THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

NATURAL HAZARDS CAPABILITY STATEMENT

The University of Queensland is uniquely positioned to lead Australia's response to natural hazards as they occur and to mitigate future environmental crises.

Contents

Our Capability

The University of Queensland is widely regarded as a leader in natural hazards research. Our academics were amongst the first to recognise the impact of climate change on coral reefs; our bushfire research capability extends from prediction to mitigation and recovery; and our social scientists have led modelling work around the impacts of future droughts and floods in Australia.

As a large comprehensive university, based in the most environmentally diverse state in Australia, UQ is the obvious choice to lead research efforts into every aspect of natural hazards.

More than 430 academics are involved in natural hazards research at UQ. Researchers work across all six faculties and two research institutes investigating all aspects of natural hazards including the health impacts; tools for prediction, mitigation and mangement; and Indigenous knowledge of previous events. The University's expertise includes:

- Traditional Owners
- Environmentalists
- Geographers
- Earth scientists
- Urban planners
- Engineers
- Medical professionals
- Social scientists
- Evaluation specialists.

UQ has a track record of successfully working with government, non-government and industry partners to influence national and international conservation policy.

> $21m NATURAL HAZARD RESEARCH FUNDING

494 NATURAL HAZARDS RESEARCH COLLABORATORS

 # 1 IN THE WORLD FOR BIODIVERSITY CONSERVATION

436+ RESEARCHERS WORKING ON NATURAL HAZARDS

4,200+ RESEARCH AGREEMENTS IN 2020

Natural hazards in focus

Bushfires

Minimising the devastating impact of bushfires demands research from a broad spectrum of inter-related disciplines. UQ has capability ranging from advanced bushfire meteorology to fire-detection drones and planning large-scale recovery operations in the aftermath of fire events, including the psychological wellbeing of survivors.

Floods

In the land of drought and flooding rains, much of eastern Australia has experienced an increase in the number and severity of floods in recent years. UQ experienced flooding first-hand, when the St Lucia campus was inundated during the 2011 Queensland floods. Our researchers are exploring all aspects of flooding including how initiatives such as the 'Mud Army' can assist future relief efforts.

Severe storms

In a matter of minutes, severe storms can cause long-lasting damage for individuals, communities, business and government. UQ is uniquely located, allowing researchers to respond to severe storms, and monitor and manage the impacts of weather events along the east coast of Australia.

Drought

As the impacts of climate change become more prevalent, droughts are becoming longer and more severe – more than two thirds of Queensland is currently in drought. UQ researchers are exploring ways to adapt including enhanced crop design, mapping methods for adaptive water governance, and informing drought reconstructions.

Coastal inundation

Healthy coastal ecosystems are vital to healthy communities. Yet, the increasing pressures of urbanisation, beach erosion and intense storms is having an unprecedented impact on Australia's coastlines and the ecosystems they support. UQ researchers work across all aspects of coastal inundation, from prediction and preparation through to recovery.

The lenses for UQ's natural hazard research

Prediction

Accurately predicting natural hazards allows government authorities, private business and individuals to plan and prepare for future disasters. UQ researchers have a range of expertise across remotely sensed data, fieldwork and spatial models. They measure, map and monitor biophysical properties in terrestrial, atmospheric and aquatic environments. Researchers are also modelling historical weather events in order to predict future natural hazards.

Risk analysis

UQ consistently ranks as a top performer in several of the world's most respected league tables – we are ranked #11 in Environmental Sciences; #30 in Geography and, in the Nature Index Tables, we are 35th for Earth and Environmental Sciences. As a world leader in environmental research, UQ is well placed to analyse risk associated with natural hazards.

Preparation

A natural disaster can occur in seconds – but the preparations to reduce the risk and impact of that same natural hazard can be years in the making. UQ researchers are involved in many aspects of crisis preparation, from targeted research into specific hazards through to preparing for multiple, simultaneous hazards and the necessary additional effort required.

Management

As the frequency and severity of natural hazards increases, the management of these crises must also evolve. UQ researchers are exploring many aspects of natural hazard management, from addressing child and adult mental and physical health issues, to ensuring environmental sustainability and determining the appropriateness of manufactured building products.

Mitigation

Improving Australia's ability to respond to more intense bushfires requires coordinated mitigation strategies and improved disaster management. Communication of risk and how to prepare and respond to natural hazards is usually seen as part of the solution. However, understanding of the effectiveness of various tools and methods in advance can help mitigate the nature hazard before it occurs.

Recovery

Loss of biodiversity is one of the greatest global challenges – and creating solutions to combat it is one of UQ's research strengths. UQ is ranked #1 in the world for biodiversity conservation. The research group comprises multidisciplinary conservation scientists who have expertise in ecology, decision science, environmental policy, mathematics, social science, economics and spatial modelling.

Prediction

In order to successfully prepare, mitigate and manage natural hazards in Australia, we must firstly predict the severity of the hazard and its impacts.

Bushfires

- UQ researchers are working with state, territory and Commonwealth agencies to develop operational procedures for mapping the extent and severity of bushfires, and to estimate fuel load and flammability. Output from these activities is used directly by government agencies in assessing fire risk, and quantifying their impact and assessing their recovery. Researchers at the Remote Sensing Research Centre are also working with small and multi-national companies and the SmartSat Cooperative Research Centre to develop and deliver work procedures for detecting and monitoring fires. By combining field work, remote sensing of satellite images and spatial analysis of environmental information researchers can model previous landscape changes, as well as predict future hazards.

  Researchers are also examining the factors of Australia's Black Summer in 2019-20 to determine why some of the wildfires burnt over larger areas, for longer durations and causing more damage to vegetation than seen before. For all large forest and non-forest fires (>100km2) between September 2019 – February 2020, researchers are calculating various response variables and considering the fires' extent in space, time, spread and intensity. They are also analysing a variety of climatic, vegetation and anthropogenic variables that may have contributed to the fire impacts.

Contact: Professor Stuart Phinn

Floods

- UQ has developed a new 2500-year flood record, in turn narrowing the uncertainties in Speleothem age models from Central Italy and having a new method for correct dating uncertainties in radiometric models and annual layer counting (e.g. tree rings, ice cores, some limestone deposits). The flood record, has removed duplicate and unlikely floods before 1422, and has included many more floods after that time than previous studies. Results from the research, undertaken by the School of Historical and Philosophical Inquiry, can be used to reduce the uncertainty in Flood Frequency Analysis in other parts of the world, including Australia.

Contact: Dr Duncan Keenan-Jones

- The mining industry is susceptible to flood and drought risks including financial, environmental and safety risks. In Chile, climate change is expected to increase these risks, in particular due to predicted increases in rainfall intensities in usually arid or semi-arid areas. The Centre for Water in the Minerals Industry and the International Centre of Excellence in Chile (SMI-ICE-Chile) undertook the Climate Change Atlas project to map mine and mine waste locations over Chile. It developed indices of hazard, exposure, vulnerability and risk for both floods and droughts. The project then focussed on improved methods for mapping flood-related risks from mine wastes (tailings), in order to support prioritisation of pro-active risk management.

Contact: Professor Neil McIntyre

Severe Storms

- The UQ Wind Research Laboratory is improving cyclone monitoring, and in turn improving cyclone prediction. WiRL - together with James Cook University and funded through the Queensland Government - form SWIRLnet, which provides real time wind speed monitoring for cyclones

that cross the Queensland coast. SWIRLnet, or the Surface Water Relay and Logging Network, studies wind fields leading through the rapid deployment of weather stations prior to tropical cyclones to provide real time data as cyclones cross the coast.

Further, WiRL researchers are statistically analysing winds measured at weather stations since the mid-1900s to estimate the wind hazard in different parts of the country. Through this work, researchers are examining possible trends in the data and the potential impact of climate change on the expected wind gusts generated from severe storms around Australia.

Contact: Dr Matthew Mason

- UQ researchers use remotely sensed data, fieldwork and spatial models to measure, map and monitor biophysical properties on land, under the sea and in the atmosphere. The Remote Sensing Research Centre is internationally recognised for its research providing private and public sector organisations with techniques for turning satellite and airborne images and field survey data into meaningful maps and information. These images and data can then be used to better understand where, how and why environments are changing.

Contact: Professor Stuart Phinn

- As the climate changes, monitoring and predicting severe storms is increasingly important for residents and ecosystems across Australia. The Coastal Engineering Group is monitoring the Great Barrier Reef to estimate wave impacts, from very detailed work around coral/wave interactions through to estimating every day and tropical cyclone wave statistics.

Contact: Dr David Callaghan

- In the South Pacific, geological and historical evidence of past extreme wave events are present at many locations but the generation mechanisms, or wave propagation characteristics of those events, are un(der)studied. Consequently, the recurrence interval, and the type of coastal inundation event (e.g. storms or tsunamis) that can cause severe damage, are still largely unknown. The School of Earth and Environmental Sciences is aiming to improve understanding of coastal inundation events along the coasts of the South Pacific by using archaeological and geological evidence, and a combination of mapping, sediment analyses and numerical modelling techniques. New knowledge of storms and tsunamis revealed in this project will help coastal populations to better prepare for anticipated hazard events.

Contact: Dr Annie Lau

Coastal Inundation

- In partnership with the School of Biological Sciences, researchers at the School of Earth and Environmental Sciences are investigating the response of tropical coasts to higher sea levels, extreme storm events, and coral reef decline by examining the near-past and modelling future coastal change. This project attempts to generate new knowledge of the links between coral reef and coastal development under different sea levels by linking marine geological methods with coastal hydrodynamic modelling. The long-term expected outcomes include a new advanced understanding of the interactions between coral reefs and tropical coastlines.

Contact: Dr Daniel Harris

Prediction

- The Coastal Engineering Team is investigating storm surge and wave run-up along the eastern Australian coast. This research, funded through the Australian Research Council, is focused on new scaling laws for coastal inundation by overtopping of beaches, seawalls, river walls and reef-protected coastlines, from both wind and swell waves and tsunami waves. This work is linked to beach erosion modelling and long term coastal hazard modelling and coastal adaptation planning.

Contact : Professor Tom Baldock

- Investigating past events can be a useful tool in predicting future events. The School of Earth and Environmental Sciences is reconstructing Holocene (covering the past ~10,000 years) coastal environmental changes and storm history from sedimentary evidence (e.g. coastal sands) in southern and central Queensland. Growing population along this coastline is causing storm and inundation risk to increase, however the current understanding of storm frequency and magnitude is constrained by limited historical records. Sediment analyses complemented by remote sensing and non-invasive geophysical surveying methods are used to reveal past environmental changes. The project intends to link storm occurrences to decadal or longer climatic cycles, therefore providing fundamental knowledge of storm activity under different climatic scenarios for improved hazard prediction accuracy that can benefit communities by reducing losses in future storm hazard events.

Contact: Dr Annie Lau

Drought

- Expected increases in food demand, climate change and the need to limit the expansion of agriculture to curtail emissions highlight the urgency to bridge productivity gaps in rain-fed cropping. One way to bridge those gaps is to identify the optimum combination of genetics (G) and agronomic managements (M). This leads to crop designs (GxM) that best suit site and expected seasonal conditions. Current understanding of sorghum stress physiology indicates that 'in hindsight', optimum crop designs can be known if the seasonal conditions are also understood. The Centre for Crop Science, within the Queensland Alliance for Agriculture and Food Innovation, is working to better inform that hindsight. Researchers are linking a tested sorghum model (APSIM-sorghum) with the Australian Bureau of Meteorology's ACCESS-S1 seasonal climate forecasting model to inform crop designs in rain-fed sorghum production. The expected outcome is an increased productivity and resilience of the Queensland sorghum industry from bridging productivity gaps by using APSIM and ACCESS-S1 products to inform optimum GxM combinations across Queensland sorghum growing environments.

Contact: Professor Daniel Rodriguez

Image credit: Dr Matthew Mason

In Focus: Mapping the weather

For more than 10 years the Atmospheric Observations Research Group has collaborated with the Australian Bureau of Meteorology (BoM) to improve storm forecasting accuracy. The research has involved understanding atmospheric conditions, from local through to synoptic scale.

The partnership has led to improved storm forecast accuracy, which has the potential to enable Australians to better prepare for severe weather events. Further, with the support of the insurance industry, Professor McGowan and the BoM have developed a hail forecasting capability using meteorological radar data, which aims to provide hail 'nowcasts' at suburb scale. This new type of radar technology, called dual-polarisation, uses two simultaneous beams that scatter off precipitation and provide relative measures of horizontal and vertical size. 'Dual-pol' can determine the density of rain droplets and whether hail is present.

UQ and the BoM are now collaborating with the Victorian Country Fire Authority and the Queensland Fire and Emergency Service to research extreme bushfire meteorological hazards, such as bushfires, that trigger thunderstorms across the country.

Contact: Professor Hamish McGowan

Preparation

Increasingly, research is highlighting the benefit of disaster preparedness for industry, government and the community. Recent scenarios where there have been multiple hazards occurring at the same time – for example, bushfires and COVID-19 – have resulted in a greater emphasis on preparation than ever before.

Bushfires

- Bushfire preparedness is not limited to responding to the immediate threat of fire. The School of Public Health has worked extensively with public health services to plan for continuity of core public health functions while responding to a hazard. This work has proven particularly important where the hazard has been localised, but the public health function covered a broader geographical area. Most recently, researchers have identified that where there are repeated hazards over a longer period of time, a failure to continue other public health functions can adversely affect the health of populations.

Contact: A/Professor Linda Selvey

- Wood is an excellent material for electricity transmission poles and is widely used for other infrastructure across Australia, such as fencing and bridges. Despite its combustible nature, most timber species should be able to withstand smaller or prescribed bushfires with limited damage and then self-extinguish. However, some chemical treatments that are added to protect against fungi and termites can lead to smouldering fires, which are driven by oxidation of the char and can destroy wooden poles and fences long after a fire has passed. The National Centre for Timber Durability and Design Life is highlighting how smouldering can be avoided whilst maintaining long design life of timber infrastructure in remote environments.

Contact: Dr Felix Wiesner

- The industry-driven Centre for Energy Data Innovation is exploring the use of smart energy technology to change the way energy is used and stored to ensure consistent energy supply during bushfires and other natural hazards. Researchers are using principals relating to artificial intelligence, game theory, optimisation and machine learning methods allocation, scheduling and queuing issues to enhance battery power.

Contact: Professor Neil Horrocks

- The lay of the land can have significant impact on the direction, speed and spread of wildland fires. The School of Civil Engineering recognised that expanding infrastructure hubs and sprawling urbanisation in areas prone to wildfires is a challenge for communities across Australia. Researchers are investigating the influence of topography and vegetation conditions, such as species and moisture content, on the development of wildland fires, and how this influences fire fighting strategies.

Contact: Dr Juan Hidalgo

Severe Storms

- The demand for safe and resilient infrastructure in regions prone to natural hazards challenges existing engineering design and construction methods in many Australian communities. The School of Civil Engineering is examining how and why extreme events, such as cyclones and thunderstorms, damage infrastructure and is developing innovative engineering solutions

that will result in safer and more resilient critical infrastructure networks across the country.

Contact: Dr Matthew Mason

Researchers are also testing the use of a number of materials including traditional timber and structural bamboo, as well as various building methods including modular and off-site construction and re-used timbers.

Contact: Dr Lisa Ottenhaus

- A key focus is the development, testing and operation of reliable, efficient and sustainable electricity supply that meets community needs. Researchers in the School of Information Technology and Electrical Engineering are applying artificial intelligence for advanced asset monitoring. By measuring power quality, researchers are able to develop suitable techniques to identify system status and ensure grid reliability.

Contact: Dr Chandima Ekanayake

- Researchers are active members in the Australasian Wind Engineering Society, and contribute to the committee developing the Australian Wind Loading Code, which will ensure building standards for Australian homes and infrastructure are appropriate for local weather conditions. Wind Research Laboratory researchers conduct damage assessment work of impacts to homes and infrastructure after severe storms to improve design and construction to minimise future impacts.

Contact: Dr Matthew Mason

Coastal Inundation

- Quarried materials play a crucial role in reconstruction of housing and infrastructure following natural disasters, yet their absence as a feature of disaster planning has led to major challenges and supply shortages. The UQ Development Minerals Programme works with communities to maximise local materials, as locally sourced mineral-based reconstruction projects can generate local employment. Researchers found that after Cyclone Winston hit Fiji in 2016, the country experienced acute shortages of construction materials and completely ran out of cement which was then imported in large quantities. A Post Disaster Needs Assessment (PDNA) was conducted but ignored the capacity of Fiji's sand and gravel industry and quarry sector to supply building materials, thereby ignoring the opportunities for local community recovery.

Contact: Professor Daniel Franks

Floods

- Monitoring and managing estuaries and rivers, water flow, and hydraulic structures such as dam walls is vital for minimising the impact of flooding on Australian communities. The School of Civil Engineering is modelling the turbulence and interfacial processes in natural hazards caused by inland tsunamis and dam break waves to enhance the development of resilient infrastructure. This will be achieved through the modelling of transient turbulence in breaking surges at the geophysical, environmental and industrial levels. Researchers expect the project to contribute to the protection of both community and industry through novel infrastructure design guidelines based upon fundamentally sound methods, with justifiable economic and environmental benefits.

Contract: Professor Hubert Chanson

Additional projects into the impact of debris flow over dry river beds and the impact of flooding of urbanised areas are also underway within the School.

- UQ researchers are members of the Water Sensitive Cities Cooperative Research Centre (WSC CRC), where they are working with more than 80 research, industry and government partners to deliver socio-technical urban water management solutions to make Australian towns and cities water sensitive.

Contact: Dr Paola Leardini

Mitigation

The need for mitigation is becoming increasingly urgent as the number, nature and intensity of natural hazards grows.

Bushfires

- Australia is home to many different wood species, however, only few have been explored for their fire safety properties, and those that have not are often excluded from construction projects, despite their desirable properties in terms of strength and durability. The lack of understanding of the fire safety of these products limits their use and this can sometimes mean that viable wood stocks are classified as waste, rather than utilised to build Australian homes and infrastructure. The Fire Safety Engineering Team is systematically testing far north Queensland timber species to find out their fire properties. The team has identified that, in addition to the density of timber, the chemical extractive content is a key parameter in determining the ease of ignition for wood products in bush fires.

Contact: Dr Felix Wiesner

- The Institute for Social Science Research specialises in evaluating the environmental, health and social effects of nature-based interventions to assist policy makers to translate theory into practice, to affect change at a community level. Previous research undertaken by Institute experts has contributed to the growing evidence-base of the association between climate change impacts on mental health and wellbeing across the life-course.

Contact: Dr Anne Cleary

- Records of past fire and vegetation change, such as pollen and fossil charcoal analysis, is being used to understand how fire regimes have changed through time. In particular, researchers from the School of Earth and Environmental Science are investigating human and natural interactions relating to fire regimes and vegetation. Researchers have engaged Indigenous groups in Queensland to investigate the impacts of European settlement on vegetation changes using both past fire and vegetation records, as well as land change analysis. This research has suggested that fire suppression activities associated with European fire management have resulted in vegetation thickening in the Gulf of Carpentaria and south east Queensland, and that the return of Indigenous fire management may redress this issue.

Contact: Professor Patrick Moss

Coastal Inundation

- Floods, severe storms, sea level rise and waves across fragile marine ecosystems (such as the Great Barrier Reef) all influence beach change and coastal inundation. The School of Earth and Environmental Science is modelling coastal dynamics and beach changes, in an effort to plan for and mitigate the impacts of sea level rise and storms on coastal and coral reef systems.

  The School, working in collaboration with the Reef Restoration and Adaptation Program, is also monitoring coastal erosion and areas of vulnerability along the Queensland coastline.

Contact: Dr Daniel Harris

- The School of Biological Sciences is working in partnership with the National University of Singapore to develop nature based solutions for adaptation to sea level rise in urban environments. This project builds on previous work whereby researchers have studied the impact of environmental change on coastal and marine plant communities. By broadening knowledge around these ecosystems, researchers hope to increase understanding of their role in coastal protection and to enhance conservation efforts for these ecosystems.

Contact: Professor Catherine Lovelock

Floods

Improving the management of Australia's inland river systems is a focus for researchers in the School of Historical and Philosophical Inquiry. How and why Indigenous communities managed Australia's cycle of drought and flood in inland waterways before European settlement, and how floodplain management changed after settlement, is being explored. Researchers aim to address significant historical and environmental issues through a novel mix of archaeological survey, historical research, flow modelling and reconstruction of past environments. In addition to increasing understanding of Australia's inland waterways, flooding and floodplain ecology, the research will map the changes brought by European settlement and assist governments, land owners and Indigenous groups to manage inland river systems.

Contact: Dr Duncan Keenan-Jones

In Focus: From the ashes

In the wake of the Grenfell Tower disaster in the UK in 2017 that killed 72 people and left 70 others injured, Australian state governments launched audits to document the existence of potentially flammable cladding on buildings across the country.

UQ's Fire Safety Engineering Research Group devised a new holistic framework to help people identify the flammability of different cladding materials. The testing framework considered the flammability of the multiple different products and materials used in building facades. It was based on renown analytical and fire testing methods widely used in the fire engineering and scientific communities and included seven separate tests that allowed a thorough characterisation of the flammability of building façade materials.

Over nearly 12 months, the team subjected 1095 samples of different cladding materials identified in the audit to their rigorous screening tests. With the support of the Queensland Government, researchers created the Cladding Materials Library, a free database that has been accessed by nearly 2000 people across 98 countries.

The team is now partnering with the private sector to assess the cladding fire risks for private homes and businesses. While it's a huge issue, the researchers have the potential to prevent catastrophic impact not only from bushfires but other fire types as well.

Contact: Dr Juan Hidalgo

Risk Analysis

Understanding the risks associated with natural hazards is one of the first steps to mitigating and preparing for the likelihood of the disaster occurring. Decision analysis and risk analysis covers a broad range of research expertise from analysing previous natural hazards to making recommendations for government policy and informing the community of what they can do to reduce risk in the future.

Despite the risks associated with climate change – such as increased coastal inundation and severe storms – many Australians are still drawn to the country's coastlines. This creates unique risk mitigation challenges for researchers, who must accommodate our current lifestyles while planning for the future.

Currently the University is developing the UQ Risk and Decision Analysis Hub to bring together a critical mass of researchers in the risk and decision analysis space. Over the coming years the aim is for this to be a focal point for decision and risk analysis expertise at UQ for tackling environment and sustainability challenges, including natural hazards.

Bushfires

- UQ researchers are using the latest technology to monitor, predict and, ultimately, respond to changes in the weather. The Robotics Design Lab is developing small disposable drones for environment monitoring and early bushfire detection. The drones feature a built-in miniature weather station, and can be self-deployed from a drone mothership to land across a wide geographic area. These sensors can return data to a monitoring station to determine how a region's environment is evolving through the growing cycle. During the fire season, the 'bush fire alarms' can track changing tropospheric conditions in near real time, allowing data to be fed into weather models to help predict how fire fronts might move. Sudden sharp spikes in temperature may be indicative of an emerging fire, which can be instantly reported for immediate action to be taken.

Contact: A/Professor Pauline Pounds

- Building homes that are fashionable and functional, while also being fit for future natural hazards is challenging. Researchers in the School of Civil Engineering are designing homes for easy disassembly and relocation through the development of flexible prefabricated building systems that can adapt to changing conditions. Not only does this allow homeowners to respond to changing fire and flood risk, but also to easily adapt for internal factors such as a growing family.

Contact: Dr Lisa Ottenhaus

- The Fire Safety Engineering Research Group is investigating behaviours that improve resilience in communities exposed to fires. Researchers have studied communities from various socio-economic backgrounds including two bushfire affected communities in Australia; one wildfire affected community in California; one wildfire affected community in Indonesia; and one informal settlement affected by fire.

Contact: Dr David Lange

- Data aggregation and analytics in the field of power and energy systems are the focus of a research partnerships between UQ and Redback Technologies. Researchers at the Centre have expertise in human-centred interaction (HCI), future energy systems, energy system resilience, visualisation, artificial intelligence (AI), data science and power engineering. In the area of bushfires, there are two themes of research, (1) communication and (2) resilience of energy supply. Researchers are developing innovative ways to communicate the experiences of bushfire impacted communities to understand how these communities are affected during and in the aftermath of an event.

  Researchers are also interested in the design of new tools and technologies to support community access to information during an evolving bushfire event. In terms of capability in resilient energy supply, they are interested in adapting energy grid systems to better support communities' access to power supply during and in the aftermath of severe storms and bushfire events. The interdisciplinary HCI, AI, data science and visualisation expertise of staff within the Centre together with links into the energy sector positions the Centre well in terms of capability for this research.

Contact: Dr Mashhuda Glencross

Severe Storms

- UQ RISK is a multidisciplinary initiative that crosses the fields of industrial risk and human factors. The group works directly with a range of industries to identify and analyse the potential consequences associated with natural hazards, such as severe storms and bushfires, as well as identifying and specifying controls needed to address the risks and the management processes needed to ensure controls are effectively maintained. Their work is informed by evidence obtained from their analysis of historical events.

Contact: A/Professor Maureen Hassall

Risk Analysis

Coastal Inundation

- Delivering practical solutions to some of the most significant global problems including climate change, urbanisation and conservation is a focus for researchers at the School of Earth and Environmental Sciences. Geographers within the School have researched how people are impacted by, and respond to, both slow- and acute-onset environmental changes and events.

  Researchers have significant expertise around risk and decision analysis relating to coastal inundation and ecosystem services. This includes the evaluation of impacts on at-risk coastal wetlands and urban communities and implications for coastal planning to manage sea level rise in Moreton Bay.

Contact: Professor Jonathan Rhodes

- The School of Economics, in collaboration with CSIRO colleagues, has developed a modelling approach to determine the discount that should apply to residential properties located in coastal areas and impacted by flooding. In a first of its kind study in Australia, researchers assumed continuous measure of flood risk and then estimated a discount that should apply to residents using a three dimensional approach – that being degrees of view of the ocean, proximity to the ocean and proximity to other waterways – in order to provide a valuation of the 'trade off' between location and flooding. The results of the study found that the identification of a significant discount due to inundation risk was highly dependent on views and proximity to the ocean and waterways, however it also demonstrated that it was possible to develop a methodology for determining statistically significant discounts due to inundation risk.

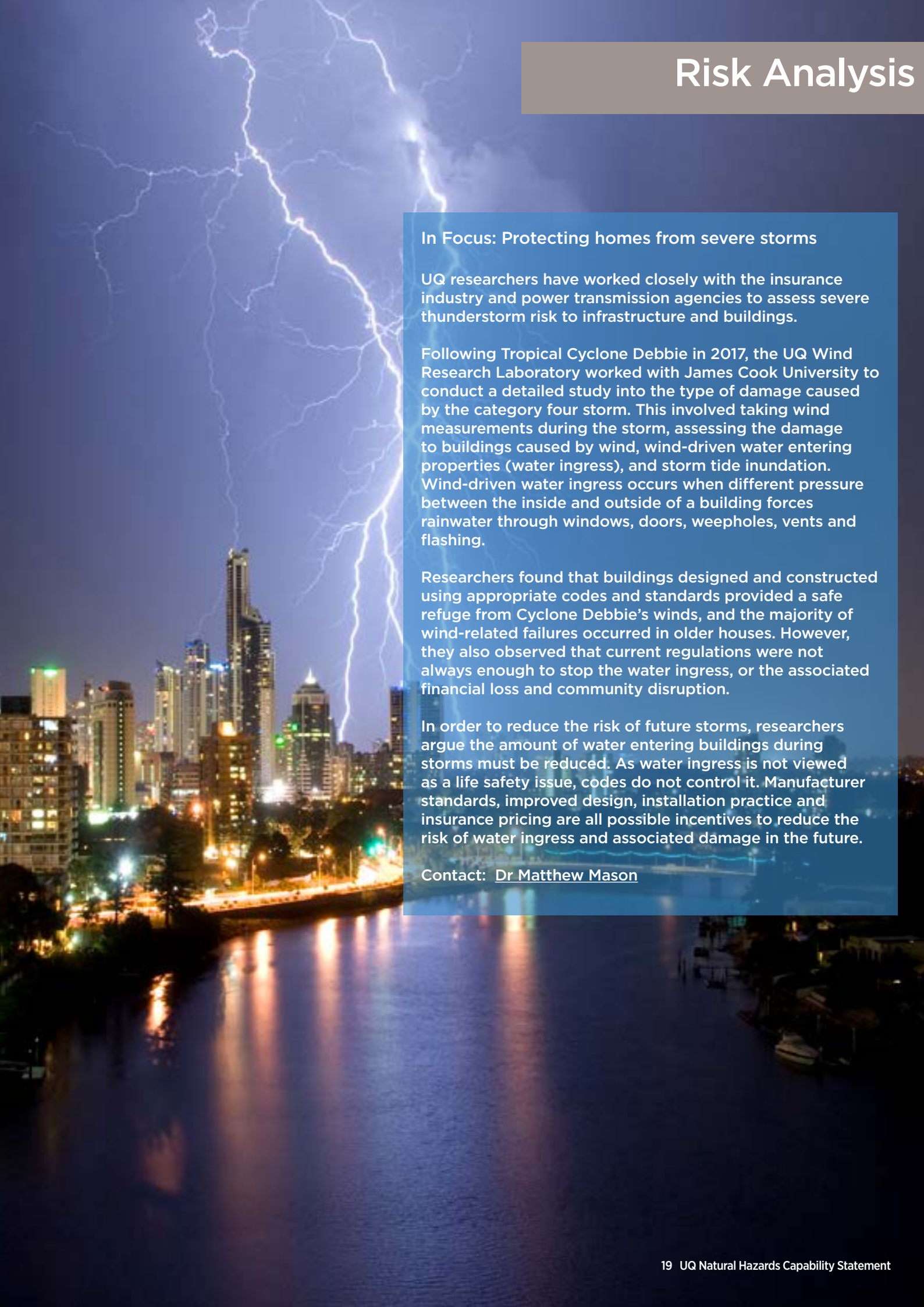
Contact: Professor Alicia Rambaldi

- Researchers are investigating decision making for managing biodiversity and ecosystem services in the presence of uncertainty and risk, including climate change. Currently, researchers in the School of Earth and Environmental Sciences are developing new decision analysis approaches for protecting koalas on private land in New South Wales, in the context of increasing risk of bushfires, drought and heatwaves.

Floods

- Extreme weather disasters have almost doubled in 20 years, outstripping the capacity of insurance markets to pay for losses. The School of Business is undertaking international research to help organisations and societies integrate the current market-oriented insurance system of paying for disaster recovery into a societally-oriented system of shared responsibility for financial protection from and physical resilience to disasters. Expected outcomes include explaining how to increase disaster protection and surmount barriers to change. This should provide significant benefits to support change in both Australia, which has the highest global level of secondary disasters from extreme weather events, causing $6.86 billion in losses in 2019; and more widely, as global extreme weather events such as flooding, drought, cyclone, and bushfire cause increasing global economic loss.

Contact: Professor Paula Jarzabkowski



In Focus: Protecting homes from severe storms

UQ researchers have worked closely with the insurance industry and power transmission agencies to assess severe thunderstorm risk to infrastructure and buildings.

Following Tropical Cyclone Debbie in 2017, the UQ Wind Research Laboratory worked with James Cook University to conduct a detailed study into the type of damage caused by the category four storm. This involved taking wind measurements during the storm, assessing the damage to buildings caused by wind, wind-driven water entering properties (water ingress), and storm tide inundation. Wind-driven water ingress occurs when different pressure between the inside and outside of a building forces rainwater through windows, doors, weepholes, vents and flashing.

Researchers found that buildings designed and constructed using appropriate codes and standards provided a safe refuge from Cyclone Debbie's winds, and the majority of wind-related failures occurred in older houses. However, they also observed that current regulations were not always enough to stop the water ingress, or the associated financial loss and community disruption.

In order to reduce the risk of future storms, researchers argue the amount of water entering buildings during storms must be reduced. As water ingress is not viewed as a life safety issue, codes do not control it. Manufacturer standards, improved design, installation practice and insurance pricing are all possible incentives to reduce the risk of water ingress and associated damage in the future.

Contact: Dr Matthew Mason

Management

Natural hazard management is significant in determining the way in which a community recovers from a crisis.

Bushfires

- The mental and physical effects of bushfire on residents and firefighters can be long-lasting and are well documented. The research team at UQ Northside Clinical Unit, based within the Prince Charles Hospital, is studying gene-environmental interaction in chronic obstructive pulmonary disease (COPD), asthma, lung cancer and air pollution. The team is focused on improving prevention, diagnosis and treatment of respiratory diseases, with a particular interest in preventing lung toxicity from air pollutants, such as bushfire smoke.

Contact: Professor Ian Yang

- The Child Health Research Centre has strong expertise in the paediatric respiratory physiology, developmental immunology and children's environmental health. Researchers use a combination of basic science, longitudinal cohort studies and the translation of research findings into clinical practice to monitor and manage children's health in relation to cystic fibrosis, asthma and environmental health. There is a specific focus on understanding the mechanisms underlying chronic childhood lung disease – including the impact of bushfire smoke on human health – in order to improve clinical management and to delay or prevent their onset, with consequent reductions in adult lung diseases.

Contact: Professor Peter Sly

- Firefighters are known to have some of the highest mortality rates in Australia compared to the average occupation and, during the 2019-20 Australian Black Summer fires, there was a spike in wildland firefighter fatalities. The Fire Safety Engineering Research Group has investigated the causes for firefighter fatalities pertaining to falling tree incidents and local extreme weather events in eastern Australian fire brigades (Queensland, New South Wales and Victoria). This was done by assessing two domains of each selected fatality event: the fire behaviour and the factors affecting it; and the fire brigade intervention techniques, strategies, and operation.

Contact: Dr Cristian Maluk Zedan

- Researchers are investigating the possibility of using low oxidation thermobaric explosives to extinguish small spot fires. While the project is in its early stages, researchers at the School of Mechanical and Mining Engineering are confident rapid fire detection and delivery will be the key.

Contact: Professor Peter Knights

- Knowledge-based innovations that can drive the future development of timber in the built environment is the focus of the Centre for Future Timber Structures. Housed within the School of Civil Engineering, the Centre has access to state-of-the-art facilities including the Fire Laboratory and Testing Facilities, which allow for testing from very small-scale material compositions through to full-scale structural fire testing. Researchers at the Centre focus on the performance of building materials for sustainable and durable construction exposed to fire conditions.

Contact: Dr Juan Hidalgo

Researchers are also investigating the role of moisture and the water cycle on the flammability of vegetation and risk of bushfires within the Centre for Future Timber Structures. This research aims to contribute to the fundamental knowledge of environmental and forestry sciences on bushfires by implementing the fire safety engineering point of view. The main objective of the work is to observe and understand clearly the changes of moisture content, and its impact to the flammability of vegetation and risk of bushfires using a wide range of experimental scenarios and several Australian vegetation species.

Severe Storms

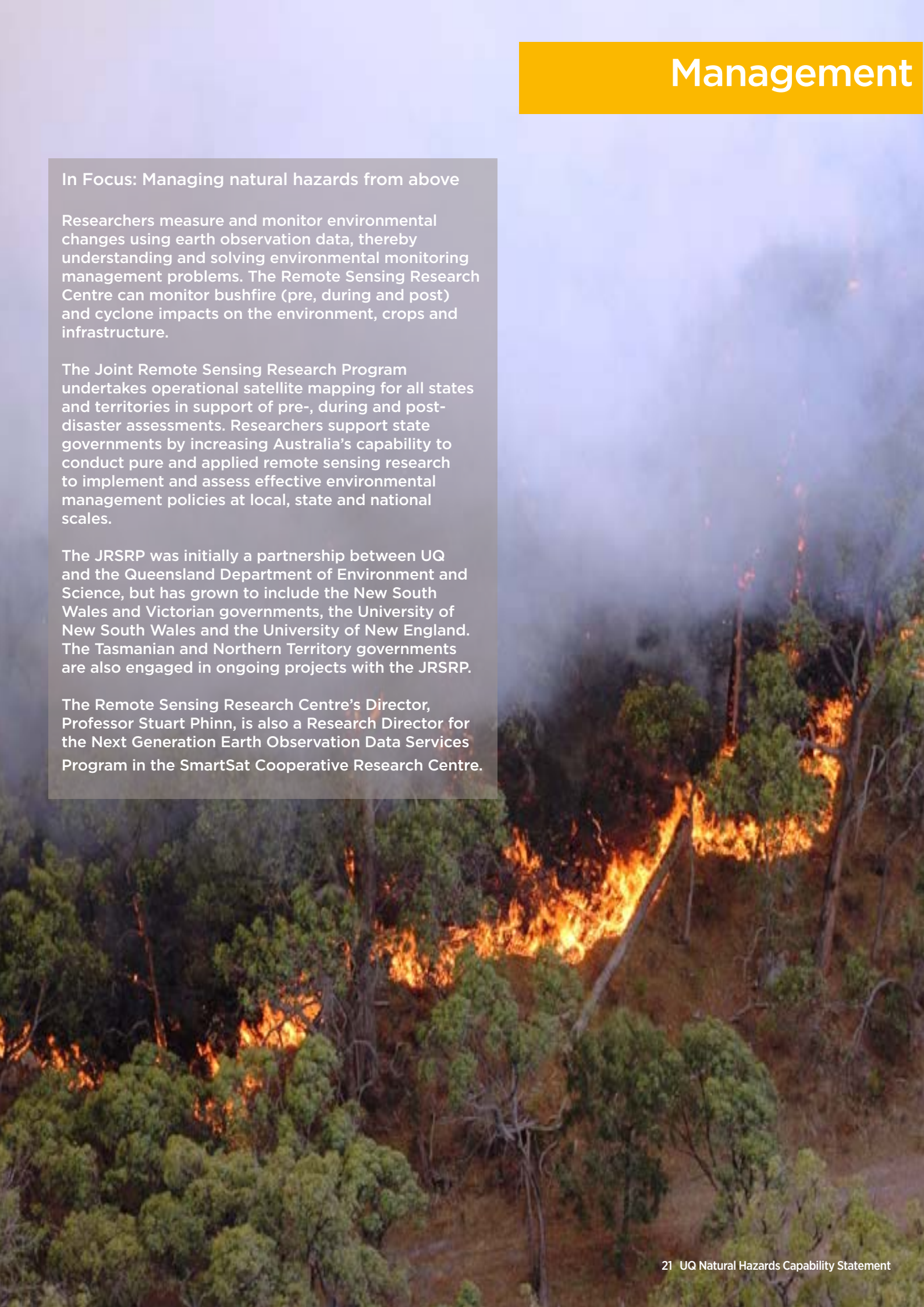
- The impact of natural disasters on tourism businesses and industries, as well as industry and government response and recovery strategies, is a focus for researchers at the School of Business. Previous research has helped tourism industries to better understand the level and nature of their disaster planning and increase their preparedness. It has also identified risk communication strategies for tourists who are more vulnerable to hazards due to a lack of familiarity with the hazards and evacuation procedures in a destination.

  Current School of Business research examines disaster planning in businesses and the factors that influence the adoption of disaster planning and preparedness for tourism related businesses. Separate research is investigating consumer perceptions of hazards on tourism destinations, and the impact on planning and preparedness measures from a consumer perspective.

Contact: Professor Brent Ritchie

Coastal Inundation

- Coastal wetlands are degraded in Australia and globally, reducing their capacity to protect shorelines, their communities and economies, which they do through providing defence



In Focus: Managing natural hazards from above

Researchers measure and monitor environmental changes using earth observation data, thereby understanding and solving environmental monitoring management problems. The Remote Sensing Research Centre can monitor bushfire (pre, during and post) and cyclone impacts on the environment, crops and infrastructure.

The Joint Remote Sensing Research Program undertakes operational satellite mapping for all states and territories in support of pre-, during and post-disaster assessments. Researchers support state governments by increasing Australia's capability to conduct pure and applied remote sensing research to implement and assess effective environmental management policies at local, state and national scales.

The JRSRP was initially a partnership between UQ and the Queensland Department of Environment and Science, but has grown to include the New South Wales and Victorian governments, the University of New South Wales and the University of New England. The Tasmanian and Northern Territory governments are also engaged in ongoing projects with the JRSRP.

The Remote Sensing Research Centre's Director, Professor Stuart Phinn, is also a Research Director for the Next Generation Earth Observation Data Services Program in the SmartSat Cooperative Research Centre.

Management

against sea level rise, wave energy and coastal flooding. Enhancing coastal sustainability through research supporting restoration of coastal wetlands to enhance coastal protection, increase storage of blue carbon, enhance biodiversity and improve water quality is a focus for researchers. By enhancing knowledge of the benefits of and processes for restoring coastal wetlands, researchers at the School of Biological Sciences are informing and improving coastal wetland management globally.

Contact: Professor Catherine Lovelock

Floods

- Ten years on from the fatal Queensland floods, UQ researchers are leading efforts to predict future flood events, both in urban and rural Australian settings. Researchers in the School of Historical and Philosophical Inquiry are investigating the history of flooding in south east Queensland, with a particular focus on the 'Mud Army' in the 2011 floods. It's hoped that learning more about the 'Mud Army' and its impact of those affected by the flooding event will guide future relief efforts.

Contact: Dr Margaret Cook

- The School of Historical and Philosophical Inquiry, School of Social Sciences, School of Civil Engineering and School of Biological Sciences are also researching how and why Indigenous communities managed Australia's cycle of drought and flood in inland waterways before European settlement, and how floodplain management changed after settlement. The researchers seek to address significant historical and environmental issues through a novel mix of remote sensing, archaeological survey, underwater excavation, historical research, flow modelling and reconstruction of past environments. The expected outcome of this research (a fuller and pre-European water history) promises significant benefits: a deeper appreciation of Indigenous civilisation and its environmental management, a better understanding of inland water resources, re-training of ex-military emergency responders and more diverse connections to country for Traditional Owners. This research is expected to provide an increased understanding of Australia's inland waterways, Indigenous ways of managing them, and the changes brought by European settlement, to enable improved practices for flood and drought management into the future.

Contact: Dr Duncan Keenan-Jones

Drought

- Water stress and extreme heat during flowering limit sorghum yields across the Northern Grains Region. Identifying combinations of management and genetics that match sensitive crop stages to optimum flowering windows, and canopy sizes to site and expected seasonal conditions, have the potential to minimise the impact of these stresses on grain yield and yield stability. However, this requires sowing sorghum in winter or early spring, into cooler soils (>12ºC instead of the commonly recommended >16ºC) and managing the canopy size by matching hybrid and population to site and expected seasonal conditions. No information is available on the growth, architecture and function of sorghum root systems when grown in cold soils. The Centre for Crop Science is developing evidence on root growth and activity (water extraction patterns) at depth, and its association with the likelihood of water stresses later in the season around flowering.

Contact: Professor Daniel Rodriguez

- The School of Earth and Environmental Sciences has experience in hydrology and water quality related hazards including flooding, drought and bushfire. The research includes investigation into various integrated social and natural methods of adaptive water governance.

The 'cultural burning' by traditional owners' is often in direct contrast with prescribed 'hazard reduction' fire regimes.

Management

Photo: Indigenous fire management research project, UQ School of Earth & Environmental Sciences

In Focus: Bringing traditional knowledge into Australia's bushfire management

The recent bushfire crisis has confirmed that current management practices are inadequate in preventing out-of-control wildfires in many parts of Australia.

UQ researchers have established a Translational Impact Research Network (TIRN) that aims to set up an interdisciplinary group to consider the future of Australia's flammable landscapes in a changing climate.

Benefits of good fire management are obvious with reduced risk of wildfires, biodiversity gains and carbon credits.

Traditional Owners in northern Australia have been implementing Indigenous fire regimes in some areas of the Top End, but markedly fewer examples of these practices can be found elsewhere in Australia.

The TIRN's focus is on Indigenous knowledge and burning practices ('cultural burning'). Cultural burning by Traditional Owners is often in direct contrast with prescribed 'hazard reduction' fire regimes.

Recovery

Once the immediate threat of a natural hazard has passed, it can take a community weeks, months, years or even decades to move on. Recovery is multi-dimensional and UQ has expertise across multiple disciplines that are working together to help communities heal.

Bushfires

- The rescue, storage and recovery of threatened plant germplasm is significantly aided through the critical capacity in plant tissue culture and cryopreservation in the Centre for Horticultural Sciences. Following the unprecedented 2019-2020 fire season, researchers are targeting the most at-risk native Australian plant species, many of which are rainforest adapted with no natural capacity to recover from increased severity and occurrence of fire, and which also produce seed that are not amenable to seed-banking. Tissue culture is used to rescue, propagate and cryobank these species from seed or cuttings, providing a long term in vitro insurance policy for genetic conservation and as a future store of genotypes for land restoration programs.

Contact: Professor Neena Mitter

- Through the Joint Remote Sensing Research Program, researchers are utilising Australian satellite mapping to undertake assessments before, during and after disasters. The technology enables researchers to fully record the impact of bushfires and severe storms on the environment, farming and infrastructure, allowing emergency services to focus recovery efforts. The Centre is part of the SmartSat Cooperative Research Centre Earth Observation Program, which uses satellite surveillance during national fire and flood emergencies.

Contact: Professor Stuart Phinn

- The Remote Sensing Research Centre also utilises the TERN OzFlux tower site to monitor vegetation recovery following bushfires.

Contact: Dr William Woodgate

- Monitoring the sites of wildfire during the recovery phase is essential for understanding the dynamics and resilience of fire affected forests. The Joint Remote Sensing Research Program is developing remote sensing approaches using satellite radar and optical data to monitor functional and structural changes in post-fire regrowth.

Contact: Dr Anthea Mitchell

Severe Storms

- The development and implementation of emergency surveillance systems for use following severe storms and other natural disasters is critical in low and middle-income settings. In the School of Public Health, researchers have significant understanding of Early Warning and Response Networks (EWARN). This follows A/Professor Linda Selvey having led the international effort to establish the EWARN in the Philippines following Typhoon Yolanda. The EWARN helped determine what responses to infectious diseases were required in different regions and assisted with planning the health response.

Contact: A/Professor Linda Selvey

- Geographers in the School of Earth and Environmental Sciences have recently completed a project in collaboration with UN Women to identify the role of women in disaster response and recovery in the face of disasters in Vanuatu, particularly cyclones (i.e. Cyclone Pam) and drought. The work has highlighted that we first need to acknowledge and utilise women's extensive knowledge, social networks and skills when it comes to disaster response, recovery and resilience-building, but that we also need to support women to further develop their capabilities and address underlying vulnerabilities. In particular, we need to proactively tackle inequitable power structures to avoid burdening women and improve their overall wellbeing.

Contact: A/Professor Karen McNamara

- The challenge of coming to grips with a rapidly changing world — change that has been accelerated by collective-level crises — is at the forefront of national and global concerns in health, organisational, educational, community and policy contexts. As the COVID-19 pandemic and natural disasters have powerfully shown, crisis events have the potential to shake society to its core. The School of Psychology's Social Identity and Groups Network (SIGN) aims to advance understanding of crisis recovery by focusing on the key role of effective leadership and solidarity in crisis recovery. SIGN will develop evidence-based scientific knowledge and resources to facilitate recovery efforts that capitalise on post-crisis opportunities to build stronger and more sustainable societies.

Contact: Professor Alex Haslam and Professor Jolanda Jetten

Coastal Inundation

- The impact of short-lived coastal inundation can be permanent loss of infrastructure, land and amenity for coastal communities. The School of Civil Engineering is actively researching various aspects of coastal engineering – including wave growth; sediment transport; surge dynamics; and surf and swash hydrodynamics – to determine local beach erosion and ocean inundation.

Contact: Dr David Callaghan and Professor Peter Nielsen

- The School of Agriculture and Food Sciences has significant expertise in the impact of coastal erosion on soil. Research is being undertaken into the impact of soil acidity, root growth, nutrient uptake and plant nutrition, and the related impact of coastal erosion on future plant growth.

Contact: Dr Gunnar Kirchhof

Floods

- UQ's Triple P Parenting Program has developed a two-hour seminar for parents and caregivers in the first four-10 weeks post-disaster, including floods and bushfires. The seminar covers common emotional and behavioural responses in children post-disaster; the natural course of children's responses; why some children are more affected than others; parent traps; managing children's emotions following disaster; and answering children's questions. A face to face version of the seminar has been evaluated and found to reduce parents' ratings of their children's emotional distress and improve parental confidence in managing children's distress.

Contact: A/Professor Vanessa Cobham

Drought

- By monitoring bushfire recovery, researchers can inform drought reconstructions and forecasting. The School of Earth and Environmental Sciences has worked with Snowy Hydro Limited for almost two decades to assess the impact and severity of drought.

Contact: Professor Hamish McGowan

- A longitudinal pilot study of sheep and beef-cattle primary production businesses is being conducted in central western Queensland, parts of which have been drought declared since 2013. The School of Law has joined forces with industry partners RAPAD (Central Western Remote Area Planning and Development Board) and the Rural Financial Counselling Services North Queensland to study four inter-related financial aspects of drought: firstly, the impact of the choice of different legal business structures on the cash flow of primary producers and their family businesses; secondly, the efficacy of income tax concessions available to drought affected primary producers; thirdly, the impact of government concessional drought loans on business success; and, finally, analysis of the application of two regional development policy tools – loan and grant funding – to establish wild dog exclusion fencing on privately owned land.

Contact Dr Thea Voogt

- As global efforts to respond to climate change and extreme weather events fail to protect the most vulnerable, the impacts will continue to cause grief and suffering through loss of life, wellbeing, place and culture. In-depth understanding of these losses, particularly the non-economic aspects, is limited. Currently underway in the School of Earth and Environmental Sciences is an ARC Future Fellowship that is deeply exploring how non-economic losses are experienced and anticipated in three Pacific Island countries and in regional Australia, and identifying ways of working through these losses and grief with frontline communities. This work has commenced in outer islands in the Cook Islands (exploring how people have experienced and responded to drought and cyclones over the years) and in Vanuatu. This work will continue over the next three years and fieldwork planning is underway to examine local experiences of persistent and ongoing drought for farming communities in the Liverpool Plains, New South Wales. The outcomes will inform international and national policy and practice, helping people plan and work through these losses, minimise their harm, and have greater hope and agency over their futures.

Contact: A/Professor Karen McNamara

Appendix 1 - Our People

BUSHFIRES

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
DENHAM, Dr Robert robert.denham@uq.edu.au pages 21 24 26 27 28	Remote Sensing Research Centre, SEES[1], Science	Prediction	Remote Sensing
GRAESSER, Dr Jordan j.graesser@uq.edu.au pages 21 24 26 27 28	Remote Sensing Research Centre, SEES, Science	Prediction	Remote Sensing
HARDTKE, Dr Leo l.hardtke@uq.edu.au pages 21 24 26 27 28	Remote Sensing Research Centre, SEES, Science	Prediction	Remote Sensing
LEVIN, A/Prof Noam n.levin@uq.edu.au pages 21 24 26 27 28	Remote Sensing Research Centre, SEES, Science	Prediction	Remote Sensing of bushfires, risk analysis of wildfires
PHINN, Prof Stuart s.phinn@uq.edu.au pages 8 9 21 24 26 27 28	Remote Sensing Research Centre, SEES, Science	Prediction	Bushfire (pre/during/ post), cyclone/hurricane impacts on environment, crops, infrastructure
SCARTH, Dr Peter p.scarth@uq.edu.au pages 21 24 26 27 28	Remote Sensing Research Centre, SEES, Science	Prediction	Remote Sensing
SPEE, A/Prof Paul p.spee@business.uq.edu.au	School of Business, BEL[2]	Prediction	Individual behaviour and organisational characteristics influencing the prediction and mitigation of risks such as bushfire
WIESNER, Dr Felix f.wiesner@uq.edu.au pages 12 14	School of Civil Engineering, EAIT[3]	Prediction	Fire safety and durability
CHAPMAN, Dr Archie archie.chapman@uq.edu.au	ITEE[4], EAIT	Preparation	Resilient energy supply during bushfires and natural hazards
CLEARY, Dr Anne anne.cleary@uq.edu.au	Institute of Social Science Research	Recovery | Preparation | Mitigation	Climate change impacts on mental health and wellbeing; evaluation of the environmental, health and social effects of nature-based interventions.
HASLAM, Prof Alex a.haslam@uq.edu.au page 24	School of Psychology, HABS[5]	Preparation	Crisis Recovery
HORROCKS, Prof Neil n.horrocks@uq.edu.au page 12	UQ Centre for Energy Data Innovation, ITEE, EAIT	Preparation	Resilient energy supply during bushfires and natural hazards
JETTEN, Prof Jolanda j.jetten@psy.uq.edu.au page 24	School of Psychology, HABS	Preparation	Crisis recovery
MASON, Dr Matt matthew.mason@uq.edu.au pages 9 13 19	School of Civil Engineering, EAIT	Preparation	Disaster scenario modelling to inform emergency management planning
OTTENHAUS, Dr Lisa l.ottenhaus@uq.edu.au pages 13 17	School of Civil Engineering, EAIT	Preparation	Infrastructure and new urbanisation in areas prone to wildland fires
WIESNER, Dr Felix f.wiesner@uq.edu.au pages 12 14	National Centre for Timber Durability and Design Life, School of Civil Engineering, EAIT	Preparation	Fire safety and durability
JARZABKOWSKI, Prof Paula p.jarzabkowski@uq.edu.au page 18	School of Business, BEL	Risk Analysis	Using insurance and reinsurance markets for disaster risk financing
FAY, Dr Suzanna s.fay@uq.edu.au	School of Social Science, HASS[6]	Mitigation	Communicating in crises
HE, Dr Lulu lulu.he@uq.edu.au	SEES, Science	Mitigation	Disaster recovery, management, preparation, Government policies

1 SEES - School of Earth & Environmental Sciences
2 BEL - Faculty of Business, Economics & Law
3 EAIT - Faculty of Engineering, Architecture & Information Technology
4 ITEE - School of Information Technology & Electrical Engineering
5 HABS - Faculty of Health & Behavioural Sciences
6 HASS - Faculty of Humanities & Social Sciences

BUSHFIRES

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
LANGE, Dr David d.lange@uq.edu.au page 17	Fire Safety Engineering Research Group, School of Civil Engineering, EAIT	Mitigation	Fire safety engineering and resilience
MOSS, Prof Patrick patrick.moss@uq.edu.au	SEES, Science	Mitigation	Fire Management
OTTENHAUS, Dr Lisa l.ottenhaus@uq.edu.au pages 13 17	School of Civil Engineering, EAIT	Mitigation	Indoor air quality, timber engineering
SNOW, Dr Steve s.snow@uq.edu.au	ITEE, EAIT	Mitigation	Indoor air quality
ALBERT, Dr Simon s.albert@uq.edu.au	School of Civil Engineering, EAIT	Management	Post-disaster resilience and tourism
COBHAM, A/Prof Vanessa vanessa@psy.uq.edu.au page 25	School of Psychology, HABS	Management	Child and adolescent post-disaster emotional health
CORCORAN, Prof Jonathan jj.corcoran@uq.edu.au	Qld Centre for Population Research, SEES, Science	Management	Response management and spatial analytics
DOLNICAR, Prof Sara s.dolnicar@uq.edu.au	School of Business, BEL	Management	Post-disaster resilience and tourism
FENSHAM, A/Prof Rod r.fensham@uq.edu.au	School of Biological Sciences, Science	Management	Fire management
GEORGE, A/Prof Nicole n.george2@uq.edu.au	School of Political Science and International Studies, HASS	Management	Crisis management
CLEARY, Dr Anne anne.cleary@uq.edu.au			
GLENCROSS, Dr Mashhuda m.glencross@uq.edu.au page 17	ITEE, EAIT	Management	Minimising power outages in severe weather events
GRINHAM, Dr Alistair a.grinham@uq.edu.au	School of Civil Engineering, EAIT	Management	Autonomous aerial and surface monitoring systems
HIDALGO, Dr Juan j.hidalgo@uq.edu.au pages 12 20	Centre for Future Timber Structures, School of Civil Engineering, EAIT	Management	Fire modelling, sensor development, fire and vegetation instrumentation
KNIGHTS, Prof Peter p.knights@uq.edu.au page 20	Schoo; pf Mechanical and Mining Engineering, EAIT	Management	Using low oxidation thermobaric explosives to extinguish small spot fires
MALUK, Dr Cristian c.maluk@uq.edu.au page 20	Centre for Future Timber Structures, School of Civil Engineering, EAIT	Management	Fire Safety Engineering
McGOWAN, Prof Hamish h.mcgowan@uq.edu.au page 11	SEES, Science	Management	Bushfire Meteorology
ONEDERRA, A/Prof Italo i.onederra@uq.edu.au	School of Mechanical & Mining Engineering, EAIT	Management	Spot fires, explosives engineering, blast design and analysis, performance monitoring and process optimisation
PHINN, Prof Stuart s.phinn@uq.edu.au pages 8 9 20 24	Remote Sensing Research Centre, SEES, Science	Management	Satellite Mapping
POUNDS, A/Prof Pauline pauline.pounds@uq.edu.au page 17	ITEE, EAIT	Management	Low cost construction of single-use drone platforms - disaster recovery and natural hazard prevent
RITCHIE, Prof Brent b.ritchie@uq.edu.au	School of Business, BEL	Management	Business survey, policy analysis and consumer behaviour studies. Disaster management strategies
SCHMIDT, Prof Susanne susanne.schmidt@uq.edu.au	SAFS[7], Science	Management	Indigenous knowledge of fire
SMITH, Dr Annabel annabel.smith@uq.edu.au	SAFS, Science	Management	Ecological Fire Management

7 SAFS - School of Agriculture and Foods Sciences

BUSHFIRES

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
SPEE, A/Prof Paul p.spee@business.uq.edu.au	School of Business, BEL	Management	Individual behaviour and organisational characteristics influence the prediction and mitigation of risks such as bushfires
WANG, Dr Jie j.wang16@uq.edu.au	School of Business, BEL	Management	Crisis Management
WATSON, Prof James james.watson@uq.edu.au	SEES, Science	Management	Biodiversity, threatened and endangered species management
WEIGEL, Mr Jason j.weigel@uq.edu.au	ITEE, EAIT	Management	Human sentiment and digital narratives during bushfires
XU, A/Prof Dongming d.xu@business.uq.edu.au	School of Business, BEL	Management	Disaster management strategies
CHARLSON, Dr Fiona f.charlson@uq.edu.au	School of Public Health, Medicine	Recovery	Mental Health Impacts
GATTAS, Dr Joe j.gattas@uq.edu.au	School of Civil Engineering, EAIT	Recovery	Bushfire recovery; low-cost housing
HART, Dr Simon s.hart@uq.edu.au	School of Biological Sciences, Science	Recovery	Effects of storms, floods, heat-waves fire on freshwater ecosystems
HE, Dr Lulu lulu.he@uq.edu.au	SEES, Science	Recovery	Long-term recovery after disasters, disaster management, community recovery, government policies. Population resettlement
KNIBBS, A/Prof Luke l.knibbs@uq.edu.au	School of Public Health, Medicine	Recovery	Air pollution and respiratory pathogens
MAIR, A/Prof Judith j.mair@business.uq.edu.au	School of Business, BEL	Recovery	Post-disaster resilience and tourism
MALUK, Dr Cristian c.maluk@uq.edu.au page 20	Fire Safety Engineering Research Group, Civil Engineering, EAIT	Recovery	Fire Safety
MITCHELL, Dr Anthea anthea.mitchell@uq.edu.au page 24	Remote Sensing Research Centre, SEES, Science	Recovery	Remote sensing and vegetation monitoring; synthetic aperture radar
MITTER, Prof Neena n.mitter@uq.edu.au page 24	Mitter Lab, QAAFI[8]	Recovery	Recovery of native species and ecosystems
MUELLER, Prof Jochen j.mueller@uq.edu.au	Queensland Alliance for Environmental Health Sciences, HABS	Recovery	Emerging environmental health risks
PHINN, Prof Stuart s.phinn@uq.edu.au pages 8 9 21 24 26 27 28	Remote Sensing Research Centre, SEES, Science	Recovery	Post-disaster assessments
SHEVELLAR, Dr Lynda l.shevellar@uq.edu.au	School of Social Science, HASS	Recovery	Community development post natural disasters
SLY, Prof Peter p.sly@uq.edu.au page 20	Child Health Research Centre, Medicine	Recovery	Determining how bushfire smoke affects human health
WALTERS, A/Prof Gabby g.walters@uq.edu.au	School of Business, BEL	Recovery	Disaster management strategies
WHITEFORD, Prof Harvey h.whiteford@sph.uq.edu.au	School of Public Health, Medicine	Recovery	Mental health impacts
WOODGATE, Dr William w.woodgate@uq.edu.au page 24	Remote Sensing Research Centre	Recovery	Carbon and water fluxes, remote sensing of vegetation function
YANG, Prof Ian i.yang@uq.edu.au page 20	Prince Charles Hospital, Medicine	Recovery	Preventing lung toxicity from bushfire smoke

COASTAL INUNDATION

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
BALDOCK, Prof Tom t.baldock@uq.edu.au page 20	Civil Engineering, EAIT	Prediction	Coastal Engineering

COASTAL INUNDATION

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
HARRIS, Dr Daniel daniel.harris@uq.edu.au pages 9 14	SEES, Science	Management	Coastal and Coral Reef Assessment (waves,beach/coastal response, reef damage assessment)
HARRIS, Dr Daniel daniel.harris@uq.edu.au pages 9 14	SEES, Science	Prediction | Risk Analysis	Coastal dynamics and beach change, modelling impacts of sea level rise and storms on coast and coral reef systems
LAU, Dr Annie annie.lau@uq.edu.au pages 9 10	SEES, Science	Prediction	Coastal Storm History and Coastal Evolution of Southern Qld Coast
MOSS, Prof Patrick patrick.moss@uq.edu.au	SEES, Science	Prediction	Sea Level Change
NIELSEN, Prof Peter p.nielsen@uq.edu.au page 24	School of Civil Engineering, EAIT	Prediction	Coastal Engineering
RHODES, Prof Jonathan j.rhodes@uq.edu.au page 18	SEES, Science	Risk Analysis | Management	Spatial modelling, risk analysis, decision analysis
RAMBALDI, Prof Alicia a.rambaldi@uq.edu.au page 18	School of Economics, BEL	Risk Analysis	Modelling approach to determine the discount that should apply to residential properties located in coastal areas and impacted by flooding
LOVELOCK, Prof Catherine c.lovelock@uq.edu.au pages 14 22	School of Biological Sciences, Science	Management | Preparation | Mitigation | Recovery	Interdisciplinary. Ecology, biogeochemistry, spatial analyses, policy. Nature based solutions for adaptation to seal level rise
CALLAGHAN, Dr David dave.callaghan@uq.edu.au pages 9 24	School of Civil Engineering, EAIT	All Themes	Coastal erosion
KIRCHHOF, Dr Gunnar g.kirchhof1@uq.edu.au page 25	SAFS, Science	Recovery	Soil Erosion
McNAMARA, A/Prof Karen karen.mcnamara@uq.edu.au pages 24 25	SEES, Science	Recovery	Impact of cyclones on communities (particularly non-economic losses) and recovery (particularly for women)
NIELSEN, Prof Peter p.nielsen@uq.edu.au page 24	Schhol of Civil Engineering, EAIT	Recovery	Coastal erosion
WEHR, Dr Bernhard b.wehr@uq.edu.au	SAFS, Science	Recovery	Soil salination (coastal inundation) nutrient pools and cycling in degraded soils (due to soil loss), trace element toxicity.

DROUGHT

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
McGOWAN, Prof Hamish h.mcgowan@uq.edu.au page 11	SEES, Science	Prediction	Meteorological hazards
RODRIGUEZ, Prof Daniel d.rodriguez@uq.edu.au pages 10 22	Centre for Crop Science, QAAFI	Prediction	Systems modelling, seasonal climate forecasting, bid data, AI, programming, digital agriculture
MOSS, Prof Patrick patrick.moss@uq.edu.au	SEES, Science	Management	Vegetation response to long term aridity
RODRIGUEZ, Prof Daniel d.rodriguez@uq.edu.au pages 10 22	Centre for Crop Science, QAAFI	Management	Participatory research, agronomy, farming systems research, field and whole farm system modelling

8 QAAFI - Queensland Alliance for Agriculture & Food Innovation

Appendix 1 - Our People

DROUGHT

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
WEI, Prof Yongping yongping.wei@uq.edu.au page 22	SEES, Science	Management	Hydrology and water quality related hazards (flood, drought and bushfire) with integrated social and natural methods
CHENU, Dr Karine karine.chenu@uq.edu.au	Centre for Crop Science, QAAFI	Recovery	Drought tolerance - environment characterisation (including heat and drought in current and future climates). Crop adaptation and improvement: crop modelling
KIZIL, A/Prof Mehmet m.kizil@uq.edu.au	Mechanical & Mining Engineering, EAIT	Recovery	Dust measurement and monitoring
RACHAPUTI, A/Prof RCN rao.rachaputi@uq.edu.au	Centre for Crop Science, QAAFI	Recovery	Drought tolerant crops
VOOGT, Dr Thea t.voogt@law.uq.edu.au page 25	Law, BEL	Recovery	Primary production drought-focused financial planning

FLOODS

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
CALLAGHAN, Dr David dave.callaghan@uq.edu.au pages 9 24	Civil Engineering, EAIT	Prediction	Flood Modelling
KEENAN-JONES, Dr Duncan d.keenanjones@uq.edu.au pages 8 22	School of Historical and Philosophical Inquiry, HABS	Prediction	Historical analysis, geoarchaeological development of clime proxies and past climate reconstruction
McINTYRE, Prof Neil n.mcintyre@uq.edu.au page 8	Centre for Water in the Minerals Industry, SMI[1]	Prediction/ Risk Analysis	Climate change scenarios, hydrology and hydraulic modelling, statistical hydrology, flood risk assessment, drought risk assessment, mine waste management
BALDOCK, Prof Tom t.baldock@uq.edu.au page 10	School of Civil Engineering, EAIT	Preparation	beach erosion modelling and long term coastal hazard modelling and coastal adaptation planning
CHANSON, Prof Hubert h.chanson@uq.edu.au page 13	School of Civil Engineering, EAIT	Preparation	Physical modelling in laboratory; field measurements in hydrodynamics; forensic investigations; theoretical modelling
FRANKS, Prof Daniel d.franks@uq.edu.au	Sustainable Minerals Institute	Preparation, mitigation, management, recovery	Disaster preparedness and response
LEARDINI, Dr Paola p.leardini@uq.edu.au	School of Architecture, EAIT	Preparation	Socio-technical urban water management solutions
HICKMAN, Prof Mark m.hickman1@uq.edu.au	School of Civil Engineering, EAIT	Mitigation	Transport
KEENAN-JONES, Dr Duncan d.keenanjones@uq.edu.au pages 8 22	School of Historical and Philosophical Inquiry, HASS	Management	Water and Flood Plain Management; historical and archaeological analysis; geoarchaeological analysis.
COOK, Dr Margaret	School of Historical and Philosophical Inquiry, HASS	Management	Predict future flood events, both in urban and rural Australian settings

FLOODS

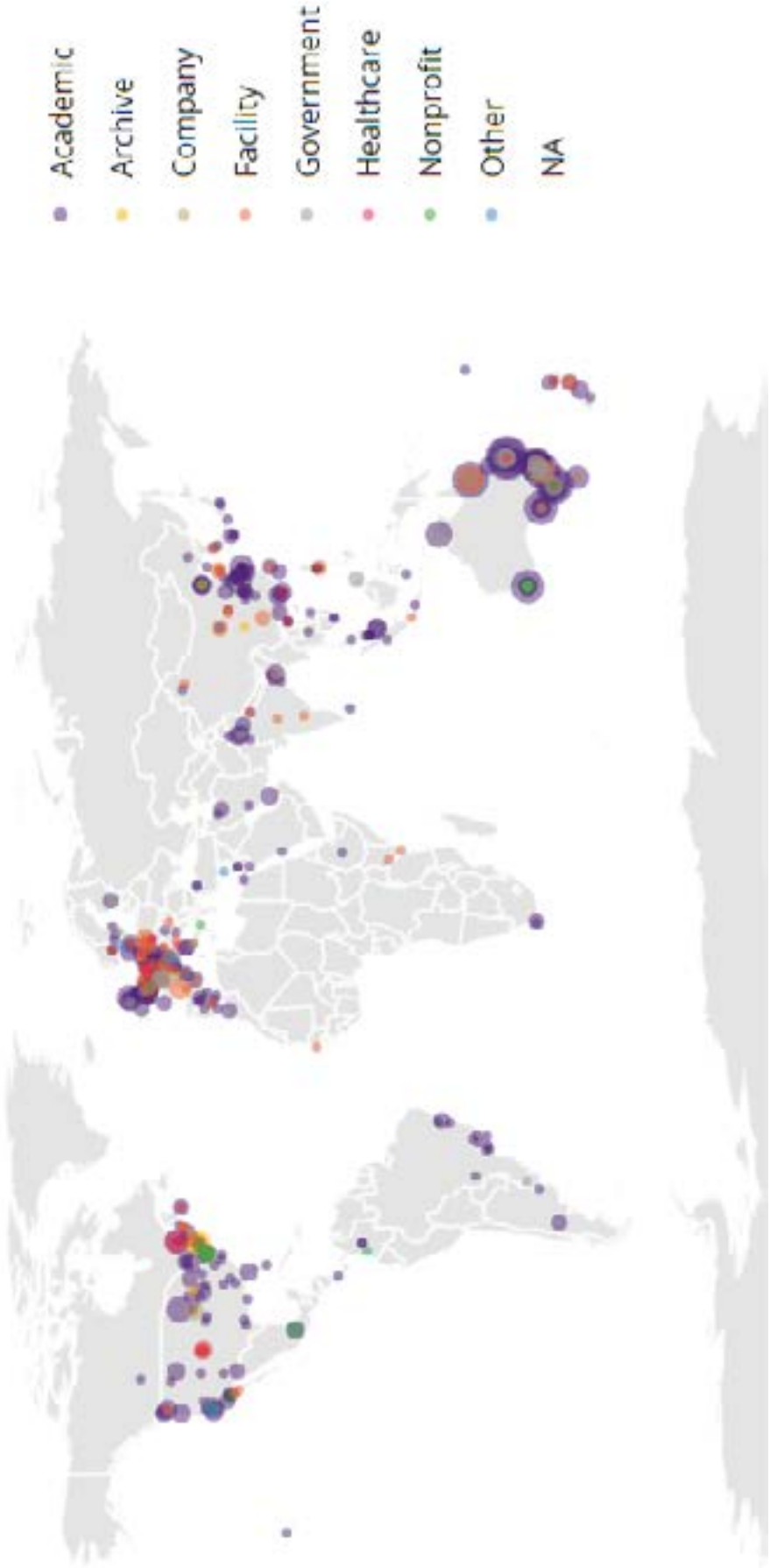
NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
RAMBALDI, Prof Alicia a.rambaldi@uq.edu.au page 18	School of Economics, BEL	Risk Analysis	Modelling approach to determine the discount that should apply to residential properties located in coastal areas and impacted by flooding

SEVERE STORMS

NAME/EMAIL	CENTRE/SCHOOL/ FACULTY/INSTITUTE	THEME	CAPABILITY
CALLAGHAN, Dr David dave.callaghan@uq.edu.au pages 9 24	School of Civil Engineering, EAIT	Prediction	Coastal Engineering: modelling surge dynamics, oceanic inundations, Waves, Tropical cyclone waves; Great Barrier Reef coral reef mapping and rubble stability
HARRIS, Dr Daniel daniel.harris@uq.edu.au pages 9 14	SEES, Science	Prediction	Coastal dynamics and beach change; modelling the impacts of sea level rise and storms on coastal and coral reef systems
MASON, Dr Matthew matthew.mason@uq.edu.au pages 9 13 19	School of Civil Engineering, EAIT	Prediction	Cyclones: monitoring and predicting paths and effects
McGOWAN, Prof Hamish h.mcgowan@uq.edu.au page 11	SEES, Science	Prediction	Meteorological hazards: severe storms (hail, extreme winds, flash flooding)
PHINN, Prof Stuart s.phinn@uq.edu.au pages 8 9 21 24	Remote Sensing Research Centre, SEES, Science	Predition	Coastal and coral reef impact assessment (waves, beach/coastal response, reef damage assessment)
ROELFSEMA, Dr Chris c.roelfsema@uq.edu.au	Remote Sensing Research Centre, SEES, Science	Prediction	Global and Great Barrier Reef coral reef mapping and monitoring
VAISMAN, Dr Slava r.vaisman@uq.edu.au	School of Mathematics & Physics, Science	Prediction	Prediction and reliability
EKANAYAKE, Dr Chandima chandima@itee.uq.edu.au page 13	ITEE, EAIT	Preparation	Electrical grid and power-lines
HASSALL, A/Prof Maureen m.hassall1@uq.edu.au page 18	School of Chemical Engineering, EAIT	Preparation	Risk and consequence analysis, risk control identification management and effectiveness assessment
MA, Dr Hui huima@itee.uq.edu.au	ITEE, EAIT	Preparation	Electrical grid, power-lines
OTTENHAUS, Dr Lisa l.ottenhaus@uq.edu.au pages 13 17	School of Civil Engineering, EAIT	Preparationchhol	Communities resilient to natural disaster
WILLIAMS, Prof David d.williams@uq.edu.au	School of Civil Engineering, EAIT	Preparation	Electrical grid stability and transport
MASON, Dr Matthew matthew.mason@uq.edu.au pages 9 13 19	School of Civil Engineering, EAIT	Mitigation	Insurance broking; power transmission agencies to assess severe thunderstorm risk to infrastructure and buildings
HALL, Dr Nina n.hall2@uq.edu.au	School of Public Health, Medicine	Recovery/ Preparation/ Management	Behaviour change to adapt to climate change/evaluation of human health impacts from climate change; Indigenous remote communities and climate change risks
SELVEY, A/Prof Linda l.selvey@uq.edu.au pages 12 24	Public Health, Medicine	Recovery	Continuity of core public health functions

1 SMI - Sustainable Minerals Institute

Appendix 2 - Our Collaborators



Research Partnerships
Deputy Vice-Chancellor (Research and Innovation)
The University of Queensland
Australia
T +61 7 336 53559
pvcrp@uq.edu.au