several common factors including the need to develop major new technology with a hard deadline set by political considerations. In both cases, this led to facilities subject to minimal testing being put into service despite serious design flaws well known to technologists. These and other cases show how catastrophic outcomes can result from interactions between political and technical priorities and also provide important insights into how such outcomes might be avoided.

Future risky: misinformation and the challenge to temporal order

Philip Pond

The Fighting Harmful Online Communication Hallmark Research Initiative, The University of Melbourne

In this paper, I argue that the problem of misinformation can be understood as a risk-problem for temporal mechanics. First, I articulate the role that information and communication play in establishing temporal order and in coordinating society as a temporal arrangement. Next, I argue that (mis)information challenges established normative practices for maintaining presence and succession in social time. Using examples from a large-scale analysis of political communication on Reddit, I show how misinformation can spread and undermine democratic norms. Normative practices for "proving" truth become untenable in an acute misinformational environment, for instance, which in turn destabilises how the meaning of truth emerges through orders of temporal succession. Finally, I demonstrate the power of the temporal method, which (re)positions the present threat of misinformation within an array of hypothetical futures. Misinformation is thus reframed as an asynchronicity, that is, as a risk to present temporal order, and quantifiable – the probability that an anti-normative and anti-democratic informational future emerges.

Government response to global catastrophic risks: What do the New Zealand public think?

John Kerr, Matt Boyd, Nick Wilson

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The world faces global catastrophic risks (GCRs) such as from nuclear war, pandemics (both natural and bioengineered), climate change, and uncontrolled artificial intelligence. Some countries have established systems to assess the risks of GCRs and how to mitigate against them eg, the US has formed an interagency committee dedicated to GCRs. While Aotearoa New

Zealand (NZ) has a National Risk Register, and a publicly facing list of the risks on it, there is a noticeable gap in unified risk planning and response systems.

Our results from a representative survey of the NZ public (N = 1,012) reveal broad, though not universal, support for a government response. Specifically, 65.7% (95% CI: 62.3-69.1%) of respondents expressed support for the government "developing specific plans to address extreme risks", and 59.7% (56.2-63.3%) supported the "establishment of a dedicated commission or agency". Notably, trust in scientists (but not politicians or mainstream media) as source of information emerged as a key factor associated with higher support for both proposals. For "developing specific plans," older individuals were statistically significantly more supportive, while those with no formal education beyond high school were less supportive. Compared to people in the lowest income bracket, those earning NZ\$85,001–120,000 were more likely to support this policy. In conclusion, these findings of majority public support offer some justification for the NZ Government to progress work on mitigating global catastrophic risks. Next steps could include deliberative democracy measures such as citizen assemblies and surveys to inform specific policy responses.

How can we improve climate adaptation planning?

Ivan Villaverde Canosa, Tom Logan
University of Canterbury

As climate risks intensify, implementing effective adaptation strategies has become crucial. However, many communities face significant barriers, including financial constraints, political volatility, and public distrust, which undermine their climate risk processes. Traditional methods also often overlook essential systemic and cascading risks, leading to incomplete evaluations that hinder preparedness and response efforts. This presentation will examine the limitations of current adaptation processes, focusing on the New Zealand National Climate Change Risk Assessment as a case study. Specifically, we will discuss how these shortcomings impact community resilience in an era of increasing climatic uncertainty and propose strategies to enhance future adaptation efforts at the local level. Key discussion topics will include the role of stakeholders throughout the adaptation planning process, various approaches to implementation, and the challenges that may arise. Our goal is to develop adaptive frameworks capable of responding to evolving risks. We will encourage attendees to share their experiences, successful strategies, and innovative tools that have proven effective in their own contexts. By pooling insights and collaborating, we aim to advance climate risk assessment practices, ultimately strengthening community resilience and responsiveness in the face of climate change.

Incentivized personal carbon scores lower the carbon intensity of urban mobility and spill over to pro-science climate attitudes

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A key challenge global society faces is how to engage the public on climate risk and educate individuals on their collective responsibility as consumers, workers, investors, and citizens, including rewarding political leaders for taking regulatory action. Here we test the hypothesis that introducing personalized feedback on the environmental impacts of a consumer's frequent choices in a specific domain—urban mobility—can lower the carbon-intensity of those choices and spill over to pro-environmental beliefs and attitudes more generally. We recruited 330 university students into a semester-long randomized control trial. We tracked urban mobility choices and, for conditions other than a control, we mapped these choices to personal carbon scores and messaged on the environmental co-benefits of taking public transport, including reduced carbon emissions, improved air quality, and active mobility. Participants who stood to receive rewards for low-carbon scores over reference periods of three weeks shifted their choices the most, away from single-rider car travel. Participants did not object to receiving personal carbon scores, likely due to their exposure to positive and hopeful messaging on the importance of taking climate action. We find evidence that the urban mobility intervention, in its

strongest form of offering low-carbon rewards on top of tracking personal carbon scores and environmental messaging, shifted stated climate change beliefs and attitudes more generally, i.e., not only specific to the urban mobility domain. This research paves the way for a scalable fintech solution that integrates personal carbon tracking with real-time transportation choices, empowering climate leaders.

Integrating behavioral heterogeneity into models of climate risk and resilience

Robyn Wilson
Ohio State University

Solving the climate challenge will require all hands-on deck as we work to understand and plan within a complex, and dynamic coupled systems context. Critical questions need to be answered about human behavior within context, requiring perspectives from across the social sciences. In addition, the heterogeneous perceptions and behaviors of individuals across the landscape need to be integrated into simulation models to accurately forecast alternative futures. In this talk, I will give examples from several projects where integrative team science is being used to both design better interventions to promote climate resilience, but also to better forecast the potential effect of those efforts on our climate future.

Integrating resilience thinking into biosecurity risk management

Edith Arndt, Karen Schneider, Lucie Bland, Andrew Robinson, Anais Gibert, James Camac, Tom Kompas
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Government regulators are responsible for protecting environmental, economic, and social assets from the potentially damaging effects of invading species. In the future, we expect more international trade and transport and continuing climate change. Higher trade volumes and changed fundamental niches influence the likelihood of pests and diseases being introduced and establishing in a new country. Biosecurity systems consist of a range of participants and management activities, or risk controls, operating at different levels and across the pre-border, border, and post-border domains. Import risk analysis, a pre-border measure, assesses the biosecurity risk of pests and diseases entering via a specific import pathway. It quantifies the risk of introducing pests and diseases in terms of likelihood and consequence, and mitigates residual risk until an acceptable level of risk is achieved. The risk analysis approach works well for disturbances that are frequent and have low impacts. However, incursions and outbreaks of pests and diseases are typically not frequent, and their impacts can be high. Consequently, the uncertainty around low-probability, high-impact events could result in an underestimation of risk.

The resilience paradigm may offer a useful framework for the management of biosecurity risk. Resilience thinking addresses the unpredictability of future incursions and outbreaks. If the biosecurity system is resilient, it can limit performance losses and recover quickly in the case of multiple disturbance events, thereby preventing or avoiding damage caused by invading species. We present a conceptual framework for integrating resilience thinking into biosecurity risk management and a pathway for enhancing biosecurity system resilience.

Investigating the atmospheric river risk to water supply in the Pacific Region

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Atmospheric rivers are crucial meteorological phenomena that significantly influence precipitation patterns, particularly in the Pacific Islands. Indigenous knowledge systems play a vital role in managing water supply in the Pacific Islands, where communities have historically relied on their unique ecological insights and cultural practices to sustain their water resources. This study examines the impact of ARs on regional water resources, highlighting their role in water supply immediate effects. Using a specific community case study, we use precipitation data, satellite imagery, and hydrological modelling to assess the frequency, intensity, and duration of AR events across the region. The variability of atmospheric river occurrences due to climate change challenges sustainable

water management and resilience planning. This paper presents our initial attempt in this research.

Island Risk and Resilience: New Zealand and the Unthinkable Consequences of Nuclear Conflict

Matt Boyd, Ben Payne, Sam Ragnarsson, Simon Terry, Nick Wilson

Adapt Research Ltd Adapt Research Ltd RONGO NZ Sustainability Council; University of Otago

The risk of nuclear conflict is probably higher today than in recent times. Previous research has neglected responses should prevention of nuclear war fail. We aimed to understand the impact of a Northern Hemisphere nuclear war on the remote island nation of New Zealand (NZ), significant because sometimes cited as a potential 'refuge' from catastrophes posing existential risk. We developed a hazard profile and validated it at a multidisciplinary workshop (n=20 participants). The hazard profile served as the basis for a scenario-based pilot survey (n=42), and in-depth interviews (n=16), with stakeholders selected for expert knowledge across core sectors of Energy, Food, Transport, and Communications/Digital. We supplemented this research with desktop review of government strategies. We also published analytical studies on crop optimisation, food supply land area requirements, biofuel production, and conducted preliminary work on the contribution of urban agriculture. Results revealed the hazard to be 'quite plausible' with likely monetised consequences exceeding NZ\$1 trillion, and few existing mitigation approaches. Survey and interview findings revealed that collapse of global trade and shipping, shortage of liquid fuels and agricultural inputs, and massive disruption to digital communications could have devastating societal and economic impacts. Frost-resistant wheat (plus carrots) is one optimal food combination for feeding the population requiring 117,000 hectares and 5 million litres of biodiesel to produce. Scaling up near-urban agriculture with optimised crops, would reduce diesel demand. Several other mitigation approaches were identified, including risk assessment, critical plans and national strategies, investment in specific resilience infrastructure, and dissemination of risk information.

Likelihood of AI Security Risks: Analysing public AI security incidents

Tania Sadhani

Mileva Security Labs

Artificial Intelligence (AI) is a widespread technology that enables many of the systems in various critical sectors. AI Security is an emerging field aims to develop knowledge, tools and practices to defend our AI-enabled systems from threats. There is a growing need to model security risk for AI systems, especially as they are vulnerable to AI-specific threats that isn't captured through current cybersecurity practices. However the likelihood component of AI Security risk remains to be a research gap.

The project's aim was to address this gap and investigate how we can quantify the likelihood of AI security risks; a rapidly changing field filled with uncertainty. It does so by developing a framework for AI security incidents by mapping the likelihood component of established risk assessment methodologies in cybersecurity and extending them with useful AI-specific descriptors and fields. To compliment the framework, the project developed an open source database of AI incidents by enriched existing reports of AI incidents.

This text will introduce this proposed framework and justifications behind the design choices and will summarise key findings and trends found through an analysis of the database. It will discuss challenges encountered during the design of the framework, the collection of data and the analysis of the database. Overall, this project plays an important initial step into quantifying likelihood for AI security, which contributes to the wider effort into understanding and handling AI security risk.

Measuring individuals' understanding of risk: From risk literacy to risk know-how

Olivia Jensen, Leonor Sierra

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Throughout the world, people need to make decisions about the risks they face as individuals: from health risks to cyber-risk, safety at work to natural hazards. Risk literacy metrics have been developed to assess whether and how people understand

the probabilities linked to different risks. While this is an essential component of understanding risk, or 'risk know-how' as we refer to it, it does not cover the full set of resources and capabilities which individuals or communities need to make the trade-offs inherent in informed decisions about risk and protective action. Measuring 'risk know-how' in addition to risk literacy is important to distinguish between cases in which individuals do not take protective actions recommended by experts because they did not understand the risk, or because they took a well informed decision while facing competing priorities.

This paper builds on an earlier study of data from frontline risk communicators in which we conducted informal interviews with over 100 people worldwide about the resources and capacities they need to engage in risk decision-making. The study revealed that communicators require a range of skills and resources which extend beyond standard measures of risk literacy. The present study has two parts: development of a set of indicators to measure risk know-how at the individual level, drawing on a critical review of literature on measurement of risk literacy (understood broadly, to include understanding of costs, benefits, trade-offs etc.); second, an initial validation of the set of indicators through interviews with practitioners. "

Meeting people where they are: Four phenotypes for risk communication

Olivia Jensen, Jill Lei, Carolyn Lo, Martin Mende, Robyn Wilson, Leonard Lee, Stacy Wood

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Are there identifiable (domain-specific) profiles of individuals (or phenotypes) in terms of how people generally respond to risk information, and to what extent are these phenotypes associated with different preferences relating to the message and medium of risk communication? We draw on information-processing research to develop a conceptual model based on two key factors relevant to interpersonal risk communication: (a) the degree of analytic engagement (individuals who are motivated and capable of engaging analytically are more likely to rely on systematic analysis of key content in a message, which is critical to comprehending science-based risk information); and (b) the degree of trust that individuals have in established scientific facts related to the risk issue (an individual's degree of trust in established scientific facts can significantly influence whether they accept, question, ignore, or reject risk information). Our model reveals four distinct phenotypes of individuals as targets of risk communication: (1) the citizen scientist (high analytic engagement, high trust in established scientific facts), (2) the motivated idealist (high engagement, low trust), (3) the constrained agnostic (low engagement, low trust), and (4) the casual observer (low engagement, high trust). To test the model, we conducted a study (N=604) involving two risk domains—vaccines and drinking tap water. A series of cluster analyses provided support for the two-factor, four-phenotype segmentation of individuals. Additional follow-up studies delved more deeply into the psychological underpinnings of the differing responses to risk information by these phenotypes, and the most effective risk communication strategies that appeal to each phenotype.

Modelling biosecurity risk at the Tasmanian border via interception data and expert elicitation

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Tasmania is particularly vulnerable to the risk of new outbreaks of agricultural pests. The state's geographic isolation is an asset to agricultural producers who benefit from a relatively low-pest environment, but it is also a biosecurity challenge because islands are especially vulnerable to the impacts of invasive pests and diseases. Furthermore, ongoing globalisation is expected to increase the movement of goods and people across borders and continue to bridge the geographic barriers that once kept places like Tasmania isolated.

The Centre of Excellence for Biosecurity Risk Analysis (CEBRA) recently conducted a study on behalf of Biosecurity Tasmania to examine the policy and practice of domestic border biosecurity.

The research focused on two main biosecurity pathways into Tasmania: fresh produce and passengers. We applied generalised linear mixed modelling tools to interception data, to identify risk factors within pathways and assess the efficacy of biosecurity interventions at mitigating those risks. By combining these results with data elicited from experts, we estimated the relative risk of five priority pest species (Queensland fruit fly, Mediterranean fruit fly, tomato-potato psyllid, grape phylloxera, and varroa mite) entering Tasmania through these pathways. These results are then used to inform resource allocations across the Tasmanian border and to quantify the value of Tasmanian border biosecurity. "

Modelling urban development scenarios for assessment of future flood risk

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Flooding is one of the costliest natural hazards in Aotearoa-New Zealand and is expected to become more frequent and more severe in the future with a changing climate. A continually growing and urbanising population is resulting in intense pressure on NZ councils to increase the supply of developable land, creating the fundamental policy challenge of facilitating flood resilient urban development under mounting climate uncertainty. Assessment of future flood risk is essential for both urban development and climate adaptation planning, but pairing long-term flood hazard projections with current urban plans misses a key element of the risk exposure – where will people be living in 2050 or 2100? A decision pathway is presented that advances a technical approach using urban growth modelling (UGM) to generate scenarios of future urban development that are suitable to inform planning under climate uncertainty. Results from a survey of NZ urban practitioners reveal that involving planning and policy decision-makers collaboratively in the model development process is also key to ensuring UGM is practically fit-for-purpose. Application of an existing model to an NZ study area illustrates how UGM is a flexible method for generating urban development projections that are consistent with a plurality of economic, climate, and policy scenarios. The goal is to create a robust methodology for integrating urban futures with flood futures, to provide decision-makers with a more comprehensive picture of the uncertainties and inequalities of future flood risk.

Navigating Choppy Waters - why are we always arguing about risk and uncertainty in marine multi-use environments and what can we do about it?

Paula Blackett, Erena Le Heron, Shaun Awatere, Richard Le Heron, June Logie, Jade Hyslop, Joanne Ellis, Fabrice Stephenson and Judi Hewitt

Arguments about risk and uncertainty are prevalent in marine decision making. Different, often invisible, starting positions of those involved – regarding world views, academic disciplines and positionality – are often responsible. Broadly agreed collective outcomes depend on uncovering these influences. In this paper we prioritise navigating multiplicity and plurality rather than constraining them. An iterative cycle of reflection and an openness to make changes are central. However, such a cycle must consider how risk assessment tools open or close possible futures, how evidence is best presented to decision makers, and how *mātauranga Māori* is reshaping risk perceptions and is the decisive intervention in creating improved decision-making spaces.

Physical and Mental Health Conditions among 51 Deceased Leaders of Nuclear Weapon States

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This study examined biographical data on the health conditions of 51 deceased leaders of the nine nuclear weapon states. It found that eight (17%) died from chronic disease while in office, with a mean of 3.8 health conditions per person (range: 1 to 10). A majority of these eight (62%) had cardiovascular disease and other conditions included personality disorders, depression, substance use disorders, and cognitive decline from multi-infarct dementia. Of the leaders leaving office alive, 15 (38%) were considered to have had health reasons playing a potential role in this departure. This group had a mean of 2.7 health conditions per person (range: 1 to 5), and all plausibly had their performance in office impaired by their health conditions (eg, via a severe stroke, severe depression, likely personality disorders, mood and anxiety disorders, and substance use disorders). In conclusion, these findings indicate that physical and mental health conditions among leaders of these nuclear weapon states have been common (23 of the 51 leaders studied). While this study is preliminary and there is a need for additional research, there are potential implications for improved governance systems to reduce impaired decision-making around nuclear weapons.

Predicting Emergency Medical Service Capacity and Distribution in Urban Areas During Seismic Disasters

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In disaster scenarios, effective allocation and deployment of emergency medical services (EMS) are critical for minimizing casualties and ensuring rapid response. However, due to the limited capacity of EMS vehicles and the need to maintain adequate resources for routine emergencies, only approximately one-third of the total fleet is available for disaster relief operations in urban areas in Taiwan. This research utilizes three distinct datasets—EMS records, seismic attributes of buildings, and age and population distribution—to analyze and predict routine EMS demand across different times and areas. Through this analysis, the study forecasts not only the overall availability of emergency resources but also their spatial and temporal distribution in disaster-affected regions. These predictive models aim to provide decision-makers with real-time insights into the expected capacity and geographic deployment of EMS, enabling a more efficient and adaptive response to dynamic disaster conditions. By integrating multiple data sources and examining the complex interrelationships between urban demographics, building resilience, and EMS demand, this study offers a comprehensive framework for optimizing emergency response strategies. The findings could significantly improve disaster preparedness, allowing for more strategic resource allocation and better coordination among various emergency response units. Ultimately, this research contributes to building more resilient cities and enhancing the overall effectiveness of disaster response, especially under a seismic disaster scenario, with the potential to reduce casualties and mitigate the strain on medical infrastructure during future crises.

Predicting road blockages caused by rainfall- and earthquake-induced landslides in New Zealand

Amelia Lin, Conrad Zorn, Liam Wotherspoon, Tom Robinson, Joe Pelmar

University of Auckland; University of Auckland; University of Auckland; University of Canterbury; University of Auckland
Landslides, triggered by both rainfall and earthquakes, pose significant risks to New Zealand's infrastructure networks. Predicting road blockages caused by these events is essential for emergency management. This study presents an approach to assess the likelihood of road blockages from landslides triggered by rainfall and seismic activity. Using precipitation and ground shaking intensity as a triggering variable, the approach estimates landslide runout by generating the viewshed – the area visible from the road. The prediction performance is evaluated using observational data from the 2016 Kaikōura earthquake and the 2023 Cyclone Gabrielle. The findings suggest that the viewshed approach performs slightly better for co-seismic road blockages, likely due to the stronger predictive capacity of the ground shaking intensity. Results also indicate a tendency to overestimate the extent of blockages for both rainfall- and earthquake-induced landslides, a limitation that can be addressed by evaluating at a road link scale (e.g., road between intersections) rather than individual segments (100 m). Despite the need for further research to validate the findings of this study, the viewshed approach is shown to be a valuable tool for the prediction of road blockages during future rainfall and earthquake events, providing critical information for emergency planning and mitigation efforts.

Primary care access in the face of climate change

Darcy Glenn, Tom Logan
University of Canterbury

There is a global physician shortage. News reports going back to 2021 note the impact of early retirement, burnout post-COVID, and a lack of interest in new graduates entering the family care field. The ability to get a timely appointment is the dominant barrier to primary care access in New Zealand. Climate change has the potential to exacerbate the situation. Sea-level rise is expected to flood coastal clinics and cut off access roads. Where do affected patients seek care? Additionally, climate migration will introduce new patients into the healthcare system. Do receiving communities have enough resources to handle these, potentially, high-needs patients? Both climate impacts will not be limited to immediately exposed

practices. They will have larger implications for the wider primary care network.

To measure these cascading climate impacts we will compare spatial access to clinics before and after the climate impacts, using metrics that consider both travel times and clinic crowdedness. We expect increased competition for GP appointments. Some practices may no longer be able to accept new patients, further impacting the wider accessibility of the system. We will also be able to observe how travel times and clinic crowdedness drive accessibility. In New Zealand, the lack of GP access is blamed on the inability to get an appointment (21%) more than a lack of transportation to the doctor's (2%). "

Quantifying AI Risk: Adapting cyber risk methodologies to AI security

Harriet Farlow

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As artificial intelligence (AI) systems are increasingly integrated into critical operations, the need to quantify and manage AI risk has become paramount. However, traditional cybersecurity frameworks lack the precision to capture the unique vulnerabilities and threat vectors specific to AI systems. This research presents a novel approach to AI risk quantification, leveraging a database of enriched AI security incidents and adapting established cyber risk methodologies.

By categorising these incidents based on common security themes—such as adversarial attacks, model manipulation, and data poisoning—we identify key vulnerabilities in AI systems. Using this enriched dataset, we explore the application of cyber risk methodologies, including FAIR (Factor Analysis of Information Risk) and Bayesian models, to AI security. Our findings highlight gaps in traditional cyber risk approaches when applied to AI. We propose specific adaptations required for accurately modelling AI-specific threats, offering a roadmap for refining risk assessment methodologies in the AI domain. This work aims to help organisations manage AI risk more effectively as these systems become increasingly integrated into critical operations.

Reframing the concept of shared responsibility: identifying expectations for action to build more efficient dialogues

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Within the field of disaster risk management (DRM), models to describe the division of responsibility have shifted across the past 20 years, leading to an approach of shared responsibility between communities, governments and agencies. As a result, DRM is built around models of mixed governance involving multiple stakeholders. While theory supports the practice and its bottom-up dimension, research has shown that the effective application of shared responsibility is not without problems. Responsibility as a principle is contingent on several conditions such as resources, knowledge or authority. Additionally, responsibility poses a linguistic problem as the multiple dimensions of the concept make it difficult to discuss. Because the concept itself is complex, and because different groups of stakeholders are involved, building collective models of risk management based on shared responsibility has proven challenging. Working with a set of 22 interviews encompassing key stakeholders involved in a large wildfire in Sweden, we have addressed the challenge of shared responsibility during an intervention. Starting with pre-existing models of the responsibility concept, we have identified and isolated spontaneous expressions of responsibility. In the participant interviews, we have observed that expressions of responsibility can inform us of stakeholders' expectations for action, oriented both towards themselves and others. While discussing a complex concept such as responsibility involves a certain degree of interpretation, listing and exposing expectations opens the possibility for clarification in discussions regarding responsibility and its division. With this result, it is possible to facilitate stakeholder dialogues by supporting common views.

Resistance in the regions: harnessing local knowledge and leadership in climate risk assessments

Alison Floyd

Urban Intelligence

In regions that have historically depended on extractive resources, even new economic pathways are often anchored on a heritage of mining, highlighting the strength of mining's legacy and sense of place. It is no surprise then, that there is often resistance to climate change initiatives in these regions.

Theories of place and storytelling methodologies from geography provide a qualitative way of understanding and making sense of the world. Leveraging the power of these qualitative methodologies offers opportunities for improving community engagement in climate change risk assessments and local adaptation planning strategies, ultimately increasing community-wide resilience. In this manner, qualitative methodologies can complement traditional quantitative based risk assessments.

This talk will explore insights from a place-based study set in a resource-dependent region in Aotearoa New Zealand, and discuss challenges with local resistance, how we can harness the power of local knowledge and leadership to support the climate risk assessment process and ultimately enhance community resilience.

Risk and Innovativeness Perception of Emerging Technologies: Cross-cultural Differences in Evaluating Improvement Potential

Jasper Teow, Leonard Lee, Sylvia Hubner-Benz, Michael Frese

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National University of Singapore; Paderborn University; Asia

School of Business and Leuphana, University of Lueneburg

In today's landscape of emerging technologies, characterized by rapid development, uncertain trajectories and continuous upgrades, consumers frequently encounter evolving "version 2.0" products and applications. This shift compels them to evaluate not only past improvements (over "version 1.0") but also future potential (of "version 3.0")—a process that involves navigating ambiguity and risk. Assessing a product's potential requires consumers to anticipate potential changes, trusting in the innovation's future evolution while accepting the possibility that future iterations may not meet expectations. This forward-looking evaluation (which we term potential-evaluation) is deeply tied to risk perception, as consumers weigh the benefits of anticipated advancements against the uncertainties of these emerging technologies.

We explore how cultural factors influence potential-evaluation, using cross-cultural data from China and Japan, two markets with differing approaches to entrepreneurship and innovation. Chinese consumers, embedded in a dynamic, risk-tolerant entrepreneurial environment, emphasize future innovation potential, reflecting a higher risk tolerance for market uncertainties. Japanese consumers, by contrast, prioritize incremental improvements, aligning innovativeness with past advancements. Our findings also reveal that Chinese consumers' higher future temporal focus leads them to engage in potential-evaluation when evaluating the innovativeness of emerging technologies, exhibiting a higher willingness-to-pay for products with potential room for improvement. Japanese consumers exhibit a stronger willingness-to-pay for innovations that display present improvements over previous versions, reflecting a lower risk tolerance in uncertain environments. Our work offers insights into how risk perception and cultural differences shape consumer innovativeness perceptions, providing valuable guidance for entrepreneurs and policymakers navigating the complexities of emerging technologies."

Risk elicitation to identify research and policy gaps at the intersection of climate change and cyber-physical systems

David Johnson

Purdue University

The necessity of adapting to and mitigating the impacts of climate change is driving global efforts to develop and deploy new technologies for critical infrastructures. These new systems must simultaneously advance the safety, security, and prosperity of individuals and societies, enable the global transition to net carbon zero, and progress generally toward fulfilling the United Nations Sustainable Development Goals. The rapid deployment of new climate-smart technologies and critical infrastructure may increase the risk of cyberattacks by

introducing novel and unanticipated vulnerabilities. Researchers at Purdue University, the US's Sandia National Laboratory, and Australia's CSIRO recently organized a workshop (funded by NATO and the US Department of Homeland Security) to identify research gaps and policy gaps associated with risks at the nexus of climate change and cyber-physical systems. In this presentation, I will describe the workshop findings but also a novel risk elicitation approach, used by attendees consisting of high-level experts from NATO member states, that combines scenario mapping with tabletop role-playing exercises.

Risk Perceptions of Climate Buffer Infrastructures

Sandra Seno Alday

The University of Sydney Business School

Climate change poses significant threats to coastal communities that are particularly vulnerable to sea level rises and intensified storms. These threats have raised the level of risk to lives, property, and livelihoods. To mitigate these risks, governments have increasingly employed climate adaptation measures such as climate buffer infrastructures. These include so-called grey infrastructure (for example, dams, seawalls and breakwaters) and green infrastructure (or nature-based solutions such as wetland restoration and the cultivation of coastal vegetation). However, the impact of these types of infrastructure and the stakeholder perceptions of their effects on risk exposure are not well understood. This exploratory study investigates the risk perception of grey and green climate buffer infrastructures across a range of stakeholders in the coastal city of Leyte in the Philippines. Around 90% of the city was destroyed in 2013 with the onset of Typhoon Haiyan, one of the most powerful tropical cyclones in history. The study examines the risk perceptions of the different stakeholders (households, local governments, small businesses) regarding the city's post-disaster rebuilding efforts. The study finds significant diversity in stakeholder perceptions of the risk mitigation effectiveness of the city's grey infrastructure (seawall construction) and green infrastructure (mangrove cultivation) initiatives. This study highlights the importance of considering stakeholder perceptions in the design and implementation of climate buffer infrastructures. It contributes to the discourse on assuring the effectiveness and inclusiveness of climate adaptation strategies.

Scenarios: using our capabilities for counterfactual thinking to reduce uncertainty

Lynette Smith

Gramma consulting

Scenarios are not new to the corporate world. However, with corporations of a certain size and turnover in Australia now required to disclose climate risks and opportunities, firms must develop scenarios and use them routinely to inform governance, strategy, risk management, and performance measurement. Skills in developing them and interpreting them will need to mature rapidly and become widespread. Skills in what though? Definitions vary. Quality varies. Perhaps the most critical issues, though, are epistemic: they relate to how we form beliefs about the world. This isn't an abstract matter. For one thing, it has direct consequences for the content and reliability of a scenario. Standards and regulations also use a wide repertoire of epistemic terms: foreseeable risks, risks and opportunities that "could reasonably be expected to affect an entity's prospects", and the effects of uncertainty on our objectives. The term plausible has also emerged in the literature as climate scientists realise the limits of models and statistical methods. We need to explicate the epistemic conditions on how scenarios are produced and used, so they can be an effective tool for thinking with. This presentation advocates a practice of scenarios which

- uses our capabilities for counterfactual thinking to form rational beliefs and intentions about future states of affairs
- emphasises the insight science has given into causal relations, more than its predictive or projective outputs
- isn't biased to scientific sources of information or knowledge
- emphasises relevance to an organisation's objectives and context, while still enlarging our conception of what could be.

Singing Death: Butcher Choirs and Voices of Resistance among Meatworkers in Australia

Evelyn Lambeth

University of Tasmania

Using two case studies, this paper will link neuroplasticity to the benefits of music and hope for dispossessed and diasporic

communities. An historical example considers the Indigenous Ntaria Choir Arramta of the German Finke River Mission at Hermannsburg (later Ntaria) founded in the late -19th century. Creative resistance, in the form of a choir, sheds light on the resilience of Indigenous peoples forced into certain industries through continuous modes of dispossession. I then draw links to the contemporary, using the example of a Samoan and Solomon Islander workers choir at the Australian Country Choice's Meatworks in Brisbane. Across the world, migrant workers comprise nearly seventy percent of abattoir workforces. The complexities around temporary visas, recruitment agencies, and the more recent shift to the Pacific Australia Labour Mobility (PALM) Scheme, leave these diasporic communities vulnerable to a myriad of associated risks. Housing shortages, healthcare access, and wage shortages run rampant while trans-pacific legacies of colonial dispossession perpetuate the need for labourers to leave their home countries to find work. Outside of these social factors, the workers spend their days confined in the labyrinth of kill-floors and cold-storage rooms that make up the abattoir. Industrialised meat production is ripe with issues, but I hope to use this research to extend the definitional umbrella of food-safety to include mental health and well-being for workers. Like gelatine, colonial debt is sticky, but music allows a way for hope, for the brain to persist or even thrive in the everyday, while the capitalistic fabric of modern societies is restructured in a more wholistic and sustainable fashion for every being.

Sociocultural impacts of climate-induced relocation in Fiji: Vunidogoloa case study and its broader implications

Lisa Neamati

University of Melbourne

Climate-induced relocation is increasing in the Pacific, which is detrimental as it is uprooting cultural heritage and impacting societies. This poses a particular risk to Indigenous societies as the people of these communities are closely woven into their environments and rely on them for their resources. With the exponential rise of internal displacements occurring due to climate change, and some Pacific nations at risk of entire inundation, a converging global crisis is emerging which is also creating a development setback as demands for resources increase. The sociocultural impacts of climate-induced relocation are only just beginning to be understood, however the precise factors that maintain sociocultural integrity during the upheaval of relocation are not articulated as clearly. My research explores these issues through a case study on the village of Vunidogoloa in Fiji and aims to answer: 1) how sociocultural elements are being continued or disrupted during relocations in rural Fiji; and 2) the global flow-on effects of this. This is explored through literature, quotes and imagery with special attention to Fijian academics and community voices to humanise the experiences and reinforce Indigenous values, perspectives, and presence in academia. The findings are that ultimately, a planned relocation to a permanent resettlement at a local destination can be achieved successfully to secure physical safety, but still carries some sociocultural shocks. The global implications of this are that threats to sociocultural elements erode the diversity of knowledge systems, which can set back our collective global resilience. Therefore, its preservation is a global responsibility.

Spatial Risk Analysis Integration in Climate Risk Assessments: A Global Review of Methodologies and Practices

Mitchell Anderson, Tom Logan, Kendrick Hardaway, Portia Sharp, Marcelle Scadden, Ivan Canosa, Alyssa Ryan, Darcy Glenn

University of Canterbury

As climate change intensifies, cities worldwide are increasingly conducting climate risk assessments to inform adaptation planning.

However, the effectiveness of these assessments in guiding robust adaptation strategies depends significantly on their integration of spatial risk analysis techniques.

This paper presents both a framework for spatial risk analysis and a systematic review of spatial risk analysis integration in climate risk assessments globally, examining 86 reports from diverse urban contexts.

Using our proposed framework covering five themes from Risk Source, Exposure, Vulnerability, Consequence, and Risk

Communication, our findings reveal substantial variability in the depth and sophistication of spatial risk analysis across different types of climate risk- and adaptation-related reports.

Over 50% of assessments failed to capture any spatial risk information, and those that did include some aspect of spatial risk seldom went beyond hazard identification and basic exposure assessments.

Common limitations include a narrow focus on flooding and heat risks, inadequate consideration of future scenarios, neglect of indirect and cascading risks, poor spatial resolution, and limited integration of vulnerability factors. These shortcomings have significant implications for the effectiveness of climate adaptation planning, potentially leading to poorly targeted or maladaptive strategies. We propose several recommendations for improving spatial risk analysis in climate risk assessments, including varying communication techniques, broadening hazard consideration, enhancing temporal analysis, integrating cascading risks, improving analytical granularity, and better incorporating vulnerability and uncertainty quantification."

Strengthening the management of systemic risks during geopolitical rivalries

Ivan Villaverde Canosa
University of Canterbury

In an increasingly interconnected world, globalization has intricately woven societal systems into a complex web of interdependencies. While this integration has generally enhanced human health and well-being through improved financial transactions and trade flows, it has also heightened exposure to various environmental and societal risks. These risks complicate the tasks of risk managers, who must devise effective strategies amidst growing uncertainty. Recent research underscores the importance of stakeholder engagement and collaboration in addressing these multifaceted challenges. However, the potential impact of future geopolitical shifts on the quality and scope of such collaboration is often overlooked. This presentation will explore how anticipated climate-related changes may reshape geopolitical dynamics and disrupt the management of systemic risks across multiple levels. It will examine the implications of transformations such as a changing Arctic, rising sea levels, and the transition from a fossil fuel-based economy to a green economy. By analyzing these factors, the presentation aims to illuminate how global changes could influence decision-making at international, national, regional, and local levels. The objective is to provide strategies for integrating these evolving scenarios into collaborative frameworks, enabling stakeholders to navigate the complexities of a rapidly changing world more effectively.

Take the money and run: understanding the decision to cash out of a risky bet

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After a risky choice, decision-makers must frequently wait out a delay period before the outcome of the choice becomes known. In contemporary sports-betting apps, decision-makers can 'cash out' of their bet during this delay period by accepting a discounted immediate payout. Two important open questions are (a) how availability of a post-choice cash-out option alters betting behaviour, and (b) which individuals are most likely to make use of a cash-out option when it is offered. We investigated these questions using a novel experimental gambling task that incorporated a cash-out option during the delay between bet and outcome. Across three experiments (N = 385 adults recruited via Prolific), we found, first, that cash-out availability significantly increased participants' bet amounts by up to 35%. Secondly, we found that cash-out rates were highest among individuals who self-reported the lowest levels of impulsivity. Taken together, results suggest that cash-out availability may promote larger bets by allowing cautious bettors to avoid losing their entire stake. This serves to reframe our understanding of the role of the post-outcome delay period in risky choice, and suggests an important role for regulation of contemporary sports-betting products to reduce gambling-related harm.

The Butterfly Effect: Identifying pathways for sustainability transformation through social processes of disaster resilience

Belinda Davis, Alan Reid, Briony Rogers
Monash University

Disasters resulting from natural hazards can generate extraordinary social dynamics. So, how can we optimize these dynamics for enhanced sustainability? Sustainability and disaster resilience frameworks commonly neglect the role of agentic social processes in influencing wider structural transformation for sustainability. We applied relational agency and social practice theory to conceptualize transformative pathways for enhanced sustainability through a review of peer reviewed literature relating to natural hazards and community disaster resilience. Our conceptual review sought to answer two questions: 1. What are the social practices that influence transformative change for disaster resilience in the context of

individual, collective and structural spheres of influence? 2. What are the social influencing processes involved, identified through relational agency? We found that empirical studies tend to focus on individual and collective or structural spheres but rarely offer a relational analysis across all three. Our findings highlight that positive relationships that prioritize restoring shared, meaningful and purposeful identities can act as a resource, which can lead to expansive and incremental transformative outcomes for sustainability: a process we liken to the butterfly effect. We reinforce these findings regarding relationality with outcomes from a community-led disaster recovery project called Fire to Flourish and present a Sphere of Influence Framework that highlights socialized practices influenced by relationality, which can be applied as a strategic planning tool to increase capacity for resilience. Future research should explore how socio-political practices (the structural sphere) influence distributed power within collective and individual spheres.

The methodology of biosecurity system evaluation – the New Zealand case study

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New Zealand operates a comprehensive biosecurity system to protect its extensive natural and agricultural resources, along with cultural assets. Substantial research efforts have been made to evaluate specific biosecurity measures and the damages incurred from particular biosecurity threats. However, no comprehensive attempt has yet been made to evaluate the entire system. The value of the entire biosecurity system and its components is of a great interest to government, Treaty partners and the public, and is crucial for ensuring appropriate resource allocation for the maintenance and optimization of the biosecurity system. Evaluating the whole biosecurity system requires a novel methodology. Such a methodology was recently developed and applied to Australia's biosecurity system. It is now being adjusted for New Zealand's biosecurity system. We are developing a comprehensive, dynamic and large-dimensional simulation model to estimate the value of New Zealand's biosecurity system. Starting with detailed asset layers and potential damage functions from invasive pests, the model will simulate the arrival, spread, and impact of biosecurity hazards (in terms of asset yield or value reduction) under different biosecurity operational scenarios. It will also estimate the economic value of biosecurity interventions. This talk will present the methodology for estimating the tangible value of New Zealand's biosecurity system, as a whole, in terms of its impact in safeguarding New Zealand's natural, cultural and economic assets. This is a large and ambitious project, in which we estimate the value of seventeen NZ assets (e.g. agriculture, fishery, flood control, gene pool, tourism and marine non-market services) and how they may be damaged by exotic invaders (pests and pathogens) over time. We are considering 48 biosecurity hazards that may affect New Zealand's vegetation, agriculture, animals, aquaculture and marine ecosystems, and cultural assets."

The perceived risks of a basic income pilot for the arts from the Australian contemporary music sector

Olivia Hally, Anna Kosovac
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In 2024, The Media, Entertainment and Arts Alliance released survey findings showing that half of Australian musicians earned less than \$AU6000 in 2023, representing a fraction of the income required to meet basic human needs. During this time, COVID-19 has had a devastating impact on musicians' viability to continue their practice, and this is further compounded by the ongoing cost-of-living crisis, collapse of festivals and music venues, and the incidences of sexual assault within the music industry. These factors reduce the ability for musicians to establish financial security leading many to leave the industry altogether. Mitigating these elements is key to sustaining a healthy and diverse cohort of artists in Australia. This study considers the industry's appetite for a basic income for musicians. Through a series of interviews (n=8) with musicians and executives of arts organisations, this study uncovers the perceived barriers and risks to implementing a Basic Income for Artists in Australia from the perspective of artists and arts

organisations. It considers how these perspectives might differ, and if other alternatives for sustaining artist careers are perceived as more viable than a Basic Income for Artists. As Ireland pilots a Basic Income for Artists, this study considers a similar program in an Australian context and is unique in its access to interviewing key decision-makers, and musicians in the space, prompting an in-depth look into how these types of policies are perceived within the industry.

The rhetoric and reality of adaptation planning to climate risk: A case study of Buller District

Alyssa Ryan, Tom Logan
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Climate change risk and adaptation planning is an iterative process that needs to be localised. In Aotearoa New Zealand, local governments are mandated to plan and prepare for climate change. However, many councils are waiting for further direction from central government on adaptation actions, rather than navigate local uncertainty. There are inherent challenges in engaging with local communities, including the lack of interest or understanding about climate change, polarising views and local tension, particularly climate deniers, and the resource intensity of running an adequate programme. Meaningful and effective community engagement requires a shared understanding of climate change and appropriate adaptation options to prepare and plan for uncertain futures.

This presentation discusses the case study of adaptation planning in the Buller District of Aotearoa New Zealand. The region is highly susceptible to the impacts of climate change as Buller is comprised of diverse and isolated small-towns and low-lying coastal settlements. Previous extreme weather events have demonstrated the increased burden on local communities with damage to infrastructure, restricted accessibility, and the imposition on socio-economic development. Drawing on the risk of feelings and personal experiences, we discuss the challenges of having an on-the-ground understanding of climate risks to assuage patterns of mistrust, miscommunication and maladaptation moving forward. We contend community-led adaptation planning is an important part of climate risk management and communication."

The World Will Not Achieve Net Zero by 2050: The Challenge of Meeting Emissions Reductions Targets in a Global Energy and Trade Model

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Meeting the Paris Agreement target and path (PTP) is vital to protect humanity from the worse impacts of global warming. Using a large dimensional and unique Global Trade Analysis Project (GTAP) model for energy and trade we calculated the needed change in the energy mix and fall in carbon emissions to meet a minimal PTP of less than 2°C warming. Covering 30 countries/regions and 31 sectors, the model shows the PTP in annual time steps to 2100 in terms of emissions reduction and the shift in energy mix allowing for changes in energy intensity, renewables growth, and rising carbon prices. By 2050, model results show carbon emissions must decrease on a compound basis by at least 5.7% globally, per year, on average, coal consumption must fall continuously from 2025 complemented by large increases in renewable energy that allow for continued economic growth. We find that global carbon emissions must decline to almost 40% in 2030 and 80% in 2050 to meet a less than 2°C warming path by 2100. Coal consumption must decline between 85-99% by 2050 among the key emitters (China, the USA, and India), compared to 2019 (the model baseline) complemented by a continuous transition to renewables. For Net-Zero Emission Targets (NZET), carbon sequestration, such as from re-forestation and land use change, is also essential, although with substantial uncertainty. Model results indicate a net-zero outcome even with carbon sequestration occurs no earlier than 2058.

Towards Open Science for Climate Risk: Identifying Combined Heat and Flood Exposure

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Climate change has increased the frequency and severity of extreme heat and flooding. However, where these climate risks

are increasing in tandem, much less who is exposed and why, is not well understood. We utilize Microsoft Azure cloud-computing capabilities with inputs from Earth and meteorology products in the Planetary Computer to identify and predict hotspots of population exposed to extreme heat and flooding risk worldwide. We observe trends of extreme heat and flooding exposure from 1984 to 2020 by mapping populations most vulnerable to the co-occurrence of flooding and extreme heat.

Open Science is essential to advance understanding and policy for climate risk through core principles including promoting data access and transparency. Access to data allows for independent evaluation paired with transparency of methods to allow reproducibility. Data accessibility through cloud platforms saves energy and promotes equity by allowing direct connection to datasets for spatial analysis in the cloud without requiring local download. Data access enables validation through comparison to independent data and models (e.g., ability to check reasonableness by splicing model output at time/space for event) which when paired with model access allows for others to evaluate the approach directly.

To advance Open Science, we facilitate mapping tools to visualize exposure trends of vulnerable populations to these twin hazards that are increasing because of climate change. As such, we aim to promote greater understanding of risk and further advocacy for climate justice with evidence of who is most exposed.

Weather hazard risk perception, outdoor activities, and decision-making under uncertainty

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Weather decisions are decisions people make every day based on weather information, forecasts, warnings, their plans, perceptions of risk, and goals. Weather-related decision-making includes how people identify and avoid weather hazards and manage uncertainty to safely and successfully conduct outdoor activities. How people perceive, interpret, understand, and act on weather information and warnings varies between individuals and their decision-making contexts. Disregarded warnings, poor risk awareness, and inadequate decision-making skills can lead to people unknowingly putting themselves in the way of hazardous weather and harm. However, there is limited research examining individual difference factors, weather hazards, and the decision thresholds at which people change their plans due to weather for their outdoor activities.

To develop our understanding of weather decisions as decisions made under uncertainty, and people's perceptions of weather risk and hazards, we conducted an online survey. Across two outdoor activity scenarios and five weather events, participants (n = 400, university students, mean age 28.6 yrs (SD = 11.2 yrs), 76.5% female) were asked at what forecasted percentage of a weather event or warning would they change their plans. Participant's decision thresholds varied with activity, weather event (rain, wind, thunderstorm) and severity. Thresholds were lower for more severe weather and warnings. Participant's experience, exposure, risk perceptions, concern, and weather salience are examined. Findings contribute to our understanding of weather-related decision-making, human behaviour, and the role of individual differences. This research may lead to recommendations to enhance weather risk communication and education, and support individuals to make safer, informed weather decisions.

Who fears what and why? Cultural worldviews and the perception of natural hazard risk in Australia

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Originating in the work of Mary Douglas, the cultural theory of risk proposes that risk perception is biased by sociality and the maintenance of four ways of life, or cultural worldviews: hierarchism, egalitarianism, individualism and communitarianism. We used Dan Kahan's measure of cultural worldviews to examine whether ways of life were related to perceptions of the general risk of bushfire, flood, storm and earthquake natural hazards in Australia. A sample of 503 participants from NSW completed two questionnaires: cultural worldviews and natural hazard risk perception. Only 30% of

participants held strongly hierarchical, egalitarian, individualist or communitarian worldviews. Several aspects of natural hazard risk perception were predicted by cultural worldviews, but associations were weak. Individualists perceived greater risk of, and responsibility for, natural hazards possibly because they perceived them to be a disruptive threat that limits freedom. Egalitarians perceived greater risk from bushfire or storm, possibly because they understand the potential for social impacts from these events and favour collective response. Notions of control and mitigation of natural hazards were associated with hierarchism. Communitarianism was not a predictor of natural hazard risk perception. Thus, people in the sample did not view natural hazards as a threat to their sociality and way of life. This is consistent with other studies outside of the USA. Single heuristics, such as the cultural theory of risk, are unlikely to capture the complexity of natural hazard risk perception and options for protective actions in Australia.

Wildfire Risk Communication Website

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FLARE Wildfire Research, University of Melbourne; FLARE Wildfire Research, University of Melbourne; FLARE Wildfire Research, University of Melbourne; Melbourne Data Analytics Platform, University of Melbourne; Melbourne Data Analytics Platform, University of Melbourne; Melbourne Data Analytics Platform, University of Melbourne

Welcome to the Pyrocene: an age of extreme wildfires marked by a growing toll on people, property and the environment. As devastating as recent fire seasons have been, they are a mere prelude to something far bigger if we are unable to curb our greenhouse gas emissions and re-think our approach to fire. Given these stakes, a shared understanding of climate change and fire is critical. The age of big data presents new opportunities to tackle the challenge of wildfire. It also creates pressures and obligations for time-poor researchers, decision makers and communities. We need ways to present data that are simple and engaging. We need to take the task of wildfire data curation seriously.

In this cross-disciplinary project we are developing a dynamic wildfire risk communication platform. We are leveraging cutting edge datasets and modelling methods to build a better understanding of risk – for the general public, fire managers and scientists. The heart of the platform is maps and time series of wildfire activity, as well as proxies of four key drivers of fire: fuel, dryness, weather and ignition. The platform is complemented by short and engaging text about useful concepts for thinking about fire. Our project has drawn seed funding from the Melbourne Data Analytics Platform, the Melbourne Centre for Data Science, the Wildfire Futures Hallmark Research Initiative, and Melbourne Climate Futures. We will shortly carry out user testing with target audiences to help shape the structure, content and direction of the platform. "

