![Australian National University logo]

**Australian
National
University**

Disaster Solutions

**Innovative research preventing hazards,
reducing exposure and building
community-led resilience.**

2024 Research Brochure

Research for a safer Australia

Beyond Incremental Thinking

Research from the Australian National University (ANU) demonstrates that a transformative approach to addressing the growing disaster risks posed by climate change is critical. Traditional, incremental strategies are not sufficient. To effectively counter the increasing frequency and intensity of natural disasters, we need new solutions that can "stop disasters in their tracks."

Australia's national priorities in disaster research, spending, and response should focus on science-based solutions to preventing disasters, as well as reducing exposure to hazards, and mitigating vulnerabilities . Research initiatives at ANU, including the Cyclone Intervention project, Nature-Based Solutions for Flood Mitigation project, and the ANU-Optus Bushfire Centre of Excellence, show that transformative solutions can be developed locally. These programs highlight the potential for advanced technologies that proactively reduce disaster risks.

Investing in disaster prevention technology is crucial and should be recognised as essential to our security. Efforts to reduce vulnerability to natural hazards, such as reinforcing buildings and public education, are insufficient on their own. Research at ANU on innovative solutions shows promise in mitigating the impacts of various hazards, potentially reducing their severity. The rapid development of the COVID-19 vaccine, driven by public-private partnerships and urgency, serves as a model for addressing climate-fuelled disasters. Australia should apply similar urgency to disaster prevention, supporting large-scale, collaborative research missions, and incubators for novel disaster technologies.

Unfortunately, not every hazard can be mitigated by technology alone. For extreme cases like severe riverine flooding or sea level rise, relocating communities away from the hazard may be the best solution. Effective research must partner with vulnerable communities, prioritising their needs and perspectives. Collaborative efforts ensure strategies are both scientifically sound and socially equitable, aiding those most affected by disasters.

The Disaster Solutions Program at Institute for Climate, Energy & Disaster Solutions (ICEDS) aligns with Australia's Second National Action Plan for Disaster Risk Reduction and the United Nations (UN) Sendai Framework, focusing on interdisciplinary research and proactive prevention. By leveraging ANU's expertise and collaborating with government, NGOs, industry, and startups, the program aims to create scalable, transformative solutions.

This approach seeks to make a real and lasting difference in building resilience against disasters.

Associate Professor Roslyn Prinsley

Head of Disaster Solutions
ANU Institute for Climate, Energy & Disaster Solutions

ANU Institute for Climate, Energy and Disaster Solutions

Hazards

Cyclone Intervention Project

Tropical cyclones are powerful storms causing significant damage and loss of life. There is a trend of increasingly powerful storms due to climate change, posing significantly increased risks to humans and infrastructure, with damage potential rising exponentially. These extreme tropical cyclones are projected to reach 315 km/h by 2090, while also moving faster, further inland, and affecting new areas. Current efforts to mitigate cyclone vulnerability are insufficient, with cyclone-induced losses doubling every 15 years and growing coastal populations increasing exposure and future damages. Traditional approaches are not keeping pace with climate change. Since 2022, ANU researchers has been leading a collaborative research program with international experts to explore targetted aerosol injection as a promising method to reduce cyclone intensity and minimise impacts.

> "Research findings suggest areosols could mitigate the devasting impact of Cyclones."
>
> — Associate Professor Roslyn Prinsley
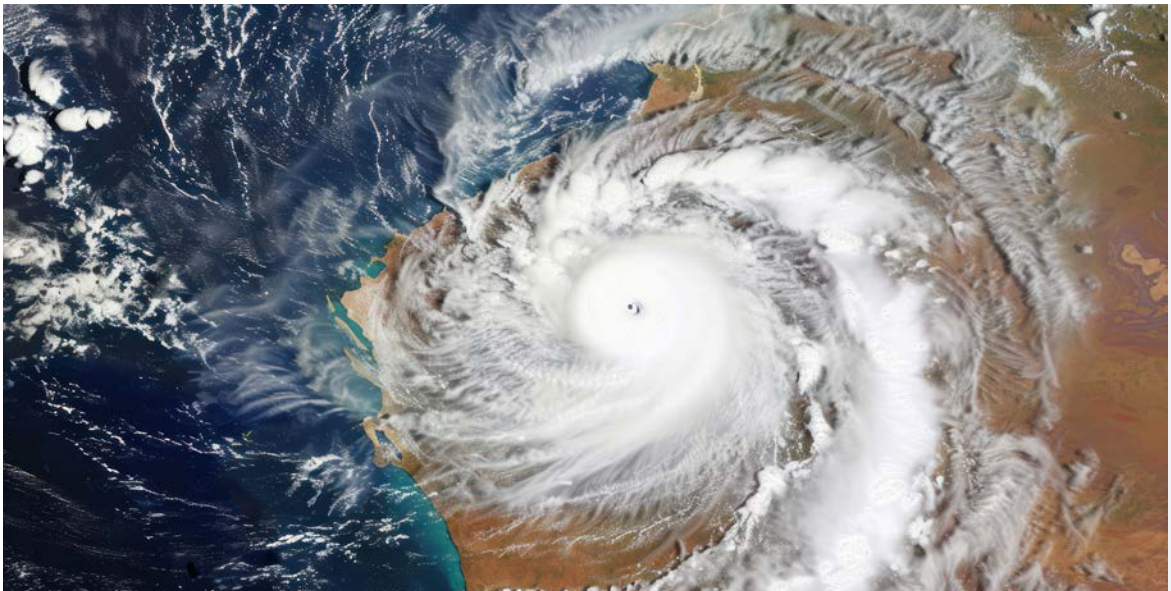
Source: Adobe Stock

This project aims to:

- Advance the understanding of aerosol-cloud interactions in cyclonic storms.
- Develop simulation capabilities to represent these processes.
- Explain the impacts of various factors involved in cyclone formation.
- Assess the viability of reducing cyclone intensity through aerosol injection.

Using Australia's Gadi Supercomputer, early computational results have shown significant promise, with specific aerosol treatments leading to notable reductions in the energy of pre-tropical cyclone vortices. Next steps include testing advanced seeding strategies during later cyclone development stages to understand the impacts on cyclone intensity, structure, rainfall, and wind.

This project has the potential to yield significant economic, environmental, and social benefits for Australia and other cyclone-prone regions as the climate warms. By contributing to the science of cyclogenesis and aerosol impacts on cyclonic circulations, it supports innovative strategies for managing increasing cyclone risks.
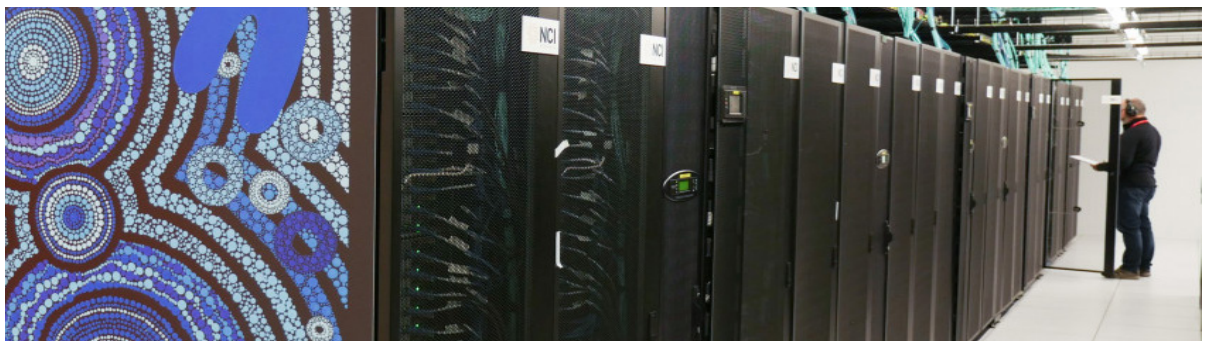
Source: NCI Australia

Bushfire Research Centre of Excellence

The Bushfire Research Centre of Excellence aims to revolutionise bushfire management in catastrophic conditionsby advancing early detection and suppression technologies. Instead of waiting until the fires become so large that it is impossible to extinguish them, the Centre aims to detect remote ignitions as soon as they start and put them out before they become too large to extinguish. Current systems rely on costly and risky methods like staffed fire towers and crewed aircraft, which are ineffective under extreme conditions. The Centre is developing an integrated, open-source suite of sensing and analysis tools for rapid fire detection and suppression.

Collaborating with the ACT Rural Fire Service, ACT Parks and Conservation Service, and industry partners, the Centre is testing these technologies in ACT bushland to demonstrate their effectiveness. With increasing bushfire frequency and intensity due to climate change, catastrophic fire conditions like those experienced during the Black Summer are likely to recur, underscoring the need for a new integrated approach to defend Australia from such disasters.

THANKS
FOR
SAVING
OUR
VILLAGE
♡
Fishos

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TOTAL
FIRE
BAN

This project aims to:

- Enhance early fire detection and response.
- Develop robust, cost-effective technologies for firefighters.
- Demonstrate practical applications in real-world conditions.

The next steps focus on refining these technologies and integrating them into broader bushfire management systems.

Source: BRCOE

Source: Adobe Stock

Nature-Based Solutions for Community Flood Mitigation

Traditional flood management methods like dams and levees are increasingly inadequate due to escalating flood risks from climate change. ANU researchers are developing the first Australian guidelines on Nature-based Solutions (NbS) for flood mitigation, focusing on both hydrological science and community resilience. Our team of researchers, drawn from the fields of hydrology, social science, ecology, and economics, is partnering with communities to develop the first-ever Australian guidelines on Nature-based Solutions (NbS) for flood mitigation and resilience.

Source: ANU ICEDS

Flooding poses increasing risks to regional communities on floodplains, as traditional defences are overwhelmed. NbS aim to reduce flood risk and restore catchment ecology and connections between rivers and floodplains.

This project aims to:

- Assess impacts on flooding from international data.
- Identify innovative and practical designs for flood risk mitigation.
- Quantify the impact in each location for flood mitigation and co-benefits.
- Demonstrate how NbS slow floods and keeps them away from populations.
- Provide Australia-specific community guidance on NbS costs and benefits.
- Improve knowledge on how to integrate NbS into flood risk management.

This initiative, funded by the Australian Government National Emergency Management Agency, is engaging regional partners across Eastern Australia to identify and evaluate NbS specific to their local environmental and social contexts.

Exposure

Relocating Australian Communities at Risk

Climate change is causing more frequent and severe extreme weather events, making many areas increasingly uninhabitable. This project addresses the urgent need for a National Planned Relocation Strategy for at-risk Australian communities. Many communities face the difficult decision of whether to rebuild or relocate following climate-related disasters. This ANU-led project brings together experts from various fields to develop comprehensive relocation strategies, addressing the long-term consequences of climate change.

Source: Brenton McGeachie

This project aims to:

- Identify starting points for preventative action.
- Canvas issues related to the creation of a national relocation strategy.
- Instigate dialogue on relocation encompassing cultural, social, environmental, economic, political, and institutional complexities.

Source: ANU ICEDS

Issues Paper

This issues paper contributes to a crucial national conversation on developing and implementing a National Relocation Strategy for at-risk communities in Australia. The document and accompanying website aim to foster comprehensive dialogue, leading to new research, collaborations, initiatives, and policy developments in response to escalating risks faced by Australian communities in a changing climate.

Vulnerability

Community-led Flood Intelligence Networks

In response to catastrophic flooding in NSW's Northern Rivers region, ANU researchers are partnering with local residents to enhance community flood intelligence systems. The People's Catchment project combines hydrological science with community engagement to build resilience against future floods. The failure of official monitoring systems highlighted the need for improved local data collection. Initiatives include a CB UHF radio network, "rain sentinels" with rain gauges, and benchmarking creek levels for better data interpretation.

This project aims to:

- Strengthen community capacity to manage flood risks with citizen science.
- Collect and share rainfall and flood observations.
- Enhance collaboration with SES, local councils, and the Bureau of Meteorology.

Next steps involve developing our methodology and resource kits for implementing community-led flood intelligence networks in similar rural and regional catchments.

Source: ANU ICEDS

Finance

Disaster Finance and Insurance Research

Australian communities and infrastructure are significantly impacted by climate-fuelled extreme weather events. Current disaster management approaches are often insufficient, with soaring insurance premiums and rebuilding costs becoming unsustainable. There is an urgent need for innovative research to develop new models for financing resilience and insurance. ICEDS emphasises the importance of supporting interdisciplinary research and innovative approaches to address these challenges equitably.

This initiative aims to:

- Develop new models for financing resilience and insurance.
- Ensure equitable distribution of climate risks.
- Increase public and private investment in preventive technologies and research.

Next steps involve setting a national research agenda to deliver innovative tools and foster collaboration, ensuring communities are better prepared and protected against future climate-related disasters.

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