Natural Hazards Research Australia

Analysis of inquiry recommendations on natural hazards and disaster risk reduction

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1. Meridian Urban

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We acknowledge the Traditional Custodians across all the lands on which we live and work, and we pay our respects to Elders both past, present and emerging. We recognise that these lands and waters have always been places of teaching, research and learning.

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Executive summary

This research conducted a comprehensive analysis of recommendations from Australian inquiries, reports and reviews related to natural hazards and disaster risk reduction. The aim was to identify key recurring themes, patterns and insights that can inform future policy development, emergency management strategies and risk mitigation efforts.

A multi-criteria analysis (MCA) was undertaken to identify priority themes from the recommendations for preparedness, emergency management and risk mitigation.

Key findings

The summary of key findings, further discussed throughout this report are:

- **The most frequently coded recommendations were not those identified as highest priority,** highlighting a potential gap between the findings from inquiries and the developing policy and strategic landscape of natural hazard risk.
- **Recommendations traditionally focused on key aspects like response and agency organisation**, but more recent inquiries expand the volume of recommendations that address contemporary risk reduction matters.
- **Inquiries are increasingly examining disaster seasons rather than specific events,** demonstrating the emerging trend of a more strategic and holistic approach to natural hazard disaster management.
- **There is a clear distinction between traditional response focused recommendations and emerging risk reduction and resilience themed recommendations,** indicating the consideration of all aspects of risk holistically is evolving.

Additional findings

Recommendations data analysed as part of this research further identified:

- The period of 2010 to 2014 was a high-water mark period for inquiries and recommendations.
- There has been a declining trend in the total amount of recommendations over the past twenty years.
- Inquiries into specific disaster events make more recommendations under ‘Response’.
- Flood inquiries have a stronger focus on ‘Responsibility’, ‘Preparedness’ and ‘Recovery’ recommendations.

Discussion

The analysis highlights a number of key recurring themes, patterns and insights that can inform future policy development, emergency management strategies and risk mitigation efforts.

Disaster risk reduction themes in the database were identified as a high priority through the workshop-participant informed MCA criteria but are not frequently used in the database. Future research and policy

development could continue to explore the lessons learned from both specific natural hazard events and disaster seasons, as well as continue to explore more strategic elements of hazards.

It is anticipated that the emergence of climate change recommendations and a wider range of recommendations relating to disaster risk reduction and resilience will continue to evolve, as seen in the database trends in recent years.

Future policy development could focus on further understanding, embedding, and strategically planning for climate change, biodiversity and disaster risk management in all stages of natural hazard events including response, recovery, resilience and risk reduction.

The ongoing implementation and monitoring of recommendations from past reviews, coupled with ongoing research collaboration of key stakeholders, policy development, and advocacy, will continue to strengthen the impact and role inquiries and research provides to addressing systemic natural hazard disaster risk.

Introduction

Federal and State inquiries following natural hazards are a regular practice, often including a variety of recommendations relating to the response to events, emergencies and disasters, as well as preparedness for hazards and their associated risks. The purpose of this research was to conduct a comprehensive analysis of recommendations from Australian inquiries, reports and reviews related to natural hazards and disaster risk reduction. The aim was to identify key recurring themes, patterns and insights that can inform future policy development, emergency management strategies and risk mitigation efforts.

This project was undertaken in three phases. Firstly, the inquiries database[1] was updated to include relevant contemporary inquiries from April 2023 – January 2025. Secondly, a comprehensive thematic analysis was conducted. And thirdly, a stakeholder workshop to weight multi-criteria analysis criteria and to undertake multi-criteria analysis to identify key recurring themes, patterns and insights as well as the relative priority of identified themes.

The analysis has sought to understand synergies and potential gaps with the themes of recommendations and broader natural hazard and disaster risk reduction policy direction in Australia.

Several terms are highlighted here for their meaning within the report.

The term 'inquiries' is used to cover all inquiries, reviews, reports completed by agency, audit, coronial, governments, independent, parliamentary and royal commissions.

This analysis of inquiry recommendations related to natural hazards and disaster risk reduction has been commissioned by Natural Hazards Research Australia (the Centre).

'Natural hazard' as defined in the Centre's *Biennial Research Plan 2024-26* includes bushfire, flood, cyclone, heatwave, storm, inundation and erosion caused by sea level rise, earthquake, tsunami and landslide. While other hazards and incidents may be recorded in the database, analysis of these are not included within the scope of this research.

The term 'all-hazard' is used throughout this report. It refers to all of the hazard recommendations from inquiries spanning disaster management and resilience, not an inquiry into all of the hazards listed above.

[1] Natural Hazards Research Australia, https://tools.bnhcrc.com.au/ddr/home

Methodology

The Centre's Analysis of inquiry recommendations on natural hazards and disaster risk reduction project included three key components shown in the diagram and summarised below. The detailed methodology is included in Appendix A.

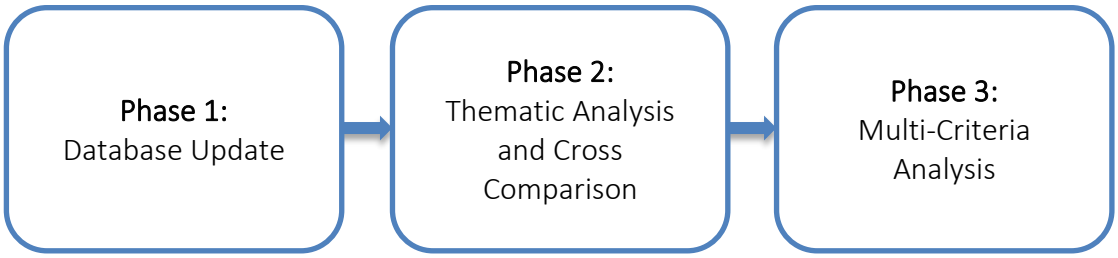

FIGURE 1: METHODOLOGY PHASES

Phase 1: Database update

The Centre's Inquiries and Reviews Database was updated to include inquiries from April 2023 – January 2025. A comprehensive search strategy was developed to ensure that all possible inquiries that fit the inclusion criteria were included. The inclusion criteria for the database update were inquiries that:

- were released between April 2023 and January 2025
- focused on the hazards outlined in the Centre's biannual research plan
- included recommendations.

Each recommendation was independently coded against the existing set of codes and sub-codes[2] used for previous updates to the database. As part of the quality control process, coding was peer reviewed. Where discrepancies were identified, these were examined by the project team and updated as required.

Phase 2: Thematic analysis and cross comparison

Following completion of the database update for 2023 to 2025, the new inquiries and recommendations were combined with the previous existing database to begin analysis.

Power BI was utilised to analyse the combined dataset, focusing on the past twenty years of inquiries and recommendations. An inductive approach was used to interrogate the dataset and draw out observations. This approach was guided by emergent themes noted during the database update and the national emergency management and disaster risk reduction policy environment at the time.

New categorisation fields for inquiries were developed to provide further analysis the data. This included the addition of inquiry event timeframes (i.e. season reviews).

Phase 3: Multi-criteria analysis

A multi-criteria analysis (MCA) was undertaken to further analyse the data and understand how themes could be prioritised for the Centre. A stakeholder workshop was held on 4 April 2025, to discuss, agree upon, and

[2] (Bushfire & Natural Hazards CRC, https://tools.bnhcrc.com.au/ddr/dataspace-home)

provide insights into weighting pre-established criteria for the multi-criteria analysis. 31 attendees from emergency management, disaster preparedness, recovery and research fields attended. The discussions and survey held during the workshop confirmed the themes to be tested, as well as the weighting of criteria which was applied during the MCA. The criteria and weighting of criteria used for the MCA are shown in Table 1 below.

Table 1: Multi-Criteria Analysis criteria and weighting of criteria

CRITERIA	CRITERIA WEIGHT	DESCRIPTION	SUB-CRITERIA	SCORING	SUB-CRITERIA WEIGHT	DESCRIPTION
Benefits	65	The estimated overall benefits of the inquiry theme	Multi-hazard	Each stakeholder has 100 points, divide these proportionally across these 5 sub-criteria	17.00	The theme addresses more than one hazard
			Co-benefits		17.00	The theme has additional co-benefits
			Geography		16.00	Estimated number of people and assets addressed by the theme (i.e. nationally and state applicable themes may be preferable than one which is hyper local)
			Timeframe		18.00	Consideration of the timeframe for expected benefits of the inquiry theme, such as how far into the future these may be expected and if these are sustained for multiple years
			Effectiveness		32.00	The effectiveness of the theme in reducing natural hazard disaster risk / enhancing recovery
Variabilities	25	The variability of effectiveness / impact due to complexities	Timing	Each stakeholder has 100 points, divide these proportionally across these 3 sub-criteria	33.00	The theme can be implemented in a relatively short amount of time (i.e. within 12 months). In general, measures that can be implemented quickly are considered more viable and less subject to variability
			Stakeholders		30.00	The implementation / effectiveness of the theme is dependent upon multiple stakeholders
			Dependencies		32.00	The implementation / effectiveness of the theme is dependent upon external / other variables
Policy & strategy	10	Alignment of the inquiry theme with the NDRRF	NDRRF alignment	N/A	100	The direct alignment of the theme with more than one outcome of the Second National Action Plan

Key findings

The update to the database, thematic analysis and MCA assessment revealed findings and insights that have been further explored to understand the systemic nature of natural hazards and all elements of response, recovery and resilience. The key findings from the research can be summarised as:

- The most frequently coded recommendations were not those identified as the highest priority.
- Recommendations traditionally focused on key aspects like response and agency organisation, but more recent inquiries expand the volume of recommendations that address contemporary risk reduction matters.
- Inquiries are increasingly examining disaster seasons rather than specific events.
- There is a clear distinction between traditional response-focused recommendations and emerging risk reduction and resilience-themed recommendations.

Inquiries database update (Phase 1)

Following the update of the database and the inclusion of inquiries and recommendations published prior to and up to December 2024, a total of 348 inquiries and 4,833 recommendations are now included in the database.

- Geographically, Australia-wide (national) inquiries are the most represented (75) followed by Victoria (71) and New South Wales (61).
- Regarding hazards, bushfire accounts for most inquiries (121) followed by inquiries that assessed or related to ‘all hazards’ (98).
- Most inquiries are independent (78), followed by audit (71) and parliamentary (68).

The remainder of this report is focused on undertaking a thematic analysis and multi-criteria analysis of the inquiries and recommendations, which used data from this updated database.

Database findings

Further additional findings arising from the review of the updated database are provided below:

- **The period of 2010 to 2014 was a highwater mark period for inquiries and recommendations**, which corresponds with a series of significant disaster events in the lead up to and during that period (e.g. Black Saturday bushfires, 2011 Queensland floods).

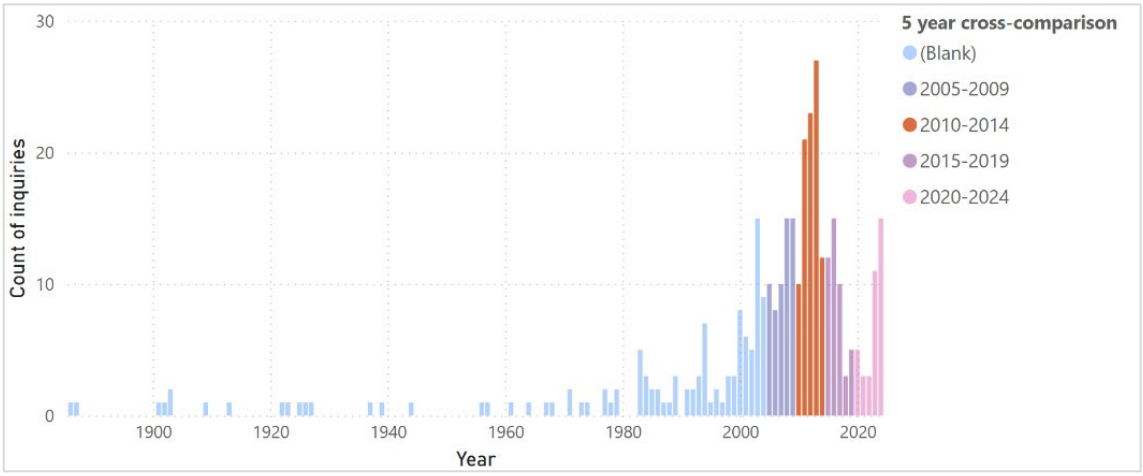

FIGURE 2 - COUNT OF INQUIRIES BY YEAR

- **There has been a declining trend in the total amount of recommendations over the past twenty years.** Over this time, 'Agency organisation' and 'Responsibility' remain a focus. However, the proportion of 'Preparedness', 'Recovery' and 'Research & Technology' have each slightly increased in the past ten years (2015 – 2024), compared to the previous ten (2005 – 2014).

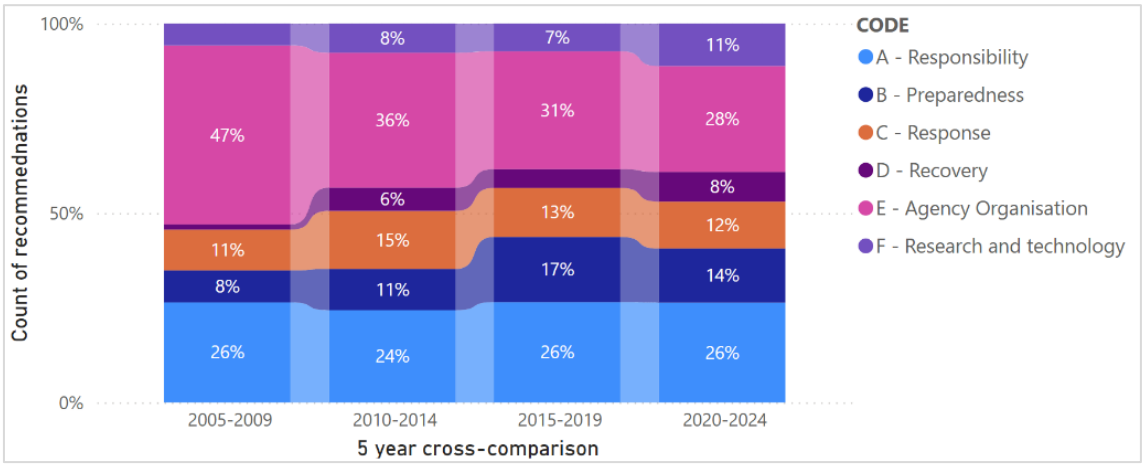

FIGURE 3 - 5 YEAR CROSS COMPARISON

- **Inquiries into specific disaster events make more recommendations under 'Response'**, while inquiries into non-specific events make more recommendations under 'Responsibility' and 'Agency organisation'.
- **Bushfire inquiries have a stronger focus on 'Response' recommendations**, compared to other hazard types. This is driven by recommendations relating to 'Incident Management Teams' and 'Communications and Warnings'. 'Community education' (Responsibility) is also a recurring recommendation type for bushfire inquiries.
- **Flood inquiries have a stronger focus on 'Responsibility', 'Preparedness' and 'Recovery' recommendations**, compared to other hazard types. This is driven by recommendations relating to 'Land use planning and building codes' (Preparedness) and 'Insurance and Legal Liability' (Recovery).
- A breakdown of findings across each code theme is provided below in Table 1.

TABLE 1 - CODE THEME FINDINGS

Code theme	Findings
Responsibility	• 'Community education' is a focus area for bushfire. • Role of governments ('Govt responsibility', 'Role of local government' and 'Role of Commonwealth') is less so a key recommendation area for bushfire than many other hazards.
Preparedness	• 'Land use and building regulations' recommendations focus on flood. • 'Infrastructure' recommendations focus on storm and cyclones/wind hazards. • 'Emergency management exercise' recommendations focus on out-of-scope hazards[3].
Response	• 'Communications and warnings' recommendations focus on cyclone and flood. • 'Inter-agency communication' is present the most for all hazard and storm inquiries, while 'Inter-service communication' is a focus for several hazards. • 'Emergency powers' most notably present for anthropogenic hazards, but also flood.
Agency organisation	• 'Doctrine, standards and reform' is present across all hazards • 'Funding' is a notable recommendation area for flood and all hazard inquiries. • 'Operational health and safety' is priority area for anthropogenic hazards. • 'Training and behaviour' is priority area for fire hazards, as well as storm.
Recovery	• 'Insurance and legal liability' is a strong focus for flood inquiries, while there are no recommendations about this at all against storm. • 'Relief and recovery' is a strong focus for bushfire and storm inquiries.
Research and technology	• 'Mapping and data quality' is a strong focus for flood inquiries, followed closely by all hazard and bushfire inquiries. • 'Assets and technology' are a key recommendation area for bushfire • By raw numbers, bushfire has the most 'Research' recommendations, but it is also a key area for flood and all hazards.

[3] Out-of-scope are those which are contained within the database but are not within the Centre's remit. Those considered out-of-scope are technical accidents, biological, fire (distinct from bushfire), oil spill and terrorism.

Thematic analysis and cross comparison (Phases 2 & 3)

The most frequently coded recommendations were not those identified as highest priority

The most frequently coded recommendations were not those identified as highest priority, highlighting a potential gap between the findings from inquiries and the developing policy and strategic landscape of natural hazard risk.

The thematic analysis of the recommendations coding revealed strong themes and trends across the recommendations which are useful for further analysis of the relationship between inquiries and recommendations and disaster and hazard policy.

'Doctrine, standards and reform' is the most coded recommendation, with 841 recommendations in the database. This is followed by 'EM agency and authority' (355), 'Government responsibility' (310), 'Inquiry, lessons management and after-action review' (243) and 'Training and behaviour' (216). The top five most frequently coded sub-codes sit within the broader coding categories of either 'Agency organisation' or 'Responsibility', as shown in Figure 4 below.

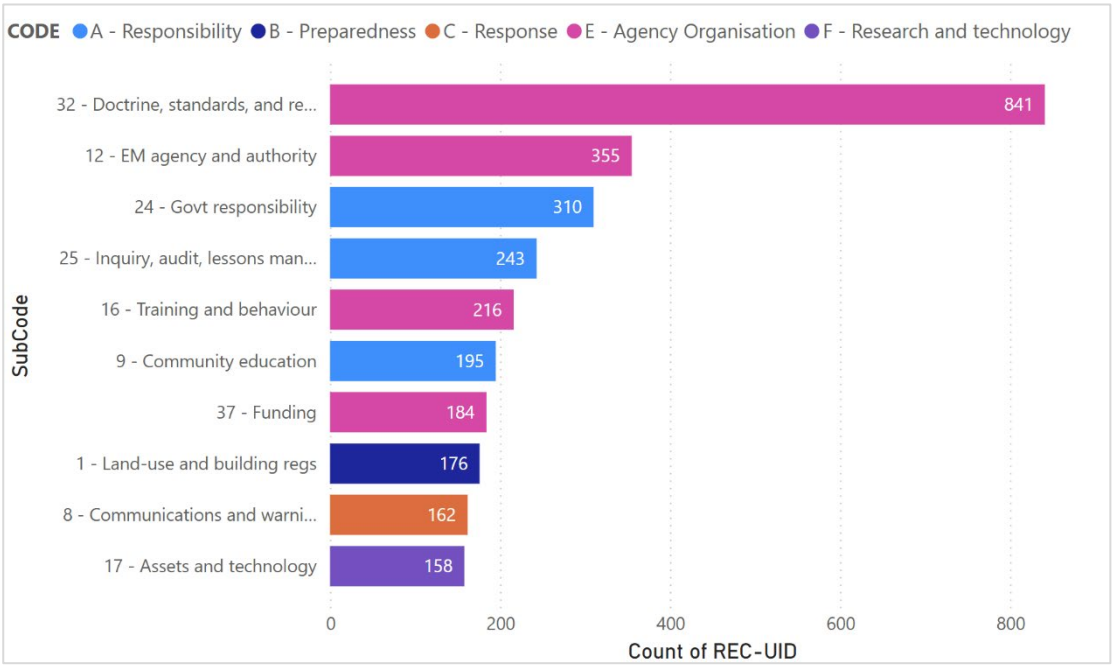

FIGURE 4: TOP 10 SUB-CODES BY CODE (ALL YEARS)

'Doctrine, standards and reform' continues to be a dominant sub-code as it was also highly coded in the recent update to the database. This was mostly derived from Parliamentary Inquiry: *Inquiry into insurers' responses to 2022 major flood claims*[4], with 32 recommendations sub-coded as 'doctrine, standards and reform' mostly relating to the General Insurance Code of Practice.

Regarding the least used sub-codes, 'Climate Change' (6) is the least used sub-code, however it is noted that this sub-code has only emerged over the last five years. This is followed by 'Culture and Heritage' (14) 'Biodiversity' (17), 'Equipment and consumables' (19) and 'Access to fire ground' (19).

When considering the entirety of inquiries and recommendations in the database, it is evident that recommendations relating 'Agency organisation' and 'Responsibility' are most represented, and recommendations relating to 'preparedness' and 'response' remain underrepresented.

[4] (Parliament of Australia, 2024)

The MCA process provided additional analysis to the sub-codes and prioritised the sub-codes based on an assessment of the agreed criteria. The sub-codes that were most frequently used in the database are often not the highest priorities when applying the weighting of criteria determined in the stakeholder workshop. Additionally, some sub-codes that were identified in the five lowest in the database have been identified as being in the top five priorities, based on the MCA criteria adopted. The comparison of the Top five prioritised sub-codes and the respective database ranking is shown in Figure 5 below.

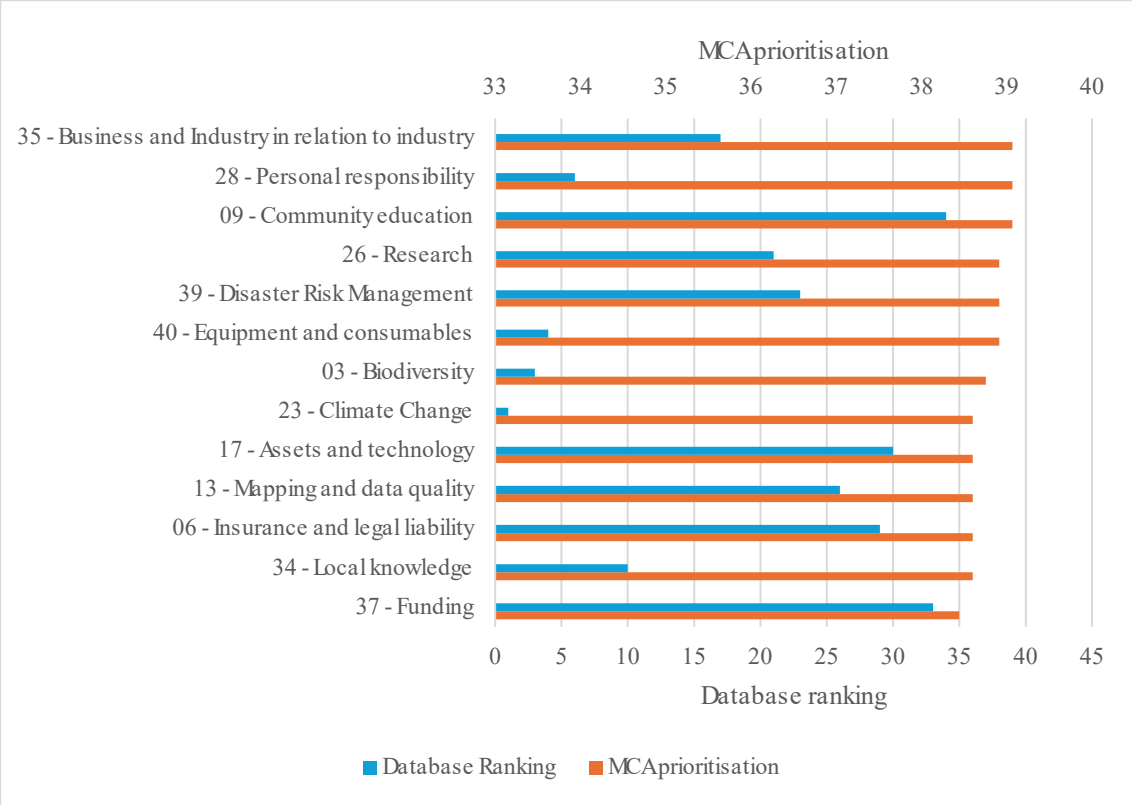

FIGURE 5: TOP 5 PRIORITISED SUB-CODES COMPARED TO DATABASE FREQUENCY

Themes identified as **most frequently used** and a **high priority** include:

- Community education
- Funding
- Assets and technology
- Insurance and legal liability
- Mapping and data quality.

Themes identified as a **high priority**, but were **not frequently used** in the database include:

- Climate change
- Biodiversity
- Equipment and consumables.

Of note, climate change and biodiversity are two of the least used sub-codes in the database but have been identified as the top five priorities for preparedness, emergency management and risk mitigation.

Community education and funding sub-codes are both high priorities and are highly used in the database, which demonstrates alignment between the findings of inquiries and the policy and strategic landscape of natural hazard disaster risk.

The variation in the identified priority sub-codes compared to the respective ranking of sub-codes in the database enables insights to start thinking about what is commonly recommended in inquiries compared to the direction of policy and a more strategic and holistic approach to natural hazard disasters.

The variation between priorities and coding in the database may be due to a number of different factors such as the **minimum requirements of inquiries**, and the distinction and interplay between **response and recovery and disaster risk reduction**. Both of these matters are further explored below.

Recommendations traditionally focused on key aspects like response and agency organisation

Recommendations traditionally focused on key aspects like response and agency organisation, but more recent inquiries expand the volume of recommendations which address a spectrum of contemporary risk reduction matters.

In further analysing the differences in prioritised themes and frequently coded themes in the database, it was important to unpack the role and scope of the inquiries themselves. It is acknowledged that inquiries are not intended to provide a broad natural hazard disaster risk and resilience strategic policy – rather the terms of reference for each inquiry are often to investigate the preparedness for, response to, and then recovery from specific natural hazard events and to provide learnings and recommendations from those events.

Table 2 below details the terms of reference from two recent inquiries and demonstrates how the terms of reference, which sets the scope of the inquiry, can significantly influence the recommendations of the inquiry. The *Select Committee on Australia's Disaster Resilience: Boots on the Ground: Raising Resilience (2024)*[5] and *Final Report of the NSW Independent Bushfire Inquiry (2020)*[6] have been used as examples to demonstrate this.

Table 2: Example of terms of reference and relationship with coding of recommendations

Inquiry	Terms of reference	Coding of recommendations
Select Committee on Australia's Disaster Resilience: Boots on the Ground: Raising Resilience (2024)	a) current preparedness, response and recovery **workforce models**, including: i. the **role of the Australian Defence Force** in responding to domestic natural disasters, ii. the impact of more frequent and more intense natural disasters, due to climate change, on the ongoing **capacity and capability of the Australian Defence Force**, iii. the **impact on the Australian Defence Force in responding to** domestic natural disasters, and iv. the **role of Australian civil and volunteer groups, not-for-profit organisations and state-based services** in preparing for, responding to and recovering from natural disasters, and the impact of more frequent and more intense natural disasters on their ongoing capacity and capability. b) consideration of **alternative models**, including:	50% Agency organisation 40% Responsibility 10% Recovery

[5] (Parliament of Australia, 2024)
[6] (New South Wales Government, 2020)

	i. repurposing or adapting existing Australian civil and volunteer groups, not-for-profit organisations and state-based services, and ii. overseas models and best practice. iii. consideration of the practical, legislative, and administrative arrangements that would be required to support improving Australia's resilience and response to natural disasters; and c) any related matters.	
Final Report of the NSW Independent Bushfire Inquiry (2020)	1. The causes of, and factors contributing to, the frequency, intensity, timing and location of bushfires in NSW in the 2019-20 bushfire season, including consideration of any role of weather, drought, climate change, fuel loads and human activity. 2. The preparation and planning by agencies, government, other entities and the community for bushfires in NSW, including current laws, practices and strategies, and building standards and their application and effect. 3. Responses to bushfires, particularly measures to control the spread of the fires and to protect life, property and the environment, including: o immediate management, including the issuing of public warnings o resourcing, coordination and deployment o equipment and communication systems. 4. Any other matters that the inquiry deems appropriate in relation to bushfires. And to make recommendations arising from the Inquiry as considered appropriate, including on: 5. Preparation and planning for future bushfire threats and risks. 6. Land use planning and management and building standards, including appropriate clearing and other hazard reduction, zoning, and any appropriate use of indigenous practices. 7. Appropriate action to adapt to future bushfire risks to communities and ecosystems. 8. Emergency responses to bushfires, including overall human and capital resourcing. 9. Coordination and collaboration by the NSW Government with the Australian Government, other state and territory governments and local governments. 10. Safety of first responders. 11. Public communication and advice systems and strategies.	26% Responsibility 24% Response 21% Agency Organisation 18% Research and technology 10% Preparedness 2% Recovery

From the two examples above, it is clear that the terms of reference given to the inquiry significantly shape and influence the scope of the inquiry and therefore the recommendations made.

The Select Committee on Australia's Disaster Resilience's *Boots on the Ground: Raising Resilience (2024)* scope is limited only to assessing disaster resilience on the basis of workforce models of the Australian Defence Force, civil groups and volunteer groups, as well as alternative models and legislative and administrative arrangements. This is reflected in the coding of the recommendations as 90% of the recommendations are related to either agency organisation or responsibility.

The *Final Report of the NSW Independent Bushfire Inquiry (2020)* has broader terms of reference to consider a more holistic and strategic review of the bushfire season, which is again reflected in the diversity of recommendations and coding applied. However, the terms of reference also included focus on the planning system, of which recommendations relating to the same were limited in number.

Through undertaking the MCA process to evaluate and prioritise the sub-codes in the database, it was evident that inquiries and commissions have traditional requirements of aspects of disaster events that at a minimum should be analysed, assessed, and provided recommendations on. This includes matters such as policy, legislation and responsibility, that have typically been categorised in the database through sub-codes:

- Doctrine, standards and reform
- Role of the Commonwealth government
- Role of local government
- Government responsibility.

Some inquiries also advise on more holistic recommendations, which address contemporary risk reduction matters and have a direct alignment with the broader natural hazard disaster strategy and policy. This includes recommendations that have typically been categorised in the database through sub-codes:

- Climate change
- Data availability and mapping
- Land use planning
- Community education

In identifying the top priorities for natural hazards and disaster risk reduction and the relationship with the recommendations in the database, it was determined that the minimum baseline requirements are foundational to inquiries, being among their core purpose, and therefore should not be prioritised against the other sub-codes. This is because themes such as doctrine, standards and reform, and responsibilities are important regardless of the scope of the inquiry and therefore should not be compared to more tangible recommendations that can be prioritised.

Whilst this determination has been made, it is important to note that in removing the relevant sub-codes of identified baseline requirements of inquiries from the MCA process, it did not change the results of the top five priorities or bottom five priorities.

Inquiries are increasingly examining disaster seasons rather than specific events

Inquiries are increasingly examining disaster seasons rather than specific events, demonstrating the emerging trend of a more strategic and holistic approach to natural hazard disaster management.

Natural hazard inquiries have typically focused on investigating specific natural hazard events. More than half of all inquiries from 2005 to 2024 are not related to a specific hazard incident or disaster. Further since 2018 there has been an emerging trend for inquiries examining disaster 'seasons' rather than single events, as seen in Figure 6 below. Inquiries categorised as examining disaster seasons typically include inquiries of multiple incidents over a typical 'disaster season'.

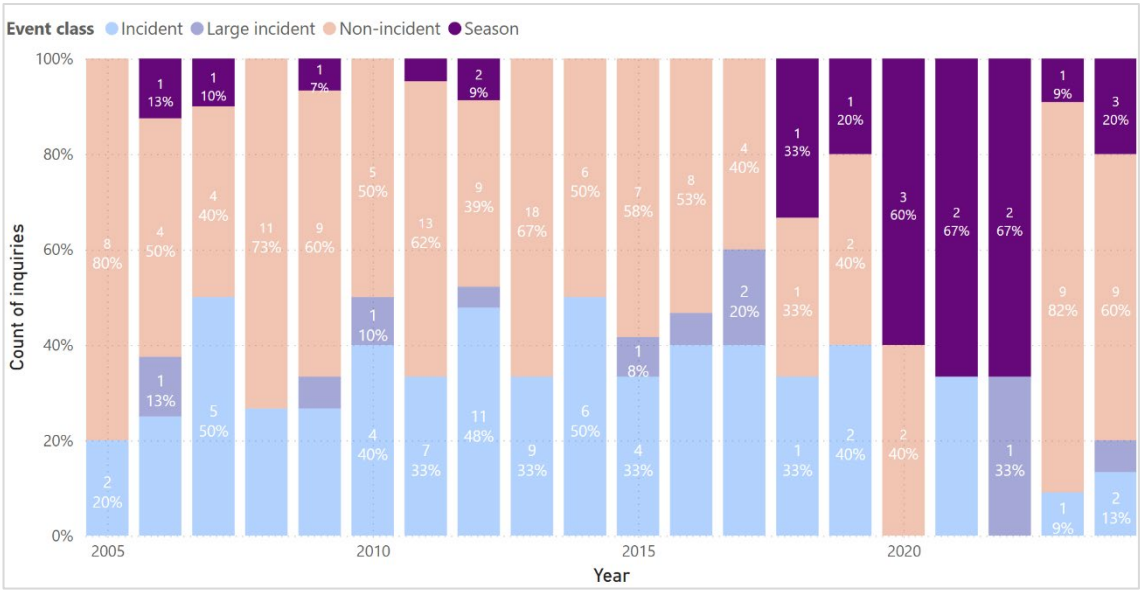

FIGURE 6: INQUIRY INCIDENT/EVENT CLASSES OVER THE PAST 20 YEARS

Disaster season inquiries have occurred across most jurisdictions, with the 2018 and 2019 disaster season inquiries both in Queensland and both for bushfire hazard, which is a common disaster season theme until 2022. Since 2022, inquiries into disaster seasons about flood events have been an emerging theme with the 2022 NSW *Independent Flood Inquiry*[7].

There is an ever-growing understanding across research, policy and practice that natural hazard disasters are often not isolated events. The investigation, findings and recommendations from specific events can apply to the more systemic nature of natural hazard and risk management, across jurisdictions and hazards. This emerging trend in the scope of inquiries follows the development of natural hazard policy, in that there is a need to think more strategically and holistically across hazards and across the broader timeframes of disaster seasons. Likewise, these seasonal inquiries have also tended to focus on a series of climate indicators and weather patterns that resulted in multiple events, or in multiple parts of each state, during the same season. Noting the emergence of climate change-related recommendations in particular over the past five years, there may be a correlation between these trends and occurrences.

Inquiries into matters unrelated to specific incidents more frequently recommend actions regarding 'responsibility' and 'agency organisation', whilst incident-specific inquiries have a higher frequency of 'response' recommendations. The recommendations from inquiries that examined disaster seasons and non-event specific disasters typically have recommendations that featured a stronger alignment with the themes identified as priorities through the MCA assessment, such as preparedness and research and technology.

[7] (New South Wales Government, 2022)

For example, the New South Wales (2024) *Inquiry into the planning system and the impacts of climate change on the environment and communities*[8] had a total of 18 recommendations, 12 of which were coded as preparedness and were specifically about land-use planning and building regulations, 4 research and technology, and 2 as responsibility. Additionally, the New South Wales (2024) *NSW Independent Flood Inquiry* had a total of 28 recommendations, including 7 coded preparedness and 4 as research and technology.

This demonstrates the evolving strategic view of natural hazard disaster risk and resilience and acknowledges the interrelationships between disaster events and the broader preparedness and resilience that is typically performed or contributed to outside of specific events. The evolution of non-event specific inquiries often addresses multiple events through disaster seasons as well as broader systemic risk management. This is better aligned to the evolving natural hazard policy framework, as well as being better aligned to the priorities identified through the MCA assessment.

Whilst there is continual understanding, research and policy investigating the relationship between natural hazards and climate change, climate change remains the least coded recommendation in the database. There are only six recommendations themed to the climate change sub-code, stemming from the following inquiries[9]:

- INQ 351 - Inquiry into the planning system and the impacts of climate change on the environment and communities (2024)
- INQ317 - Royal Commission into National Natural Disaster Arrangements (2020)
- INQ332 Maribyrnong River Flood Event, Independent Review (2023)
- INQ335 - Inquiry into the implications of severe weather events on the national regional, rural, and remote road network (2023)

It is acknowledged that the climate change theme has only emerged over the last five years, with three of the recommendations stemming from the 2024 *inquiry into the planning system and the impacts of climate change on the environment and communities.* Given the evolving scope of terms of reference for inquiries, and the change to look at disaster seasons and risk more strategically, it is anticipated that climate change recommendations will continue to evolve in the years to come.

[8] (Parliament of New South Wales, 2024)

[9] It is noted that whilst there may be other recommendations in the database that have regard to climate change, due to the existing coding structure they have been coded to another theme. For example, the *2022 NSW Flood Inquiry*, included recommendations for climate change but these have been coded to themes such as 'research' and 'doctrine, standards, reform'.

There is a clear distinction between traditional response focused recommendations and emerging risk reduction and resilience themed recommendations.

There is a clear distinction between traditional response focused recommendations and emerging risk reduction and resilience themed recommendations indicating the consideration of all aspects of risk holistically is evolving.

The data analysis reveals a significant shift in the focus of natural hazard inquiries, from a traditional emphasis on disaster response to a more integrated consideration of disaster resilience. Traditionally, these inquiries have been reactive in nature, often limited to investigating specific hazard events and focusing attention and recommendations on the immediate response and recovery.

This approach has resulted in a prevalence of recommendations in the database focused on operational themes such as emergency powers, policing, communications and agency responsibilities. However, there has been a recent shift toward broader, more strategic disaster risk and resilience considerations. Inquiries are now increasingly considering longer-term risk reduction, preparedness, and systemic resilience. For example, earlier inquiries and their recommendations are focused on agency roles and operational arrangements aligned with emergency management and response. However, more recent inquiries have expanded the terms of reference to include disaster seasons, land-use and emergency management planning, and strategic management of risk.

The MCA used in this study further illustrated the distinction between the two emerging categories of recommendation coding. Recommendations coded as response and recovery to hazard events are operational in nature and tend to be action-oriented and short term. In contrast, recommendations coded as preparedness, research and technology and responsibility, such as those focused on land-use planning, mapping and data, community education, and research, are more strategic in nature and address aspects of risk reduction and resilience.

A further difference between these recommendation themes in the MCA, is the timeframe and implementation of the different themes. For example, response and recovery themed recommendations typically scored higher for timing, as they are often focused, immediate actions to be enacted during the response and recovery phase of a disaster, or in need of rapid implementation ahead of the following disaster seasons. Whereas risk reduction and resilience-themed recommendations were typically identified as being subject to longer implementation timeframes, as these recommendations were generally observed in response to identified systemic issues. These tend to be longer-term in their implementation, often requiring sustained coordination across multiple sectors and levels of government.

One of the key challenges exposed through the MCA was the need to assess and balance the traditional emergency management and response recommendations with risk reduction and resilience-focused recommendations. While both sets of recommendations serve different functions, they are both equally essential and inherently connected in the emergency management cycle encompassing prevention, preparedness, response and recovery (PPRR) as shown in Figure 7 below[10].

[10] (Australian Institute for Disaster Resilience, 2019)

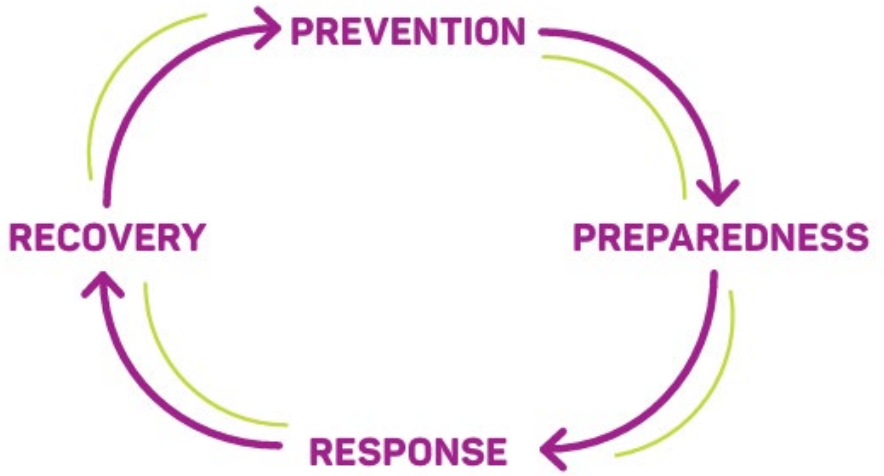

FIGURE 7: PPRR CYCLE FROM AUSTRALIAN EMERGENCY MANAGEMENT ARRANGEMENTS 2019

For example, communications, warnings and the role of police during an event are critical for emergency management response. Response to a disaster event may trigger lessons and changes needed for future prevention and preparedness. Therefore, quality mapping and data to inform emergency management planning and land use planning to reduce natural hazard risk are essential aspects of emergency management in minimising risk in the first place. Response to disaster events relies on hazard and risk understanding and planning foundations, and ongoing disaster resilience depends on lessons learned from operational performance.

Further analysis of the characteristics of each recommendation code is provided below:

Agency organisation

'Doctrine, standards and reform' sub-code is the most frequent in the database and is present across all hazards, indicating the scope of the terms of reference for inquiries but also the significant role this has in disaster management. The funding sub-code is most used in relation to flood and all-hazard inquiries. The training and behaviour sub-code is particularly noted in recommendations for storm.

Preparedness

Across all hazard type inquiries, 'flood' and 'storm' hazards have a stronger preparedness focus with 16 per cent and 20 per cent of recommendations coded preparedness, respectively. The 'Land use and planning' sub-code is most coded for 'flood' hazard inquiries. The majority of recommendations in this context come from *Inquiry into the planning system and the impacts of climate change on the environment and communities* by the Parliament of New South Wales (2024), *Flood failure to future fairness – Report on the inquiry into insurers' responses to 2022 major flood claims* by House of Representatives Standing Committee on Economics (2024), and both the *Inquiry into the 2022 flood event*[11] in Victoria and *2022 NSW Independent Flood Inquiry.*

Recovery

Recovery is under-represented across all hazards, although there are slightly more recovery recommendations for flood hazards (14%). The 'insurance and legal liability' sub-code is a frequent recommendation for flood inquiries. 'Relief and recovery' sub-codes are frequently used for bushfire and storm inquiries.

[11] (Parliament of Victoria, 2024)

Research and technology

Research and technology recommendations are also less represented across all hazards, although there is a slight increase for flood hazards (12%). The 'Mapping and data quality' sub-codes are a frequent recommendation for flood inquiries. 'Assets and technology' is a frequent recommendation for bushfire inquiries. Research recommendations are also a key recommendation for flood and all-hazard inquiries.

Response

When compared across all hazards, 'bushfire' and 'cyclone' hazards have more recommendations relating to response with 21.4% of response recommendations for bushfire and 21.4% of response recommendations for cyclone. The 'communications and warnings' sub-code makes up 73% of the cyclone related recommendations. 'Inter-agency communication' is present the most for all-hazard and storm inquiries, while 'Inter-service communication' is a focus for several hazards.

Responsibility

'Responsibility' is one of the most frequently used codes for recommendations in the database. This continues to be frequently used and has not changed from the previous 10 years (2015 – 2024) when compared to the 10 years prior (2005 – 2014). The 'community education' sub-code is most coded for 'bushfire' hazard inquiries. Whereas the role of governments identified through the 'Government responsibility' 'role of local government' and 'role of Commonwealth Government' are more frequently used for other hazards.

Discussion

The purpose of this research is to identify key recurring themes, patterns and insights from an analysis of disaster inquiries and recommendation themes that can inform future policy development, emergency management strategies and risk mitigation efforts.

What does this mean for informing future policy development, emergency management strategies and risk mitigation efforts?

The Centre's *Biennial Research Plan*[12] sets the key focus and capability areas for the Centre, shown in Figure 8. The key focus areas of *understanding and mitigating risk*, *land-use planning and urban design, environmental solutions, next generation and capability* and *social equity* are in the sphere of disaster risk reduction. Whereas the key focus area of *resilient recovery* is more aligned with disaster recovery. The analysis of priority themes and the recommendations in the database can be used to inform future research and policy direction and can influence the role and advocacy efforts of the Centre.

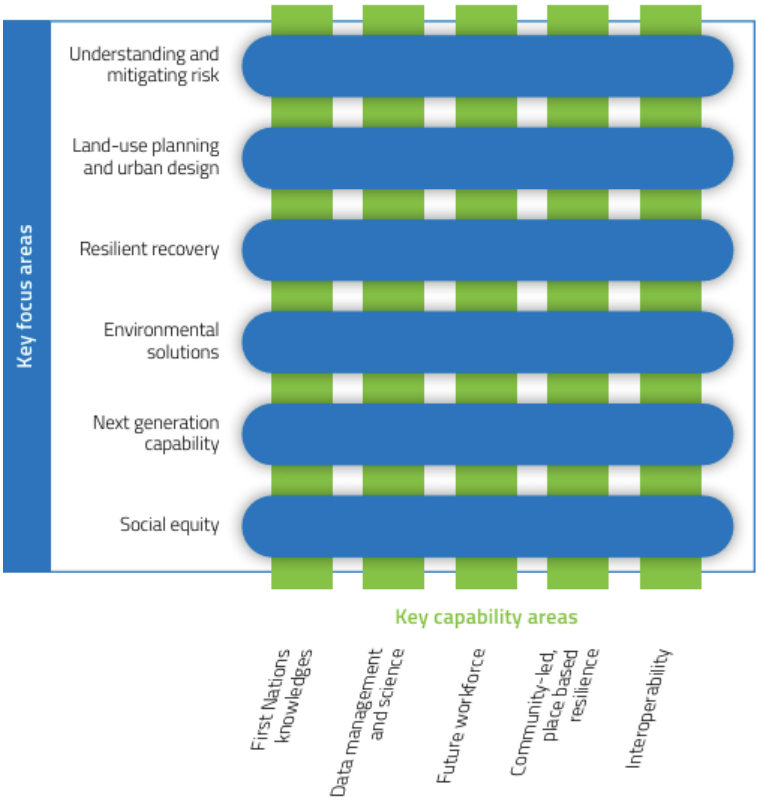

FIGURE 8: NATURAL HAZARDS RESEARCH AUSTRALIA KEY FOCUS AND CAPABILITY AREAS. NHRA BIANNUAL RESEARCH PLAN.

As identified through the MCA, there is a gap between the themes of the recommendations in the current database and the emerging priorities for addressing natural hazard disaster risk. The underlying finding is that the themes identified as a high priority to natural hazard disaster risk are not as frequent in the recommendations. This is likely due to the limited terms of reference and scope of inquiries. However, it is noted that this has been evolving over recent years and the nature and scope of inquiries is becoming more aligned with DRR strategic policy. Moreover, the prioritisation of these themes highlights the recognition of their criticality by workshop participants in the face of national policy and emergent focus of inquiries, which is cognisant of their contribution to systemic disaster risk reduction.

[12] (Natural Hazards Research Australia, 2024)

In identifying these trends, there is the potential for the future research focus of the Centre to assist in bridging the gap between the operational and enabling focused recommendations stemming from the inquiries and the strategic planning and implementation of tangible recommendations to address disaster risk and resilience more holistically.

The key areas of research focus of the Centre are reflective of emerging inquiry recommendations in policy, and to guide the translation of recommendations into policy and practice, and how to implement the recommendations to ensure the tangible actions to address disaster risk and resilience.

Future policy development

The MCA-identified themes that are either a high priority but not frequently coded in the database, or a few themes that were both high priority and frequently coded. Future research and, if needed, future policy development could further explore the priorities and frequencies of the themes. Future research and policy could explore how the identified higher priority recommendations have been implemented in practice. This would provide insight as to whether these themes have been extensively explored, learned from, and successfully implemented in natural hazard disaster response, recovery, resilience and risk mitigation. The themes identified as most frequently used and a high priority, and should be the focus of this future research, are:

- Community education
- Funding
- Assets and technology
- Insurance and legal liability
- Mapping and data quality.

Future research and policy development should also be explored to understand the lessons learned from specific natural hazard events, disaster seasons, as well as strategic DRR aspects specific to the themes identified as a high priority but are not that common in the database. The themes identified as a high priority but that were underrepresented in the database, and should therefore be the focus of future research and policy are:

- Climate change
- Biodiversity
- Disaster risk management.

Climate change is the least represented sub-code in the recommendations database. However, the climate change theme has only emerged in inquiry recommendations over the last five years. Given the evolving scope of terms of reference for inquiries, and the observed change in focus of disaster inquiries to look at disaster seasons and risk more strategically, it is anticipated that climate change recommendations will continue to evolve in the years to come, and this should continue to be an area of sustained focus.

Future research will enable an enhanced understanding of the influence and subsequent lessons learned from disaster events and seasons in relation to the above. From this research, future policy development could focus on further understanding, embedding, and strategically planning for climate change, biodiversity, and disaster risk management in all stages of natural hazard events including response, recovery, resilience and risk reduction.

Natural hazard preparedness and emergency management

As noted, in the last five years inquiries have increased the consideration of disaster risk more strategically, examining disaster seasons and strategic and systemic hazard environments, rather than single hazard events. It is foreseeable that this observed trend is likely to continue, maintaining a strong focus on natural hazard disasters more strategically, offering a more comprehensive and holistic approach to the consideration of disaster risk reduction. The observed broadened scope of inquiries is likely to continue to allow for the identification and recommendation of systemic issues, leading to more effective and coordinated risk-based management and planning contributing to resilience building.

Risk mitigation

Recommendations relating to preparedness remain underrepresented in the database; however, there has been an emerging shift towards disaster risk reduction and resilience in both policy and in recent inquiries and the recommendations, such as the emergence of climate change recommendations over the last five years.

The themes identified as the highest priorities sit within the broader codes of responsibility, preparedness and research and technology. However, agency organisation and responsibility dominate recommendations in the database.

Although risk reduction and mitigation are not exclusively highlighted through recommendations in inquiries (often due to the limited scope), it does not mean that apparent gaps cannot be addressed in other ways. The ongoing implementation and monitoring of recommendations from past reviews, coupled with ongoing research collaboration of key stakeholders, policy development, and advocacy, provides an opportunity to address risk more holistically.

Conclusion

The purpose of this research was to conduct a comprehensive analysis of recommendations from Australian inquiries, reports and reviews related to natural hazards and disaster risk reduction. The aim was to identify key recurring themes, patterns and insights that can inform future policy development, emergency management strategies and risk mitigation efforts. The analysis has synthesised synergies and potential gaps within the context of natural hazards and disaster risk reduction policy in Australia.

The key findings from the research are:

- **The most frequently coded recommendations were not those identified as highest priority,** highlighting a potential gap between the findings from inquiries and the developing policy and strategic landscape of natural hazard risk.
- **Recommendations traditionally focused on key aspects like response and agency organisation,** but more recent inquiries expand the volume of recommendations that address contemporary risk reduction matters.
- **Inquiries are increasingly examining disaster seasons rather than specific events,** demonstrating the emerging trend of a more strategic and holistic approach to natural hazard disaster management.
- **There is a clear distinction between prevention, preparedness, response and recovery (PPRR) themed recommendations and disaster risk reduction (DRR) themed recommendations,** however, the consideration of all aspects of risk holistically is evolving.

The findings from this research can be used to inform the sector's engagement with inquiries as a tool for learning and improvement, and to inform future research and policy direction for the sector.

Future research should be explored to understand the lessons learned from specific natural hazard events, disaster seasons, as well as strategic DRR aspects specific to the themes identified as a high priority but are not that common in the database. Future policy development could focus on further understanding, embedding, and strategically planning for climate change, biodiversity, and disaster risk management in all stages of natural hazard events including response, recovery, resilience and risk reduction.

Considering the focus of recommendations, there is scope for policy development to holistically embed and strategically plan for disaster risk management. The implementation and monitoring of recommendations from past reviews, coupled with ongoing lesson learning about trends, will continue to strengthen the tool of inquiries to enable safer, resilient and more sustainable communities in Australia.

Team members

Laura Dance

Laura is a strategic planner with extensive experience in strategic planning and policy analysis, specialising in sustainable urban development, urban form, and climate adaptation and resilience. Her work focuses on integrating climate change adaptation and mitigation into planning frameworks and public policy to support the development of climate-resilient cities.

With a strong foundation in policy analysis, Laura is experienced in policy research, critical analysis, drafting, and implementation. Her research interests lie at the intersection of urban planning, climate risk, and community resilience, where she seeks to challenge conventional approaches and contribute innovative, evidence-based perspectives.

Laura's academic background includes a Master's degree that explored climate resilience, health and wellbeing, and social value in urban environments—reflecting her commitment to fostering sustainable and thriving cities through research and policy influence.

Ryan McNeilly Smith

Ryan McNeilly Smith is a land-use planner and urban designer specialising in urban climates. He is an emerging leader in the field of urban planning and design responses to heat and heatwaves. He is Queensland's 2024 Young Planner of the Year.

Ryan has experience across a variety of fields, including urban climate policy, strategic planning, policy review, urban design and placemaking, community engagement, and human and social disaster recovery. Ryan holds a degree in Urban Design and Town Planning (Class I).

Ryan's PhD is founded in bioclimatic design principles, his research combines human factors and systems methods with microclimatic computational simulations to understand the impacts of urban planning and design policy on microclimates and heat.

Laura Gannon

Laura is a nationally recognised risk-based land use planning and resilience specialist with 20 years of experience across Australia and both the public and private sectors. Laura specialises in the integration of natural hazard risk management into policy, strategy and governance, with an emphasis on bushfire risk, resilience and climate adaptation.

Laura's work is highly regarded, receiving the 2023 and 2021 PIA Queensland Climate Change and Resilience Award for Planning Excellence, and with case study projects cited as best practice in the 2020 AIDR Land Use Planning for Disaster Resilient Communities Handbook.

Laura is a recognised leader in the planning profession, awarded the 2022 PIA Queensland Outstanding Woman in Planning and Australian Young Planner of the Year in 2011.

Stephen Dredge

Stephen is the Director of Australian-based land-use planning, resilience and adaptation firm Meridian Urban. He is a trusted advisor to all levels of government and communities across Australia in risk-based land use planning, resilient urban growth management, disaster risk reduction, and adaptation. He is driven by his passion for enabling local communities to realise their visions for sustainable and resilient settlements.

He has designed and delivered multi-year and multi-million dollar planning programs that have influenced for the better where and how our settlements develop, and has created, led or supported much of the risk-based land use planning policy development work undertaken in Australia since 2011.

He has developed and implemented disaster risk reduction, resilience and climate adaptation policy in the built and socio-economic environments at regional and local scales across Australia. He provides trusted advisory, thought leadership and technical support for specific settlements, broader governance reviews and strategic policy or regulatory system changes.

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Appendix 1: Additional methodology notes

The below provides additional detail on the methodology used for this research.

Phase 1: Database update

The NHRA Inquiries and Reviews Database was updated to include inquiries from April 2023 – January 2025.

The inclusion criteria for the database update were inquiries that:

- were released between April 2023 and January 2025
- focused on the hazards outlined in the Centre's biannual research plan
- included recommendations

To update the database, a comprehensive search strategy was developed to ensure that all possible inquiries relating to natural hazards were included.

The search engine strategy used is as follows:

- <jurisdiction> + natural hazard OR emergency management OR disaster review OR inquiry. For example: "Queensland" "natural hazard" "review" and "New South Wales" "disaster" "inquiry"
- <jurisdiction> + hazard + review OR inquiry. For example: "Queensland" "flood" "review" and "Victoria" "bushfire" "inquiry".

A review of relevant jurisdictional websites was undertaken, including each jurisdiction's:

- parliamentary website (e.g. parliamentary committees)
- coronial database
- auditors-General reports
- Inspectors-General of Emergency Management reports (where relevant)

Inquiries which were outside of scope (e.g. outside the scope timeframe) for this review but may have relevance to the database have been noted for future inclusion in the database.

Each recommendation was independently coded against the existing set of codes and sub codes used for previous updates to the database. As part of the quality control process, coding was reviewed by a different individual. Any discrepancies were flagged, discussed internally and then updated if required.

It is noted that a limitation of the database is that a recommendation can only be coded against a single theme.

Phase 2: Thematic analysis and cross comparison

Following completion of the database update for 2023 to 2025, the new inquiries and recommendations were combined with previous existing database to begin analysis.

Power BI was utilised to analyse the combined dataset, with a focus on the past twenty years of inquiries and recommendations. An inductive approach was used to interrogate the dataset and draw out observations. This approach was guided by emergent themes noted during the database update and national emergency management and disaster risk reduction policy environment at the time.

New categorisations fields for inquiries were developed to further analyse the data. This included the edition of inquiry event timeframes (i.e. season reviews).

Phase 3: Multi-criteria analysis

A multi-criteria analysis (MCA) was undertaken to further analyse the data and understand how themes would be prioritised for the Centre. Two multi-criteria analysis options were developed, each with separate criteria. These were reviewed, tested and discussed with members of the Centre and one MCA option was decided on.

A stakeholder workshop was held on Friday 4th April 2025 to discuss, agree upon, and provide insights to weighting the criteria for the multi-criteria analysis. 31 attendees from emergency management, disaster preparedness, and research fields attended.

Themes

The themes to be tested through the MCA process were determined to be the sub-codes used for the coding of recommendations. This provides a finer level of detail of the recommendations than the overarching codes and will provide further analysis to the thematic analysis already undertaken to date.

Criteria

The initial criteria developed for the MCA process are listed in Table X below. These criteria were derived from considering best practice knowledge or disaster risk and resilience, and were discussed in the stakeholder workshop.

Criteria	Sub-criteria	Description
Benefits	Multi-hazard	The theme addresses more than one hazard
	Co-benefits	The theme has additional co-benefits
	Geography	Estimated number of people and assets addressed by the theme (i.e. nationally and state applicable themes may be preferable than one which is hyper local)
	Timeframe	Consideration of the timeframe for expected benefits of the inquiry theme, such as how far into the future these may be expected and if these are sustained for multiple years
	Effectiveness	The effectiveness of the theme in reducing natural hazard disaster risk / enhancing recovery
Variabilities	Timing	The theme can be implemented in a relatively short amount of time (i.e. within 12 months). In general, measures that can be implemented quickly are considered more viable and less subject to variability

	Stakeholders	The implementation / effectiveness of the theme is dependent upon multiple stakeholders
	Dependencies	The implementation / effectiveness of the theme is dependent upon external / other variables
Policy & Strategy	NDRRF alignment	The direct alignment of the theme with more than one outcome of the Second National Action Plan