Home insurance affordability

and socioeconomic equity in a changing climate

About the Actuaries Institute

The Actuaries Institute ('the Institute') is the sole professional body for Actuaries in Australia. The Institute provides expert commentary on public policy issues where there is uncertainty of future financial outcomes. Actuaries have a reputation for a high level of technical financial expertise and integrity. They apply their data analytic and risk management expertise to allocate capital efficiently, identify and mitigate emerging risks and help maintain system integrity across multiple segments of the financial and other sectors. Our public policy principles can be viewed at: https://actuaries.asn.au/public-policy-and-media/public-policy/policy-principles.

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Actuaries use data for good by harnessing the evidence to navigate into the future and make a positive impact. They think deeply about the issue at hand, whether it's advising on commercial strategy, influencing policy, or designing new products. Actuaries are adept at balancing interests of stakeholders, clients, and communities. They are called upon to give insight on complex problems, they will look at the full picture. Actuaries analyse the data and model scenarios to form robust and outcome-centred advice.

The Actuaries Institute acknowledges the traditional custodians of the lands and waters where we live and work, travel and trade. We pay our respect to the members of those communities, Elders past and present, and recognise and celebrate their continuing custodianship and culture.

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Glossary

Term	Description
AAHIA Index	Australian Actuaries Home Insurance Affordability Index
ABR	Australian Business Roundtable for Disaster Resilience and Safer Communities
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ARI	Annual Return Interval
ARPC	Australian Reinsurance Pool Corporation
CMSI	Climate Measurement Standards Initiative
CRP	Cyclone Reinsurance Pool as announced by the Commonwealth Government and which commenced on 1 July 2022
Defin'd	Finity's database of demographic and socioeconomic information for Australian Households, described in Appendix E
GCM	General Circulation Model
IPCC	Intergovernmental Panel on Climate Change
LGA	Local Government Area
NbS	Nature-based Solutions
RCP	Representative Concentration Pathway
SEIFA	Socio-Economic Indexes for Areas produced by the ABS
Vulnerable or base households	Defined in section 3.2

Executive summary

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1.1 Home insurance premium affordability today

Developing resilience to natural disasters will be crucial to how well Australia adapts to the changing climate. Among the many factors that affect resilience is economic and financial capacity, of which insurance can be an important part. Concern around insurance affordability and availability is already prominently on the agenda of many stakeholders, from consumer groups to regulators and governments. It is therefore important to understand the specific impact insurance can have on resilience and socioeconomic outcomes and how we should prepare for this in a changing climate. This Paper seeks to fill that gap by building on earlier Institute research, addressing data limitations, modelling climate change projections at local levels and aggregating the results to understand the national picture.

> **Home insurance premium affordability is not only affected by the risk of extreme weather but is also driven by socioeconomic disadvantage.**

Today, the median Australian household uses 1.1 weeks of gross annual income to pay a median annual home insurance premium of about $1,500. Income after taxes and household expenses is lower, so home insurance premium costs are a much larger portion of net household income.

However, this does not tell the full story of home insurance premium affordability, which we have measured as the ratio of the annual home insurance premium to the annual gross household income, expressed in weeks. This **Australian Actuaries Home Insurance Affordability** (AAHIA) Index varies from 0.2 weeks for households with the most affordable insurance premiums to in excess of 7.1 weeks for 0.5 million (5%) of households with the most unaffordable insurance premiums.

The one million households with AAHIA exceeding four weeks (which we define in this paper as **vulnerable households** – those experiencing extreme home insurance affordability pressure) are concentrated in Northern Queensland, NT and Northern NSW, while remaining households (**base households** – those experiencing no pressure to high pressure) are concentrated in capital cities.

The median AAHIA for base households is 1.0 week of gross household income. In comparison, the median AAHIA for vulnerable households is 7.4 weeks – more than 7 times the median for the base population. For households where the annual home insurance premium is over $2,000, half earn less than $65,000.

Concern about insurance affordability and availability has become a prominent issue.

Figure 1.1 – Australian Actuaries Home Insurance Affordability Index by percentile[1,2]
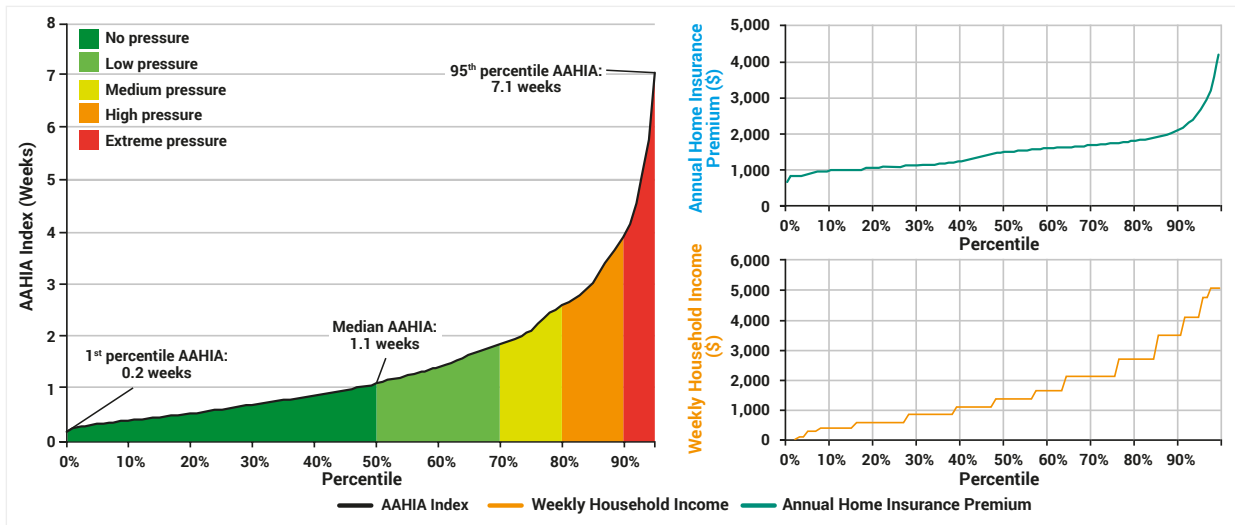
> Individuals living in these one million vulnerable households facing home insurance premiums more than four weeks of gross income are more likely to be older, retired and renting[3], have lower insurance literacy[4], live in socioeconomically disadvantaged areas, and have lower current saving balances.

Figure 1.2 – Population characteristics of vulnerable and base households

1 Home insurance premium and household income shown to the 99th percentile, and AAHIA shown to the 95th percentile, due to significant increases in the premium and AAHIA in the highest percentiles.

2 The AAHIA Index is calculated for each household, regardless of whether or not insurance is purchased for the house and does not consider under-insurance.

3 We have assumed that landlords will pass on buildings insurance premiums to renters.

4 Defined in Section 2.7

1.2 Impact of climate change

> Climate change is not just an environmental and financial issue, but also one of socioeconomic equity. Households that are already struggling to pay home insurance premiums will also suffer most from the impacts of climate change on home insurance premiums.

Overall across Australia, climate change is expected to materially increase the risk of extreme weather events, though the impacts will vary across the nation and by different types of perils. The impacts of climate change on the vulnerable population are far greater than the base population under the climate scenarios we have considered.

Under a scenario[5] where global warming remains below 2°C by 2050 and all other factors remain constant, median AAHIA in 2050 will increase by 0.2 days for base households but 7.6 days (14%) for vulnerable households.

Under a scenario with continued high emissions where global temperatures rise by approximately 3°C by 2100, the median AAHIA in 2050 will increase by 0.4 days for base households but 10.7 days (20%) for vulnerable households.

While these figures are concerning in themselves, it is important to note that they still represent average impacts and approximately 50% of vulnerable households will experience even worse deterioration in home insurance premium affordability.

Further, since these figures represent only the change in home insurance premiums, they do not include other exacerbating factors that may also arise from climate change[6].

Under a high emissions scenario, premium affordability deteriorates a further 20% for vulnerable households.

Figure 1.3 – Increase in median AAHIA under a high emissions scenario
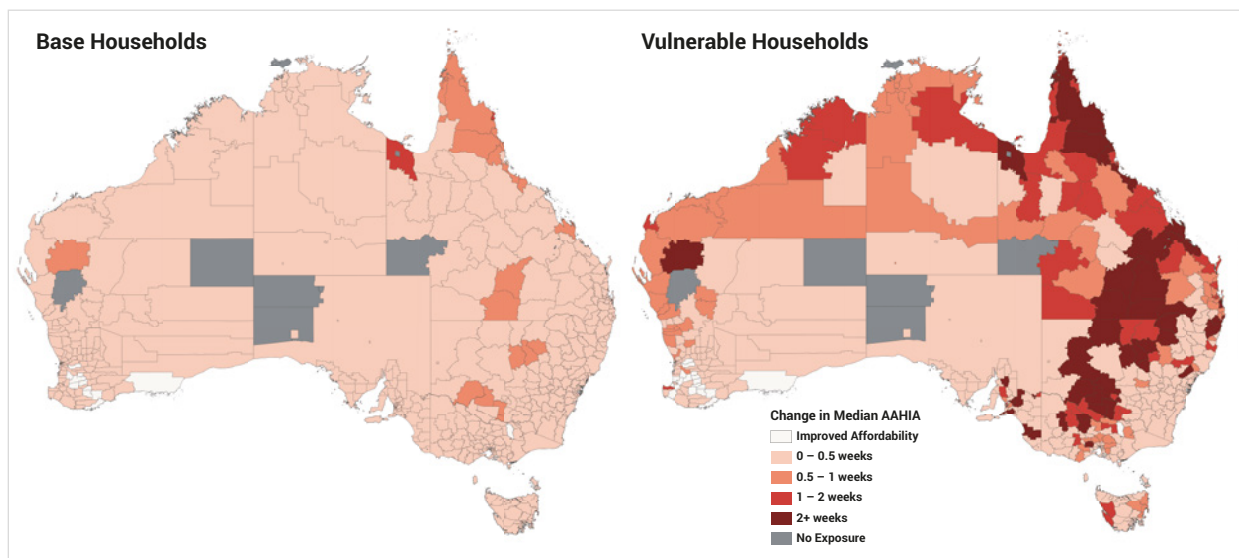
Figure 1.3 compares the impact of the high emissions climate scenario on the median AAHIA between base and vulnerable households by Local Government Area (LGA). The majority of the base population will see increases of up to half a week of income. However, climate change will worsen the pressures experienced by the most vulnerable – those already facing high or extreme affordability pressures. Northern Queensland will face the highest median AAHIA increases, but other regions in Northern Australia and Central NSW will also see significant home insurance affordability pressure. By 2050, around 1 in 25 LGAs will have a median AAHIA of more than four weeks of household income. This compares to around 1 in 45 LGAs today.

1.3 Recommendations

By acting today, policymakers can begin to address home insurance affordability and the socioeconomic inequities of climate change. We make the following recommendations for action. Importantly, these actions will require strong collaboration between multiple parties, including local, state and Commonwealth governments, insurers and banks, builders and developers, and First Nations Australians.

5   Climate scenarios are defined in Section 3.3.

6   These may include, among others, the following:
- Economic impacts on households as the Australian economy shifts to net-zero emissions, including impacts on employment and income;
- Insurance premiums represent the average expected cost of claims. Actual claims experience varies substantially from year to year, and can considerably exceed premiums;
- Home insurance does not generally cover other hazards such as soil contraction, coastal inundation and erosion, which may also adversely impact households;
- Climate change may have significant physical impacts on agriculture and global supply chains, driving up inflation or otherwise resulting in shortages of essential goods and services; and
- Actual impacts from climate change could differ from the scenarios assessed in this paper.

> **Systemic solutions such as better building standards and land use and planning have the potential to reduce inequity.**

1. Investment in resilience measures is required to address home insurance affordability pressure for vulnerable communities. Such investments include infrastructure projects or nature-based solutions to protect vulnerable communities, measures for individual homes, as well as direct subsidies for vulnerable households.

2. Investments with a focus on those measures that have a high benefit to cost ratio and allow for the impact of climate change are needed to effectively and efficiently address home insurance affordability pressure.

3. Systemic solutions such as better building standards and land use and planning have the potential to reduce inequity, especially if applied to social as well as private housing, and by avoiding development in high-risk areas such as flood zones.

4. State based stamp duty and levies also have a compounding impact on home insurance affordability issues by penalising those with the highest insurance premiums. We recommend that these taxes are replaced with alternative revenue sources that are more equitable and efficient.

5. In areas where mitigation and adaptation systems cannot adequately or economically manage the losses suffered from persistent severe weather events and rising sea levels, communities may need to consider relocating some or all of its people and assets. Policymakers should advance frameworks for planning managed retreats.

6. The Cyclone Reinsurance Pool (CRP) has the potential to reduce inequity, especially in Northern Australia where vulnerable households are over-represented. However, the CRP is a systemic market wide solution to a problem in specific communities, and is likely not to be as effective or efficient as measures that are targeted at households with home insurance affordability pressure. The current CRP is intended to be cost-neutral to government, with no cash subsidy from the taxpayer. We recommend that options to subsidise home insurance for lower income households be explored, in order to improve the effectiveness of the CRP in improving affordability. By encouraging take up of home insurance, this will also reduce the burden post-event on governments, charities and other groups in supporting recovery for communities and households.

7. The Australian Reinsurance Pool Corporation (ARPC), which manages the CRP, has included reductions in premiums for households that undertake cyclone mitigation measures. Depending on the take up and expansion to additional measures, the CRP has the potential to address the need for adaptation and resilience and to ensure the long-term sustainability of the CRP. We recommend that the ARPC continues to investigate other resilience and mitigation measures and to monitor the take up of these options. Information captured by the ARPC on the vulnerability of houses in cyclone zones, together with the mitigation measures, will be valuable in developing policy for future resilience measures.

8. There are significant opportunities to improve policy and decision making through better information on natural hazards, and the impact of climate change. This will help households, communities and local governments to make better informed choices on resilience measures and mitigation spend. Australia lags behind other jurisdictions where such information is

more broadly available. Providing this information through a public central database should improve efforts to address home insurance affordability. In particular, we recommend the following:

a   Explicit inclusion of home insurance affordability measures in broader measures of housing affordability;

b   Nationally consistent, publicly available, climate-adjusted flood hazard maps across Australia;

c   Open source modelling of natural disaster risks incorporating climate change impacts;

d   Publicly available high-quality up-to-date exposure and vulnerability data across Australia for all buildings and infrastructure, including any mitigations carried out to date;

e   Prioritise the development and implementation of a national strategy to address resilience in existing buildings and infrastructure; and

f   Prioritise the development and implementation of a national strategy to embed climate and disaster risk considerations into land use and planning, including close consultation with insurers.

9   Nature-based solutions to adaptation and mitigation should be further explored. The implementation of resilience measures should include close consultation with First Nations Australians, including recognition of indigenous knowledge on land management.

There are significant opportunities to improve policy and decision making through better information and data analysis on natural hazards.

2 Introduction and background

2.1 Why has the Actuaries Institute released this Green Paper?

Over the last decade, Australia has seen the increasing costs of natural disasters, including the floods in Queensland and NSW in 2022, and the extended bushfires in the Black Summer of 2020. This is consistent with the key conclusion of the Intergovernmental Panel on Climate Change (IPCC) in the Sixth Assessment Report (IPCC, 2021), that:

> **It is indisputable that human activities are causing climate change. Human influence is making extreme climate events, including heatwaves, heavy rainfall, and droughts, more frequent and severe.[7]**

Figure 2.1 shows that insurance losses have increased over recent years compared to long-run historical averages, approximately adjusted to reflect current housing stock and historical building cost inflation. The breakdown by natural hazards shows the variability in weather patterns year on year.

7   From Climate Risk Task Force IAA and WGI Technical Support Unit of IPCC, 2022, p. 4.

Figure 2.1 – Historical insurance losses in Australia[8]
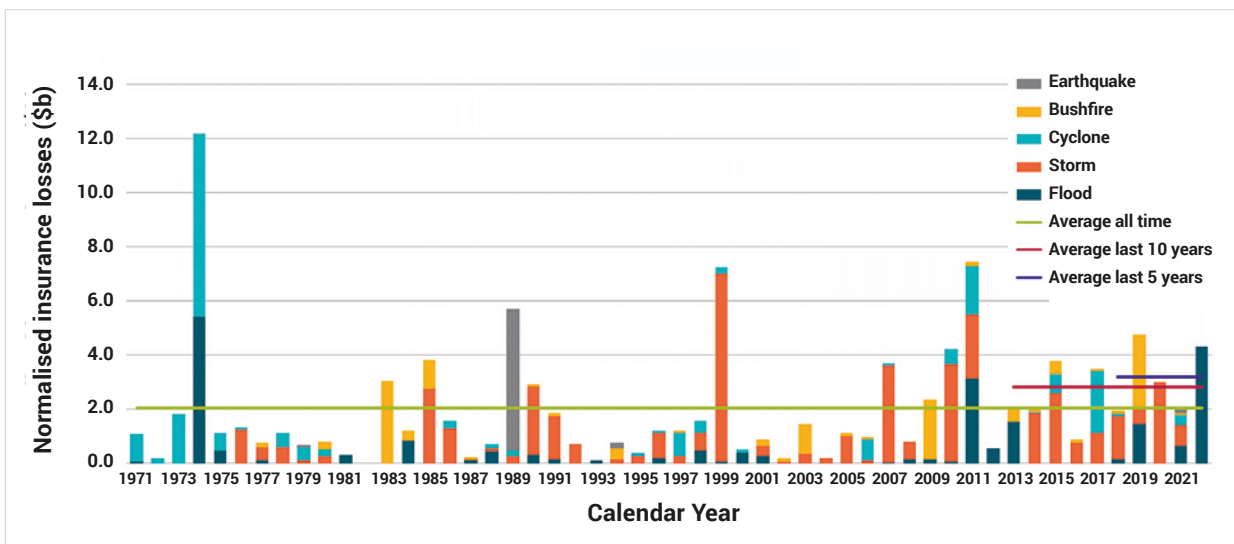
8   Inflated to current values and allowing for exposure growth at 2% per annum. Source: Finity analysis of Insurance Council of Australia data. Storm includes damage from severe convective storms, east coast lows and hailstorms.

In addition, insurers have applied increasingly sophisticated techniques and more granular data to price home insurance. This is more prevalent for natural hazards like cyclone and flood, where different locations within postcodes can have a significant variation in risk level.

> A combination of increasing insurance losses and granular pricing approaches has resulted in significant increases in some home insurance premiums, and a wide variation in those premiums across Australia (ACCC, 2020).

2.2 Government response to insurance affordability issues

In response to these trends the Commonwealth Government has undertaken a series of investigations into insurance affordability, including the Productivity Commission Inquiry into Natural Disaster Funding (2014), the Northern Australia Insurance Premium Taskforce (2016), the Senate Standing Committee on Economics Inquiry into Australia's general insurance industry (2017), the Royal Commission into National Natural Disaster Arrangements (2020), and the Australian Competition and Consumer Commission (ACCC) Northern Australia Insurance Inquiry (2020). These investigations provided a range of recommendations, mostly focussed on measures to improve the resilience of households to natural disasters. None of these reports recommended a government reinsurance pool, with the ACCC concluding that "we do not consider that a government reinsurance pool would be an effective way to address affordability issues in Northern Australia at this time" (ACCC, 2020).

Nevertheless, mounting community pressure for a solution led to the Commonwealth Government forming a Treasury-led Taskforce to establish a reinsurance pool for cyclones and related flood damage. The CRP commenced on 1 July 2022, backed by a $10 billion Government guarantee. The CRP also introduces discounts for households that undertake mitigation work to reduce the risk of damage from cyclones. We discuss the CRP in greater detail in Section 6.7.

2.3 Equity

This Green Paper focusses on the current inequities caused by home insurance unaffordability, and the exacerbation of inequities expected to emerge in the future as a result of the changing climate, through construction and analysis of an AAHIA Index[9]. The AAHIA Index is based on the framework proposed in the Actuaries Institute's Property Insurance Affordability Research Paper (Actuaries Institute, 2020). We also discuss possible policies to increase the resilience of the Australian population to natural hazards, with a focus on home insurance affordability and equity.

The pricing of home insurance is based on a variety of factors, which insurers use to understand the relative riskiness of one property compared with another. Examples of this include the level of the sum insured, the year the home was built and the types of construction materials used. Location plays an important role and where individual households are exposed to high natural peril risks the insurance premiums are often significant.

Equity is often considered with reference to what is fair and just. In the context of home insurance premiums, questions around equity include:

▶ Is it fair to charge premiums that reflect the full expected impact of natural disasters to only those that are exposed to those disasters?

Over many years, the government has undertaken a series of investigations into insurance affordability.

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9 The AAHIA Index is calculated for each household, regardless of whether or not insurance is purchased for the house, and assumes no under-insurance.

Location plays an important role and where individual households are exposed to high natural peril risks the insurance premiums are often significant.

▶ Or is it fair to share the cost of natural disasters impacting a smaller number of homes across the population, for example through cross-subsidies of premiums between higher and lower risk homes?

In this Green Paper, we focus on the questions: who faces the highest home insurance premiums, are they able to afford it, and are the most vulnerable Australians living in Australia's most vulnerable housing?

Our framework for considering **equity** is as follows.

▶ We identify the households most vulnerable to home insurance affordability stress through high home insurance premiums and/or low household income.
▶ We identify the socioeconomic characteristics of these vulnerable households and compare them with households where home insurance is more affordable (base households), including considering differences in savings, financial literacy, socioeconomic status and geographic location.
▶ We consider the impact of climate change on home insurance premiums.

2.4 Frameworks for disaster risk management

Figure 2.2 summarises the relationship between natural disasters, vulnerability and disaster resilience.

Figure 2.2 – Natural disasters, vulnerability and resilience

This Green Paper considers the impact of climate change on home insurance premiums.

Disaster risk management has traditionally focussed on measures that lessen the scale or severity of the impact of natural hazards on communities, with a focus on hard infrastructure solutions such as levees and seawalls.

In more recent decades, the framework for disaster management has expanded to incorporate the concept of **vulnerability** – disasters only occur when there is an intersection between natural hazards, and exposed and susceptible populations (UNDRR, 2022).

Hazards such as cyclones, floods and storms are inevitable, but their impact on communities depend critically on economic, planning and other socioeconomic decisions that will alter the community's vulnerability to hazards and change how the hazard impacts them.

All communities are vulnerable to some extent, but social and economic disadvantage increase the risk and impact of disasters for certain communities over others (Parsons, et al., 2020). For example, people with disabilities are significantly more likely to suffer injury or death during a disaster, but those with strong support networks are more likely to survive (Quaill, Barker, & West, 2018). Informal care responsibilities following a disaster fall disproportionately on women, who are also more impacted financially than men (Parkinson, Duncan, Kaur, Archer, & Spencer, 2022). In addition, displacement due to natural hazards is more likely to affect First Nations Australians[10] (Miranda, Du Parc, Benet, Kurkaa, & Fung, 2020).

Resilience refers to the capacity of a community to absorb and adapt to shocks and stresses. The resilience of a community is the result of interactions between many factors, including: physical factors such as protective infrastructure, building codes, and land use planning; social factors such as available care systems, strength of community ties, attitudes to disaster preparation, and access to goods and services; economic factors, which impact the ability to absorb or transfer the financial impact of disasters, such as insurance; and governance factors, such as the level of emergency relief, and the speed of clean-up, recovery and rebuild.

Evidence in Australia and the US shows there are significant links between economic and financial capacity and disaster resilience (Parsons, et al., 2020). However, there has been limited research on how insurance interacts with resilience and equity, due in part to insurance data not being available to researchers. This Green Paper also expands the available resources on the economic and financial capacity of communities in Australia, through considering savings levels and insurance literacy.

2.5 Perceptions of disaster risk

The Australian population is generally well aware that the country is susceptible to natural hazards. However, the level of risk exposure is typically understood with reference to historical events. Climate change has altered the profiles of extreme events, and events of the past may no longer provide a reliable indicator for how natural hazards will impact communities in the future. A recent example is the extreme flooding affecting eastern Australia in early 2022 (Climate Council, 2022). Many of the affected communities have faced floods in the past, but were devastated by unprecedented levels of damage.

10 We recognise that Australia is made up of many different and distinct Aboriginal and Torres Strait Islander communities, each with their own culture, language, beliefs and practices. First Nations Australians inhabited Australia some 60,000 years ago, and are referred to in a variety of ways, including as Aboriginal and Torres Strait Islander peoples, First Australians, Sovereign Peoples, or Indigenous Australians.

Increasingly, the severity of a disaster is referred to in media as a '1 in X year' event, where X is the annual return interval (ARI). The early 2022 floods were referred to by various government authorities as 1 in 500 year; 1 in 1,000 year; and 1 in 3,500 year events (Grieve, 2022). Over the last three years, there have been at least three separate catastrophes impacting NSW alone labelled as a '1 in 100 year' (or greater) disasters – the 2020 Black Summer bushfires, the 2021 floods, and the 2022 floods – along with the COVID-19 pandemic, the deadliest global viral outbreak in over a century.

There are many issues with this language.

- ▶ It can be misinterpreted as saying if a 1 in 100 year event occurred last year, then one will not occur for another 100 years. This is incorrect, as such an event (or worse) could occur again with a probability of 1%.
- ▶ It is very difficult to precisely measure the ARI, especially with records only available in Australia for at most 200 years.
- ▶ The ARI varies depending on the area you are considering, and generally is not comparable. For example, the ARI for a cyclone affecting a specific community in Queensland is much higher than the ARI for a cyclone occurring anywhere in Queensland.
- ▶ The ARI does not provide any information on the damage associated with such an event. In flood, for example, at the 1 in 200 year ARI the flood depth could be 0.1m or 10m, with very different outcomes.
- ▶ ARIs for events have changed historically and are expected to change further under future climate scenarios. For example, heavy precipitation over land events (a key driver of flood risk), which in pre-industrial times were 1 in 10 year events, are now 1 in 7.7 year events and 6.7% wetter when they occur. Under future climate scenarios this could increase to 1 in 6.7 year events and 10.5% wetter (under a 1.5°C global warming), or even 1 in 3.7 year events and 30.2% wetter (under a 4°C global warming) (IPCC, 2021).

Despite awareness of these issues the use of this language continues, rather than a shift to saying, "There's a 1% chance of this event occurring."

Historical land planning and building standards have contributed to the impact and severity of disasters, as building approvals granted by governing authorities implicitly provide assurance of safety. Communities in these areas may lack awareness of the potential risks, or the ability to relocate to safer locations. Even where individuals might understand the risk of natural hazards, they may not factor this into their decision making. For prospective homebuyers, exposure to natural hazards is generally only considered immediately following a severe event (Cheung & Yiu, 2022). In Australia, in areas devastated by disasters, it may take as little as three to five years before house prices recover (Owen, 2022). In a heated housing market, this may further encourage or force homeowners to build or purchase sub-standard or poorly located houses disregarding the potential disaster risk, or to have even less financial resilience (in the form of equity in the property or other savings) to help manage recovery and improve their resilience. Access to reliable data about home insurance risk is important to limit the construction of less resilient homes in highly vulnerable areas. We discuss this in greater detail in Section 6.8.

Historical land planning and building standards have contributed to the impact and severity of disasters today.

2.6 The role of insurance in disaster risk management

In the context of disasters, home insurance provides the means to start the process of rebuild. The Productivity Commission Inquiry into Natural Disaster Funding found that insurance is an important disaster risk management tool (Productivity Commission, 2014). Gaps in insurance cover through under-insurance or non-insurance are costly to society, as they are borne by governments, taxpayers and charitable organisations, as well as those directly affected households.

Disasters stress more than the financial resilience of a household. These events cause injury and death, as well as the loss of homes and treasured and irreplaceable memories and possessions. There are also mental health and other social costs; for example, it is well documented that domestic violence increases in the wake of a disaster (Deloitte Access Economics, 2016), and lack of insurance was significantly associated with PTSD following flooding events in the UK (Mulchandani, Smith, Armstrong, Beck, & Oliver, 2019). Households without insurance become more vulnerable to these risks – a compounding impact that further exacerbates inequity.

In Australia, sophisticated methods in the pricing of home insurance premiums are employed which consider the exposure of individual properties to natural hazards. The level of home insurance premiums provides a signal of the disaster potential, and gives an incentive for policyholders to reduce the risk. However, a lack of awareness and understanding of insurance and disaster risk, as well as the absence of readily accessible information to the general public before purchasing or renting a property, means that sometimes these pricing risk signals are not adequately considered when deciding where to build, purchase or rent a home. Improvements in data availability and accessibility will improve household awareness of disaster risk, discussed in Section 6.8.

Further, insurance pricing may change over time as improved data and modelling techniques become available. This could mean that properties considered low risk at the time of purchase could see increases in cost over time. One example is the shift by insurers from largely postcode-based rating to address-based rating from 2010 onwards, with some homeowners facing significant premium increases. For many households, this increase in insurance premiums is perceived as unfair as at the time they purchased the home these risks were not accurately reflected in the premiums, and something that they have no control over.

As discussed in Section 4.1, climate change may increase the insurance risk, and insurance premiums will likely respond with some households facing potentially significant premium increases. Equity considerations around changing views of insurance risk are discussed in Section 6.3.2.

The impact of climate change on home insurance premiums increases the argument for policy intervention due to a number of factors.

- ▶ Home insurance contracts provide coverage for one year, and so are not capable of sending price signals for future climate effects.
- ▶ Building standards are often set based on current or historical evidence of the impact of perils, which is retrospective. However, climate change necessitates setting building standards on a prospective basis.

The impact of climate change on home insurance premiums increases the argument for policy intervention.

▶ Further, the natural turnover of housing stock is too slow to incorporate changes in building standards, and retrofitting solutions need to be implemented for legacy housing stock.

▶ It is almost inevitable that some homeowners will be caught in an affordability trap over time which was not foreseeable when they purchased their home.

▶ Simply charging for risk after a house has been built not only affects premium affordability, but depresses the property value, and can impact on savings and retirement plans for households.

▶ This effect is exacerbated for older Australians who are more likely to live in older homes more prone to the above effects.

2.7 Under-insurance and non-insurance

Insurance provides an important contribution to the financial resilience of individual households as well as to the wider community. However, rates of non-insurance and under-insurance, particularly in disadvantaged communities, is significant and growing (Maury, Lasater, & Mildenhall, 2021). In Northern Australia, where extreme weather events are relatively frequent compared with the rest of Australia, the rate of home non-insurance (20%) is almost double the rest of the country (11%). In particular, many areas have seen increases in non-insurance and under-insurance in recent years (ACCC, 2020). Over one-third of economic losses from natural disasters are not covered by insurance, resulting in a protection gap of $19 billion over the decade to 2021 (Swiss Re, 2022).

A key driver of the rising levels of non-insurance is increasing affordability pressure, particularly in areas of high natural hazards risk, as insurers respond to more frequent and severe extreme weather events by increasing insurance premiums. For many low-income households, other expenses are often prioritised over insurance, with some being forced to drop formerly held policies due to affordability issues (Maury, Lasater, & Mildenhall, 2021). As the climate changes, insurance affordability pressure is expected to change as discussed in Section 4.1.

2.8 Insurance literacy

Another contributing factor to non-insurance and under-insurance is low **insurance literacy** – an understanding of exposure to natural disasters and other risks, and how insurance provides an important risk management tool to compensate for the financial impact of the risk. Figure 2.3 shows how insurance literacy varies geographically across Australia, based on Finity's *Defin'd* dataset[11] which models the demographic and socioeconomic characteristics of Australian households. Details of the insurance literacy metric can be found in Appendix E.3.

Insurance literacy is generally high in the capital cities, and in regional areas close to the cities. In more remote areas insurance literacy is low, a result of lower attained education levels, lack of access to economic resources as well as socio-demographic factors like life-stage, age and ethnicity. Older Australians, those on higher incomes, and tertiary graduates are more likely to be insured, possibly due to a better understanding of value of insurance, and a greater accumulation of wealth and assets which better allow them to afford insurance coverage (Booth & Tranter, 2018).

Rates of non-insurance and under-insurance, particularly in disadvantaged communities, is significant and growing.

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11   See Appendix E

Figure 2.3 – Insurance literacy across Australia[12]
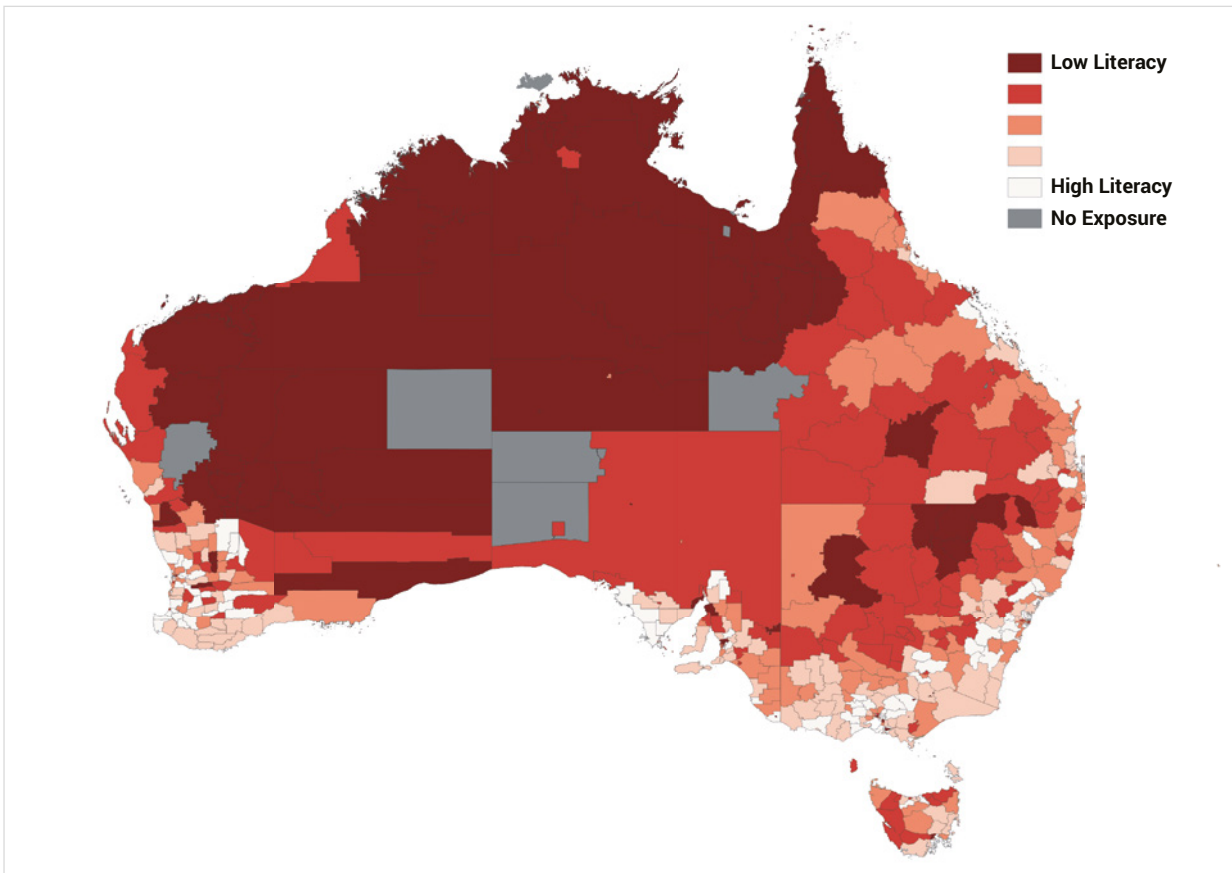
Many Australians who are under-insured, or do not hold insurance, perceive insurance to be a low value product. Customers who have not made any claims to their insurance policy over the past years were likely to consider their policy as providing no benefit. For those who do not have coverage, many view insurers as untrustworthy, based on experiences or stories about long and difficult claims process in the past (Maury, Lasater, & Mildenhall, 2021).

These findings are consistent with the ACCC Inquiry, which found that trust was a concern, with 25% of respondents not believing they would be able to get insurance if they tried, and more than 10% who said they did not trust insurers. Interestingly, the ACCC Inquiry found that First Nations Australian residents generally placed a lower value on insurance, with only 43% of surveyed First Nations Australian homeowners considering insurance to be essential, compared to 70% for all homeowners. This could be due to increased community support amongst First Nations Australians, with 40% of uninsured First Nations Australians having received financial support from family and friends, compared to only 8% of Northern Australian residents (ACCC, 2020).

The Productivity Commission recommended that insurers "can and should do more" to educate current and prospective homeowners about the risk of natural hazards to their property and the cost of rebuilding following a disaster. Improving education around insurance will provide greatest benefit to disadvantaged communities. Increased insurance take-up and appropriate levels of insurance coverage will increase disaster preparedness and risk management by improving the financial capacity of these communities (Productivity Commission, 2014).

Many Australians who are under-insured, or do not hold insurance, perceive insurance to be a low value product.

[12] Source: *Defin'd* (Appendix E)

Methods and assumptions

3

3.1 Australian Actuaries Home Insurance Affordability Index

This Green Paper constructs and analyses an **Australian Actuaries Home Insurance Affordability Index** defined as the ratio of the:

▶ Annual **Home Insurance Premium** for each residential property[13] in Australia, which includes home buildings and contents cover. The home insurance premium considers the natural hazards risk specific to the house location as well as the level of retail home insurance premiums across the Australian market[14], to the

▶ Annual **Household Income Gross of Tax**, modelled at an individual household level using Finity's demographic and socioeconomic dataset *Defin'd*[15].

The AAHIA Index is expressed as the number of weeks of gross household income required to pay a home buildings and contents insurance premium. The higher the AAHIA, the more unaffordable the home insurance premium is. The AAHIA Index is calculated across each household in Australia, regardless of whether or not insurance is purchased for the house, and does not consider under-insurance.

The AAHIA Index discussed in this Green Paper is based on the framework proposed in the Actuaries Institute's Property Insurance Affordability Research Paper (Actuaries Institute, 2020), with the following adjustments.

▶ The Home Insurance Premiums have been updated to reflect improvements in Finity's modelling of natural hazards risk, and the level of retail premiums as at March 2022.

▶ In the 2020 Research Paper, affordability pressure was considered in relation to the available income, defined as the Australian Bureau of Statistics (ABS) median disposable household income net of tax for a sub-postcode geographic area, less housing costs[16]. The use of household level information in this Green Paper allows for better identification of insurance affordability pressures, and in particular, the identification of vulnerable communities. A future improvement would be to source a measure of individual household income net of tax and net of household expenses

3.2 Identifying vulnerable populations

In this paper we examine the characteristics of vulnerable households, compared to the remaining (or base) households. To proxy households that

13 For rental or strata properties we have assumed that the cost of any home insurance premium paid for by the landlord or the strata are effectively passed onto the household occupying the property.

14 See Appendix D for details on the calculation of the annual home insurance premium.

15 See Appendix E.

16 The ABS mean disposable household income was available at a Statistical Area 2 (SA2) level, but housing costs were taken as an average across Australia rather than at an SA2 level, which was the most granular data available. SA2s are defined by the ABS as groups of medium-sized general purpose areas representing a community that interacts together socially and economically.

cannot afford partial or full insurance coverage due to affordability pressures, we identify households where the AAHIA is four weeks or greater, broadly equivalent to the 90th percentile of the AAHIA Index (and banded as extreme pressure). At this threshold, we consider insurance to represent a significant financial burden.

This threshold is informed by the following considerations.

▶ Around 15% of Australian households experience financial stress (Australian Bureau of Statistics, 2017).

▶ Energy poverty and health care literature often use 10% of income as the threshold for identifying vulnerable households (Pye & Dobbins, 2015; United Nations).

▶ As discussed in Section 2.6, 11% of households across Australia (and 20% of households in Northern Australia) do not purchase insurance (ACCC, 2020). This implies that 11% of households consider insurance to be unaffordable, notwithstanding that some households elect not to purchase insurance due to personal views around risk tolerance.

▶ 4 weeks, or one month, of gross income is a significant allocation of a household's income to cover a single expense. This amount is even more significant noting it must be met from net, after tax, income.

3.3 Allowance for climate change

There is strong scientific consensus that global surface temperatures will continue to increase until at least the mid-century under a range of future greenhouse gas emissions scenarios, which will increase the frequency and severity of extreme weather events (IPCC, 2021), and flow on to increased insurance premiums.

In Australia, one measure of this change in extreme events is the Australian Actuaries Climate Index. This was developed by the Actuaries Institute to quantify the change in the frequency of extreme weather conditions relative to the base period of 1981 to 2010. The index focuses on extremes rather than averages, which makes it more relevant to disaster risk and insurance. The results indicate that the frequency of extreme weather events is increasing, especially with regards to extreme high temperature and sea levels.

We have estimated the annual home insurance premiums at 2050 under a low and a high emissions scenario, as set out in Table 3.1, based on the recommendations of the Climate Measurement Standards Initiative (CMSI)[17]. These two scenarios represent the highest and lowest Representative Concentration Pathways (RCPs) considered in the fifth assessment report of the IPCC. However, they do not represent maximum or minimum outcomes, and it is possible that emissions may be higher or lower than the range we have considered, resulting in higher or lower pressures on affordability than considered within this paper. Current emissions are trending closer to the high emissions scenario than the low emissions scenario. The actual future emissions scenario will depend on global actions to reduce emissions, the extent of which is unknown. Further detail around the carbon dioxide emissions and concentrations for each RCP, and the resulting projected temperature anomalies (on a global basis) is provided in Appendix A.

The projected changes in key climate variables for hazards in Australia as at 2050 are provided in Appendix A and are summarised as follows:

The strong scientific consensus is that the frequency and severity of extreme weather events will increase.

[17] www.cmsi.org.au.

Table 3.1 – Climate scenarios[18]

Emissions Scenario	RCP and likely SSP	Carbon Dioxide emissions	Australian warming relative to 1986-2005 (°C)	Average Australian Sea level rise (m)
Low	RCP2.6 SSP1 – Sustainability [i]	Net Zero by around 2070	0.5-1.5 by 2050 1.5-2.5 by 2090 67% chance of warming of less than 2°C by 2100	0.1-0.3 by 2050 0.2-0.6 by 2090
High	RCP8.5 SSP5 – Fossil fuelled development [ii]	High and increasing	1.8-3.0 by 2050 3.2-5.4 by 2090	0.1-0.3 by 2050 0.4-1.0 by 2090

i SSP1 assumes a gradual but pervasive shift towards sustainable development that respects environmental boundaries.

ii SSP5 assumes that the world emphasises competitive markets and technological progress leading to rapid economic growth but with energy intensive lifestyles and a strong reliance on fossil fuel energy to power this growth, at least initially.

▶ Overall cyclone frequency is expected to reduce by 5% and 10% under the low and high emission scenarios respectively, but the relative frequency for severe cyclones is expected to increase. There is expected to be a poleward expansion of cyclone tracks (i.e. the location of cyclones will extend further south).

▶ The frequency of East Coast Lows will reduce by 10% and 20%, but the hourly extreme rainfall intensity will increase by 10% and 20%, under the low and high emission scenarios respectively. Large hail is expected to increase in the east, and there may be a poleward shift in features.

▶ The intensity of extreme fire days is expected to increase by 20% and 40% under the low and high emission scenarios respectively

The above changes can, in certain circumstances, lead to the reduction in overall home insurance premiums. For example, in a small minority of areas the reduction in frequency of East Cost Lows can reduce the overall risk of flood. Generally, the above factors drive an increase in AAHIA between the current and future climate scenarios.

3.4 Key assumptions, uncertainty, and limitations

Our results are based on several models, each of which makes several assumptions. Due to the variable nature of extreme weather events, our results are subject to significant uncertainty. We emphasise the following uncertainties.

1   In line with the recommendations of the CMSI, we have based our analysis on a static portfolio of risks (Climate-KIC Australia, 2020). We have made no allowance for the impact of the CRP, and no explicit allowance for inflation in construction costs for buildings. We have also assumed no changes in the vulnerability of houses (e.g. due to resilience and adaptation measures), no changes in home insurance products, no changes in home insurance premiums for non-hazard related components between 2022 and 2050.

2   Our household income estimates are based on 2011 Census figures, and so the relative incomes of different households are potentially out of date, and do not consider COVID-19 impacts. We have however increased income in line with changes between 2011 and 2022 as discussed in Appendix E.1. Estimates of household income at the

18 From Table TS2b in ESCC, 2020

A variety of factors, not just climate change, will influence future home insurance affordability.

household level based on more recent Census data were not available at the time of writing this report.

3   We have made no allowance for income and other taxes on the household, and not considered household expenses, which could also vary due to socioeconomic factors we have not considered.

4   For each household in Australia, we have estimated the gross household income and the home insurance premium. The ABS income data is provided in bands, and statistical sampling is used to map the household income to an address. In addition, the dataset used for individual residential addresses is based on the Geoscape Geocoded National Address File, which does not perfectly match the number of households in the ABS data at SA1 level. This may result uncertainty at the household level, which is why our results are aggregated to an LGA level. We have also assessed the sensitivity of our results to different sampling in Appendix G.

5   The AAHIA Index only examines the impact of climate change on bushfire, cyclone, flood and storm on insurance premiums. It does not consider the impact of other climate-related issues, such as coastal inundation and erosion, drought, heatwaves, air pollution or the socioeconomic impact of a transition to a net-zero economy, including migration caused by climate.

6   Our climate models are based on two scenarios representing the highest and lowest RCPs considered in the fifth assessment report of the IPCC. Each RCP is a summary of multiple General Circulation Models (GCMs), each of which results in different climate projections, and our results are based on the average projection (ensemble mean) for each RCP. Actual future emissions scenario will depend on global actions to reduce emissions, the extent of which is unknown.

For detailed description of our assumptions and limitations, refer to Appendix B.

Australian Actuaries Home Insurance Affordability Index

4

In this section we discuss the components that make up insurance risk (annual home insurance premiums), how economic resources vary across the country (annual gross household income), and insights into the home insurance affordability pressures across Australia (the AAHIA Index).

4.1 Annual home insurance premiums

4.1.1 Overview

Home insurance premiums consist of the insurer's estimates of a number of components, including:

▶ The cost of natural catastrophes covered by home insurance policies – in Australia these are usually bushfire, cyclone, flood and storm. These costs generally comprise between 20-40% of the technical insurance premium (ACCC, 2020) and vary by location across Australia.

▶ The cost of attritional components, including theft, accidental damage, non-catastrophe weather claims, and large non-weather claims.

▶ Insurer expenses, net cost of reinsurance, and the insurer's profit margin including any cost of capital.

▶ Taxes, including stamp duty, Emergency Services Levy (in NSW) and GST.

Table 4.1 shows the estimated components of home insurance premiums by state. This includes Finity's view of the natural hazards risk[19] and cost of rebuild[20] for each residential property in Australia. State taxes and levies (i.e. stamp duty and Emergency Services Levies) and GST are explicitly allowed for. The total premiums are then calibrated to the level of retail premiums across the Australian market at March 2022[21]. Details around these data sources are shown in Appendix D.

19 From Finity's natural hazards models, *finperils.*

20 From Finity's sum insured calculator, *Rebuild.*

21 From Finity's competitor premiums monitoring tool, *Finesse.*

22 The median total premium does not equal the sum of the median of the component parts, due to skewness in the distribution of natural hazard risks, differences in state taxes, and differences in the expense and profit margins across Australia.

Table 4.1 – Home insurance premium components ($2022 values)[22]

	Estimated mean by state								Australia	
	NSW	VIC	QLD	SA	ACT	NT	TAS	WA	Mean	Median
Storm	306	162	306	93	183	241	149	141	230	214
Flood	102	72	235	88	43	67	37	37	110	6
Cyclone	5	0	222	0	0	1,505	0	126	70	0
Earthquake	37	44	13	44	65	43	17	42	35	37
Bushfire	47	17	33	13	9	17	82	37	33	0
Other insurer cost components[1]	772	647	933	530	807	103	579	608	728	722
Stamp Duty, Levies and GST[2]	519	198	347	170	111	415	181	208	328	259
Total premium	**1,789**	**1,140**	**2,089**	**938**	**1,218**	**2,390**	**1,045**	**1,200**	**1,534**	**1,484**
Stamp Duty	*9%*	*10%*	*9%*	*11%*	*0%*	*10%*	*10%*	*10%*		
Emergency Services Levy	*17.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*		

1 Attritional losses, expenses, net cost of reinsurance, profit margin.

2 The Emergency Services Levy in NSW is passed onto the policyholder at the discretion of each insurer. For the purposes of estimating the home insurance premiums we have assumed 17.5% loading charged to all NSW homeowners.

30% of total insurance costs today are for natural hazards, spread unequally around Australia.

23 Calculated as the average home insurance premium in Table 4.1 multiplied by 10.1 million households. In reality, however, some households are under- or un-insured. This figure therefore over-estimates the total home insurance premium for the Australian market.

24 Assuming no under-insurance or non-insurance. Other costs include attritional losses, insurer expenses, net cost of reinsurance, profit margins.

The average (mean) home insurance premium is $1,534, and the median home insurance premium is $1,484. This difference reflects the skewed nature of the distribution of natural hazard losses (see also Figure 1.1). In particular, the median premium for cyclone and bushfire risks is $0 and the median premium for flood is $6, but these hazards make up 5%, 2% and 7% of the average premium of $1,534 respectively.

> **That is, while the majority of households in Australia are not exposed to cyclones, bushfires or floods, a portion of homeowners are charged significant amounts for these risks.**

State and Commonwealth taxes make up 21% of the total insurance premiums. The level of state duties and levies varies by state. The impact of taxes on community resilience and the AAHIA is discussed in Section 4.6.

Figure 4.3 shows the current distribution of average annual home insurance premiums by LGA. Australians living in Northern Queensland and Northern WA currently pay the highest amounts for insurance coverage, with mean annual home insurance premiums over $3,000 mostly from exposure to cyclone risk. Communities in the NT are also impacted by cyclone risk, while inland NSW and Southern Queensland have high exposure to flood risks.

There are around 10.1 million households in Australia in 2022, concentrated in the capital cities (Australian Institute of Health and Welfare, 2022). In total, if all Australian households purchased sufficient home insurance each year, the premiums would amount to $15.5 billion[23].

Figure 4.1 – Total annual home insurance premiums by component ($2022 values)[24]
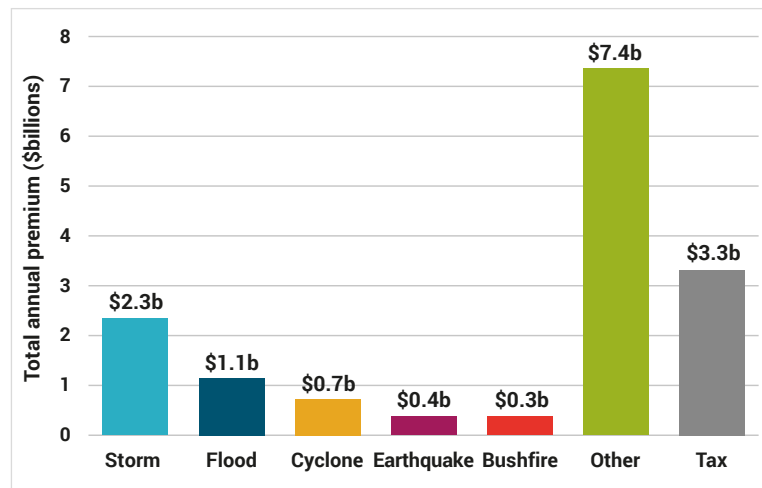
Figure 4.1 shows that the majority of the natural hazard premium is from storms, which is the main natural hazard impacting densely populated metropolitan areas.

4.1.2   Impact of climate change

Figure 4.2 shows the expected changes to the home insurance premiums under the low and high emission scenarios. In total, by 2050 the weather-related natural hazards components of the home insurance premiums are expected to increase by 6% ($309 million) under the low emissions scenario

and 15% ($782 million) under the high emissions scenario. Overall, cyclone, bushfire and flood costs are expected to increase materially, but storm costs will remain relatively unchanged under the scenarios considered, noting that the impacts of climate change will vary across the country. We have assumed there are no changes to the cost[25] of earthquake claims, attritional claims, expenses, profit margins or taxes.

As we discuss below, these changes in the total premiums are not spread equally across Australian households, but are concentrated in households that are already experiencing extreme home insurance affordability pressure. In effect the financial burden of climate change is being carried by a few.

Further, since these figures represent only the change in home insurance premiums, they do not include other exacerbating factors that may also arise, including:

▶ Growth in population and inflation.
▶ Impacts on income levels for households as the Australian economy shifts to net-zero emissions, including impacts on employment and income.
▶ Insurance premiums represent the average expected outcome, and actual claims experience varies substantially from year to year, and can considerably exceed premium changes. So actual events arising under climate change could be substantially worse in a particular year than the estimated premium for that year.
▶ Home insurance does not generally cover other hazards such as soil contraction, coastal inundation and erosion, which may also adversely impact households.
▶ Climate change may have significant physical impacts on agriculture and global supply chains, driving up inflation or otherwise resulting in shortages of essential goods and services.
▶ Actual impacts from climate change could differ from the scenarios assessed in this paper.
▶ These figures exclude impacts to business and government sectors, and costs not included in insurance premiums such as emergency response costs including clean-up and evacuation, health costs from fatalities and physical and mental injuries, and social costs such as unemployment, crime, education, family violence and drug and alcohol abuse.

Figure 4.2 – Changes to annual cost of weather-related hazard components under climate scenarios compared to current ($2022 values)

Climate change will not have an equal impact on home insurance premiums across Australian households.
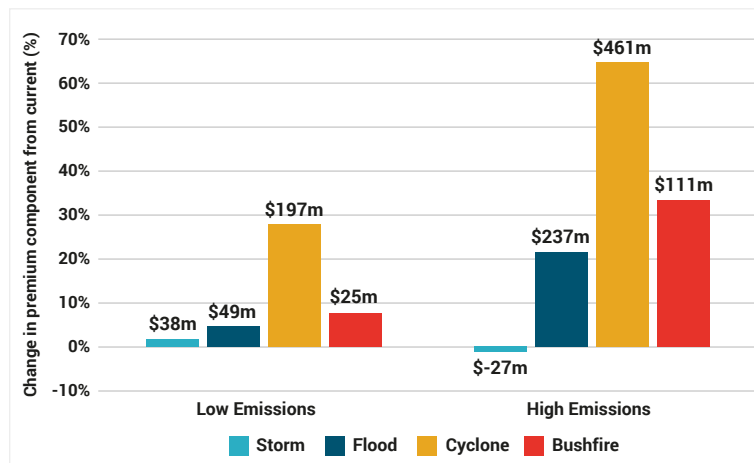
25 As a ratio of those costs to the overall premium.

Figure 4.3 compares the distribution of average annual home insurance premiums across Australia now and under the climate scenarios considered. The following sections discuss the individual natural hazards in further detail.

Figure 4.3 – Mean annual home insurance premium by LGA – current, low and high emissions scenario ($2022 values)
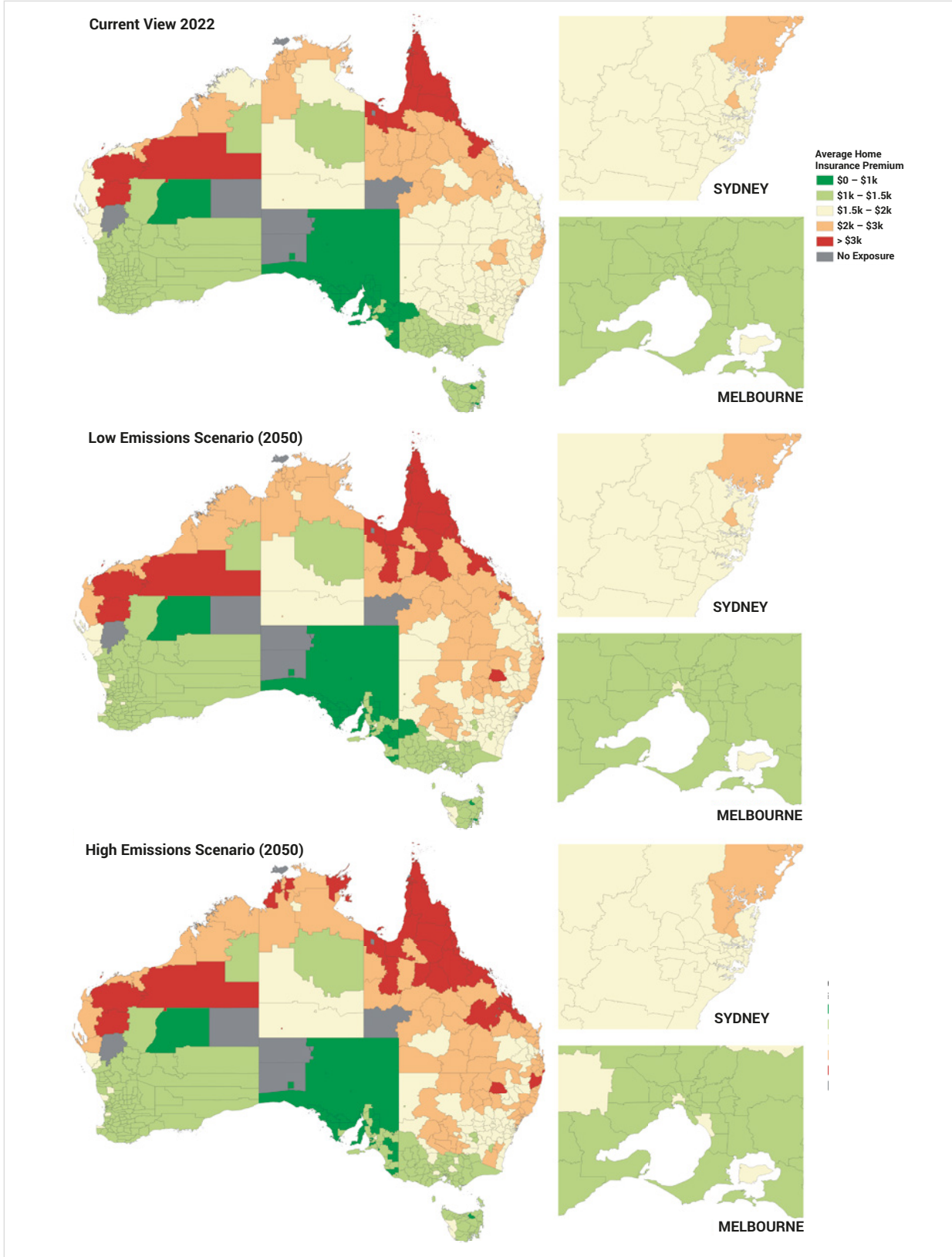
4.1.3   Bushfire

Bushfire risk reflects the exposure of the property to fires that started in wild vegetation (grasslands, woodlands etc). Bushfire risk is influenced by climatic conditions (humidity, temperature, rainfall and wind) together with the distance and topographic features of the asset relative to vegetation.

Bushfire costs in Australia are concentrated in the east coast of NSW, central regional Victoria, Tasmania, and the south of WA. These regions are at the edge of urban areas surrounded by denser vegetation with high bushfire risk, and have experienced catastrophic bushfire events, such as the 2020 Black Summer Bushfires and the 2009 Black Saturday fires. There is limited bushfire risk in central urban regions, given the high density of road networks which serve as firebreaks, and the clearing of vegetation.

Based on historical insurance industry losses (which do not reflect the non-financial flow-on impacts on affected communities and businesses), our estimate of the current bushfire component of home premiums is $332 million. This is expected to increase by $25 million (7%) under the low emissions scenario and $111 million (33%) under the high emissions scenario. Figure 4.4 compares the current bushfire premiums with the expected profile at 2050 under each emissions scenario.

Figure 4.4 – Average bushfire premium by LGA – current, and changes under low and high emissions scenarios ($2022 values)
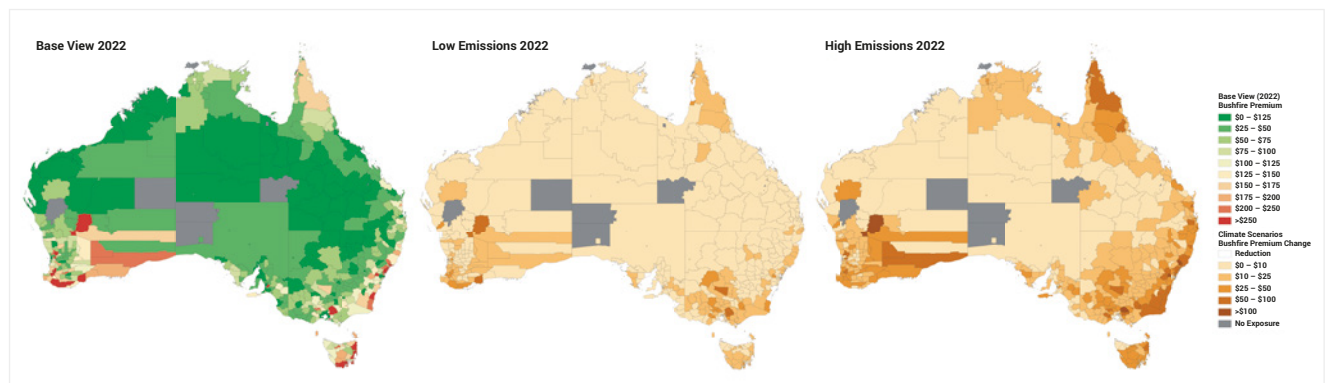
As discussed in Section 3.3, the number of days of extreme fire weather danger are expected to increase under both the low emissions scenario and high emissions scenario, both driven by decreases in average rainfall and increases in temperature. The extent to which this occurs varies across the country, but the increase in risk is most noticeable in southern and eastern Australia. Under more extreme climate change scenarios, tropical regions (such as Far North Queensland) are also exposed to greater variability in weather conditions which increase the possibility of larger losses, especially during prolonged periods of limited rainfall.

4.1.4   Cyclone

Cyclone risk reflects the exposure of the asset to damage from extreme wind and rain, and includes the exposure to storm surge events driven by cyclones. Cyclone risk is influenced by regional cyclone risk (calibrated to historical experience), tree coverage, shielding from wind and the distance of the asset to the coastline.

Cyclone costs in Australia are heavily concentrated along the coast of Northern Australia, in Queensland, WA and NT. Cyclone risks reduce for LGAs further south due to the reduction in cyclone generation, and also reduce

Bushfires are expected to increase in severity and frequency.

Climate change may cause the range of cyclone-exposed areas to expand to the south.

for inland LGAs due to reduction in cyclone intensity. The nature of cyclone events means a higher proportion of properties require total rebuild (rather than repairs), and consequently the severity of losses is much higher for cyclone than other natural hazard types.

Our estimate of the current cyclone component of home premiums is $716 million. This is expected to increase by $197 million (28%) under the low emissions scenario and $461 million (65%) under the high emissions scenario. Figure 4.5 compares the current cyclone premiums with the expected profile at 2050 under each emissions scenario.

Figure 4.5 – Average cyclone premium by LGA – current, and changes under low and high emissions scenarios ($2022 values)
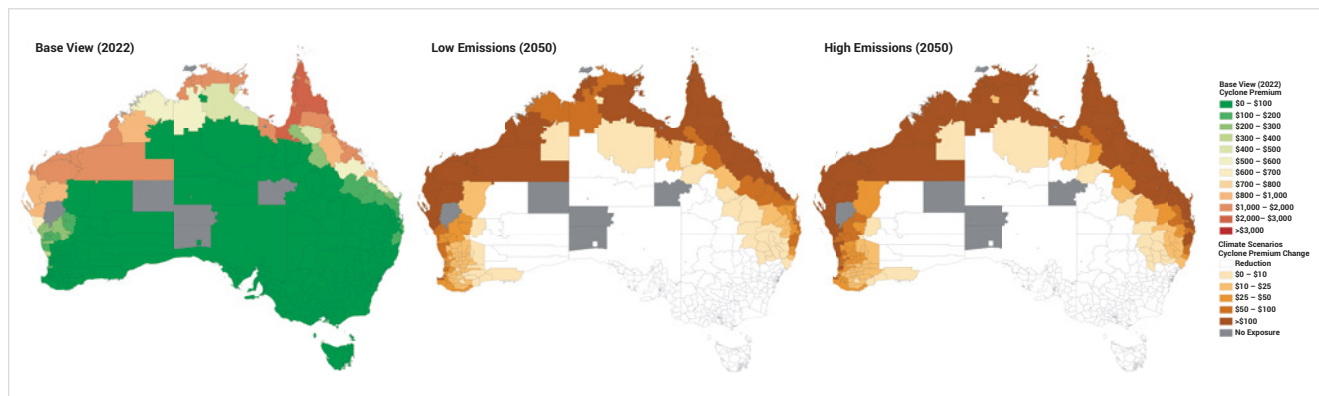
The main impact of climate change is a poleward (towards the South) shift of the cyclone risks, as discussed in Section 3.3. This shift is noticeable along the southern coast of WA as well as Southern Queensland/Northern NSW (Kossin, Emanuel, & Vecchi, 2014). The migration is more noticeable under the high emissions scenario and along the east coast due to warmer waters (Bruyère, et al., 2020).

Consistent with guidance from the CMSI, cyclone costs in currently impacted areas are also expected to increase with climate change, with the expected reduction in the frequency of cyclones offset by the increase in the severity of cyclones.

Figure 4.5 shows that parts of the Pilbara are exposed to significant cyclone risk which is expected to increase under the climate scenarios considered. However, Figure 5.2 does not show high affordability pressure for some of the Pilbara. This is due to the high income in this area within the 2011 census, likely driven by the mining boom at that time. Given the changes in income levels since 2011 there are likely to be some communities facing affordability issues today that are not shown in our analysis.

4.1.5   Flood

Flood risk reflects the exposure of the property to riverine flooding (water spilling out of riverbanks)[26]. Flood risk is influenced by climatic conditions (rainfall, temperature), surface hydrology, together with the distance and elevation of the property relative to a river.

The highest flood costs are concentrated in inland Queensland and NSW, which is reflective of townships being built on and around the extensive inland riverine systems. Flooding over the last two years has demonstrated the risk of severe flooding in these areas, even with the presence of flood mitigation infrastructure.

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26   Flash flooding is considered within the storm peril, and coastal flooding within the cyclone peril as storm surge

Our estimate of the current flood component of home premiums is $1.1 billion. This is expected to increase by $49 million (4%) under the low emissions scenario and $237 million (21%) under the high emissions scenario. Figure 4.6 compares the current flood premiums with the expected profile of flood risks at 2050 under the climate scenarios.

Figure 4.6 Average flood premiums by LGA – current, and changes under low and high emissions scenarios ($2022 values)
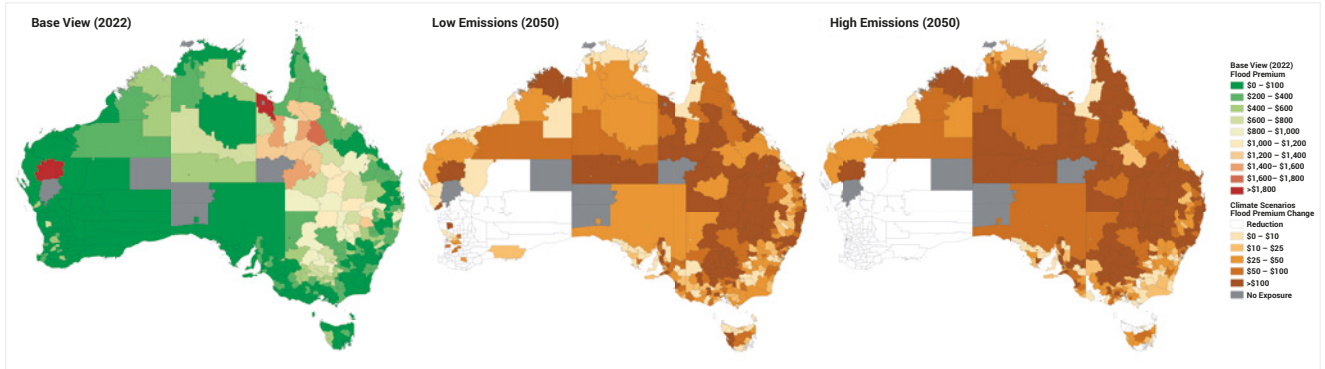
Given that flooding is dependent on existing riverine systems, climate change does not significantly broaden the exposure to loss, but rather increases the costs faced by communities already exposed to flood risk, due to increases in the frequency of extreme rainfall events. Particular pressures can be seen in Northern NSW and Southern Queensland, which are communities that have recently experienced severe flooding events.

4.1.6   Storm

Storm risk reflects the exposure of the property to high wind, hail, and rainfall events including flash flooding. Storm risk is influenced by climatic conditions (temperature, rainfall and wind) together with topographic surroundings of the property.

Storm costs in Australia are prevalent along the east coast, driven by the higher propensity for hailstorms and low-pressure systems to form in this region. Metropolitan areas along the east coast tend to face higher storm risk, including greater Sydney, Gold Coast and Brisbane.

Our estimate of the current storm component of home premiums is $2.3 billion. This is the highest source of insurance losses in Australia, as storm risks affect highly populated metropolitan areas. Storm premiums are expected to increase by $38 million (2%) under the low emissions scenario and reduce by $27 million (1%) under the high emissions scenario. Figure 4.7 compares the current storm costs with the expected profile of storm risks at 2050 under the climate scenarios.

Figure 4.7 Average flood premiums by LGA – current, and changes under low and high emissions scenarios ($2022 values)
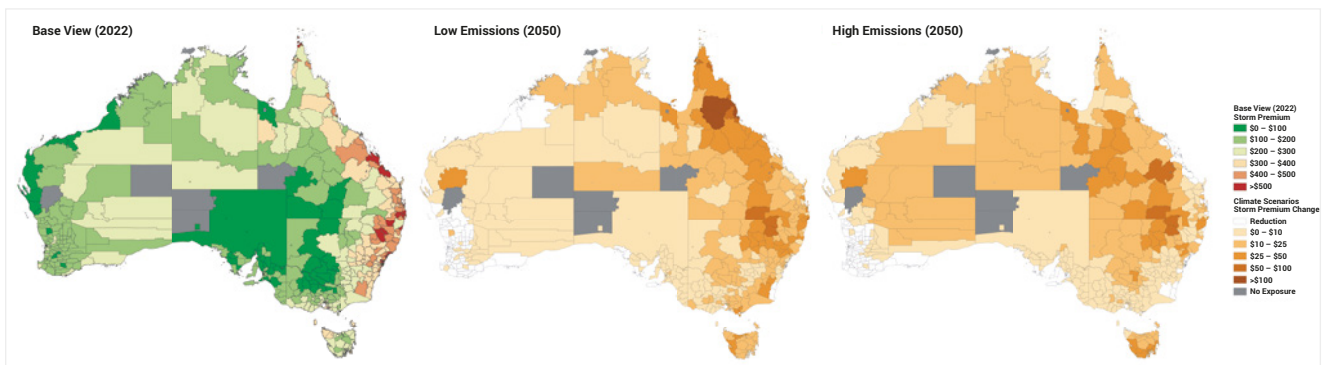
There is broad consensus among recent studies that East Coast Low frequency will decrease under future warming scenarios, particularly over the winter months (ESCC, 2020), as discussed in Section 3.3. This results in a reduction in rainfall across many parts of Australia, in particular in metropolitan areas where the storm losses are concentrated. The frequency reduction is more pronounced in the high emissions scenario, and there is reduction in expected costs across Far North Queensland and Southern NSW.
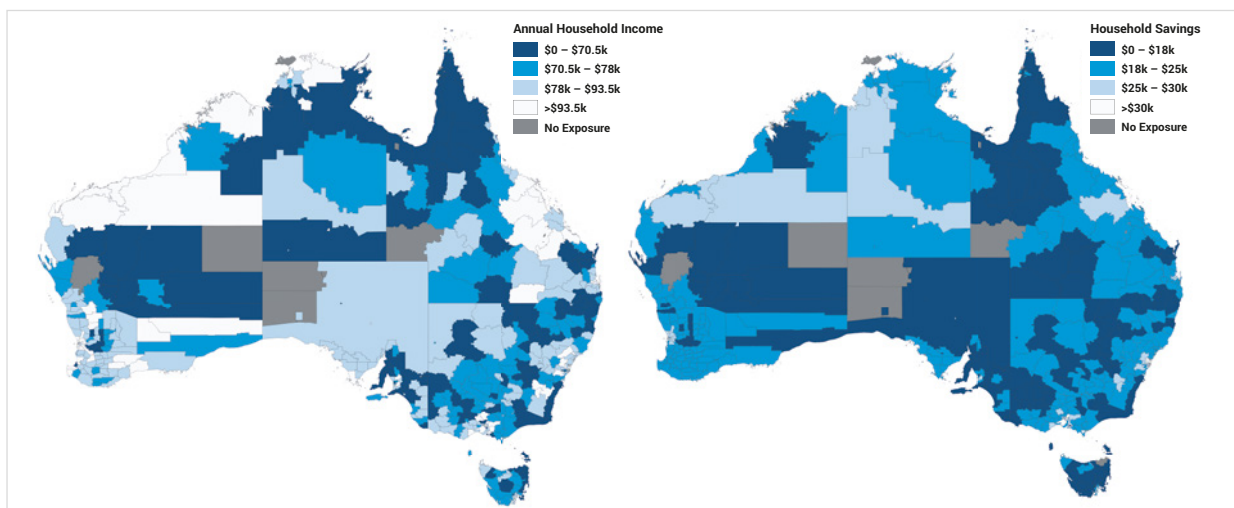
4.2 Household income

The economic resources available to households are a key feature of home insurance affordability pressure. Table 4.2 and Figure 4.8 show the annual gross household income and household savings[27].

Table 4.2 – Household income and savings by state ($2022 values)

	Estimated mean by state								
	NSW	VIC	QLD	SA	ACT	NT	TAS	WA	AUS
Annual household income	88,000	85,000	90,000	80,000	110,000	105,000	77,000	97,000	**88,000**
Household savings	26,000	25,000	23,000	21,000	28,000	32,000	18,000	26,000	**25,000**

Figure 4.8 – Average annual household income and current savings by LGA ($2022 values)

The average annual household income across Australia is $88,000 and the average level of household savings is $25,000. The distribution of household income is similar to the distribution of savings. Regional and remote areas, particularly areas in Northern Australia, central WA, inland NSW, inland Victoria and Tasmania have the lowest economic resources. Differences in the household income compared to savings, such as in NT, could be driven by retirees who no longer earn material income but have access to savings and other assets.

4.3 Home insurance affordability issues

4.3.1 Current AAHIA Index

The median Australian household pays a home insurance premium equivalent to 1.1 weeks of gross household income, while 10% of Australian households face home insurance premiums greater than four weeks of gross household income.

Table 4.3 summarises the AAHIA Index by state under current climate conditions.

27 Source: *Defin'd.* Annual household income is based on total family income as stated (FINASF) from the 2011 Census, inflated to 2022 values. Further detail can be found in Appendix E.1.

Table 4.3 – Australian Actuaries Home Insurance Affordability Index by state

	NSW	VIC	QLD	SA	ACT	NT	TAS	WA	AUS
Median AAHIA Index (weeks)	1.4	0.9	1.4	0.8	0.7	1.3	0.9	0.8	**1.1**
Total number of LGAs	129	80	74	69	1	16	29	135	**533**
Number of LGAs with median AAHIA Index greater than 1.1 weeks[i]	78	1	61	1	0	12	2	12	**167**
Proportion of LGAs with median AAHIA Index greater than 1.1 weeks[i]	60%	1%	82%	1%	0%	75%	7%	9%	**31%**
Number of LGAs with median AAHIA Index greater than 4 weeks[ii]	0	0	12	0	0	0	0	0	**12**
Proportion of LGAs with median AAHIA Index greater than 4 weeks[ii]	0%	0%	16%	0%	0%	0%	0%	0%	**2%**

[i] This corresponds to the median across all households.
[ii] This corresponds to the 90th percentile across all households.

There is variation of up to half a week between the state and national median AAHIA. Differences in the home insurance premium and annual household incomes between individual households means that the AAHIA varies substantially between households. For example, the median AAHIA by LGA shows that 12 LGAs in Queensland have significant affordability pressures, with 50% of households in these LGAs paying insurance premiums of more than four weeks of income.

4.3.2   Impact of climate change on AAHIA

Table 4.4 shows that the AAHIA Index increases under the climate scenarios considered. The median of the AAHIA Index increases by 4% and 6% under the low and high emission scenarios, and the 90th percentile of the AAHIA Index increases by 4% and 10% respectively.

Under both climate scenarios, around 1 in 25 LGAs have a median AAHIA of more than four weeks of household income. This compares to around 1 in 45 households today. This difference is driven purely by the increase in expected losses from weather-related natural hazards, as all other parts of the AAHIA Index calculation are unchanged.

Insurance premium pressures can vary substantially from state to state.

Table 4.4 – Australian Actuaries Home Insurance Affordability Index under climate scenarios

	Current 2022	Low Emissions Scenario 2050	High Emissions Scenario 2050
Median AAHIA Index (weeks)	1.1	1.1	1.2
90th percentile of AAHIA Index (weeks)	4.0	4.2	4.4
Number of LGAs with median AAHIA Index greater than 1.1 weeks[i]	270	293	299
Proportion of LGAs with median AAHIA Index greater than 1.1 weeks[i]	50%	55%	56%
Number of LGAs with median AAHIA Index greater than 4 weeks[ii]	12	20	23
Proportion of LGAs with median AAHIA Index greater than 4 weeks[ii]	2%	4%	4%

[i] This corresponds to the median across all households on the current 2022 scenario

[ii] This corresponds to the 90th percentile across all households

5 Equity issues arising from home insurance affordability

5.1 Distribution of home insurance affordability pressures

Figure 5.1 shows how annual home insurance premiums, annual household income and the AAHIA Index vary by percentiles[28].

Figure 5.1 – Australian Actuaries Home Insurance Affordability Index by AAHIA percentile[29]
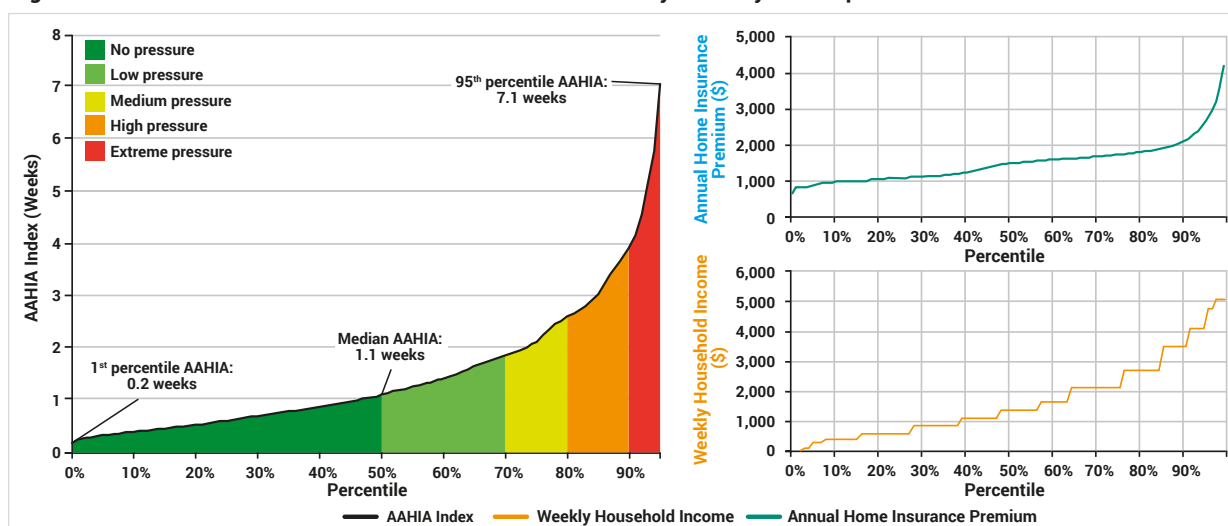
The AAHIA Index varies from 0.2 weeks for households with the most affordable insurance to in excess of 7.1 weeks for the 5% of households with the most unaffordable premiums. In the AAHIA Index we consider Australian households grouped into the following bands of Home Insurance Affordability pressures.

Pressure Band	AAHIA (Weeks)	% of households	Vulnerability group
No Pressure	0 to 1.1	50%	Base
Low Pressure	1.1 to 1.8	20%	Base
Medium Pressure	1.8 to 2.5	10%	Base
High Pressure	2.5 to 4	10%	Base
Vulnerable	4+	10%	Vulnerable

28 Note that the percentiles between the charts are not comparable, i.e. the 50th percentile (for example) of the AAHIA Index is **not** the ratio of the 50th percentile of the home insurance premium to the 50th percentile of the household Income.

29 Note that Figure 3.19 shows home insurance premium and household income to the 99th percentile, and AAHIA income to the 95th percentile due to significant increases in the premium and AAHIA in the highest percentiles.

5.2 Geographic distribution of home insurance affordability pressure

5.2.1 Current scenario

Figure 5.2 – Median AAHIA as at 2022 and under low and high emission climate scenarios[30]
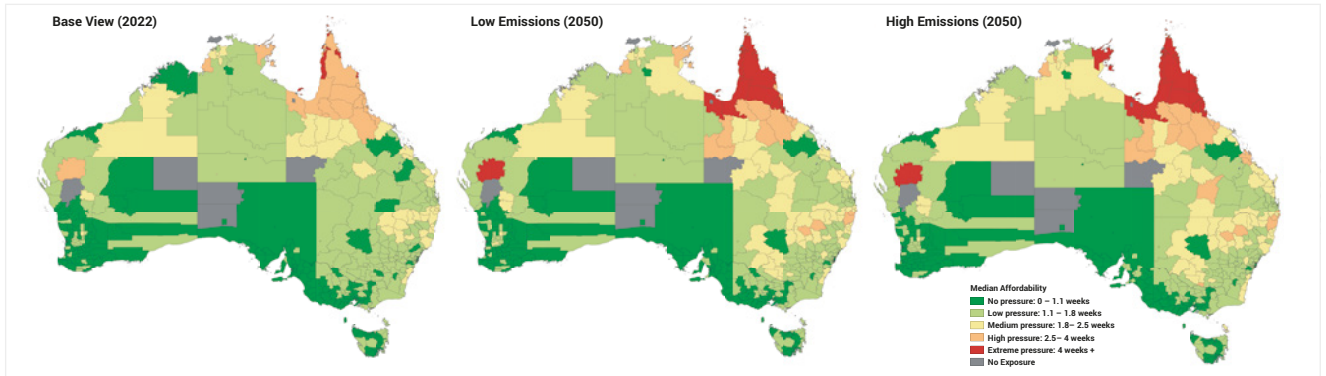
The first map in Figure 5.2 shows the median AAHIA by LGA under the current climate and illustrates the following.

▶ LGAs suffering high and extreme home insurance affordability pressures are concentrated in Northern Queensland and the top of the NT. In these areas, half of the population pay more than a month of gross household income for their annual home insurance premium. The affordability pressures faced in these regions is driven by their high cyclone risk combined with lower gross household incomes.

▶ Despite having similar levels of insurance risk as Northern Queensland, LGAs in Northern WA (including the Pilbara) do not face the same levels of affordability pressure, as the income level in these regions are higher, likely driven by the mining boom in this area at the time of the 2011 census. We note that the maps show medians across the LGA, and there may be specific communities in these regions that face significant affordability pressures.

▶ LGAs with medium affordability pressures are more spread across Australia. In these regions – Northern NSW and inland Queensland – affordability pressure is driven by a combination of lower household incomes, and higher flood and bushfire risks.

▶ Metropolitan areas typically have lower natural hazard risks and higher incomes. This means that the capital cities have lower affordability pressures on average. However, affordability pressure is still present within the capital cities, for example in Greater Sydney, Greater Melbourne and Greater Perth. Many communities in these areas already are struggling with limited household income and a high AAHIA and climate change will only exacerbate the pressures already faced.

The second and third maps in Figure 5.2 shows that climate change particularly increases affordability pressure in Northern Australia, and along the East Coast.

Figures 5.3 and 5.4 show that climate change does not significantly impact home insurance affordability for most LGAs. Even under the high emissions scenario, only 9% of households currently under no affordability pressure will transition to low affordability pressure, and 18% of households currently under low pressure will transition to medium or high affordability pressures.

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30 When examining AAHIA Index distributions, we have considered the pressure bands shown on page 32.

Figure 5.3 – Movement of LGAs between current and low emissions scenarios by band
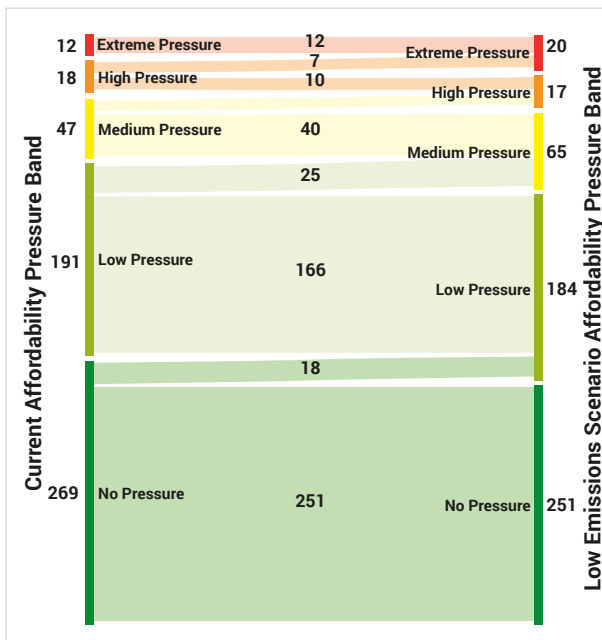
Figure 5.4 – Movement of LGAs between current and high emissions scenario by band
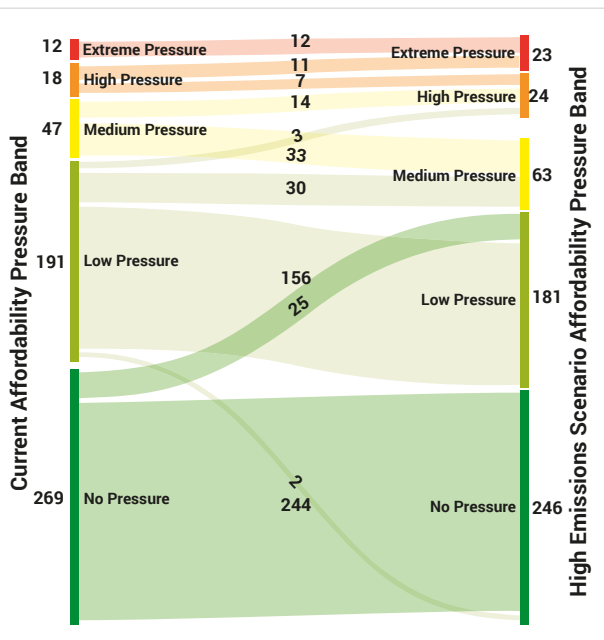
Figure 5.5 shows the proportion of vulnerable households in each LGA (i.e. with AAHIA greater than four weeks, as defined in Section 3.2) and demonstrates that:

▶ There are vulnerable households in every LGA.
▶ Affordability pressures are particularly concentrated in Northern Australia. In Far North Queensland, over 40% of households are part of the vulnerable group.
▶ Northern NSW and inland Queensland also face higher pressures given higher flood risk and lower household incomes.

Figure 5.5 – Proportion of vulnerable households by LGA
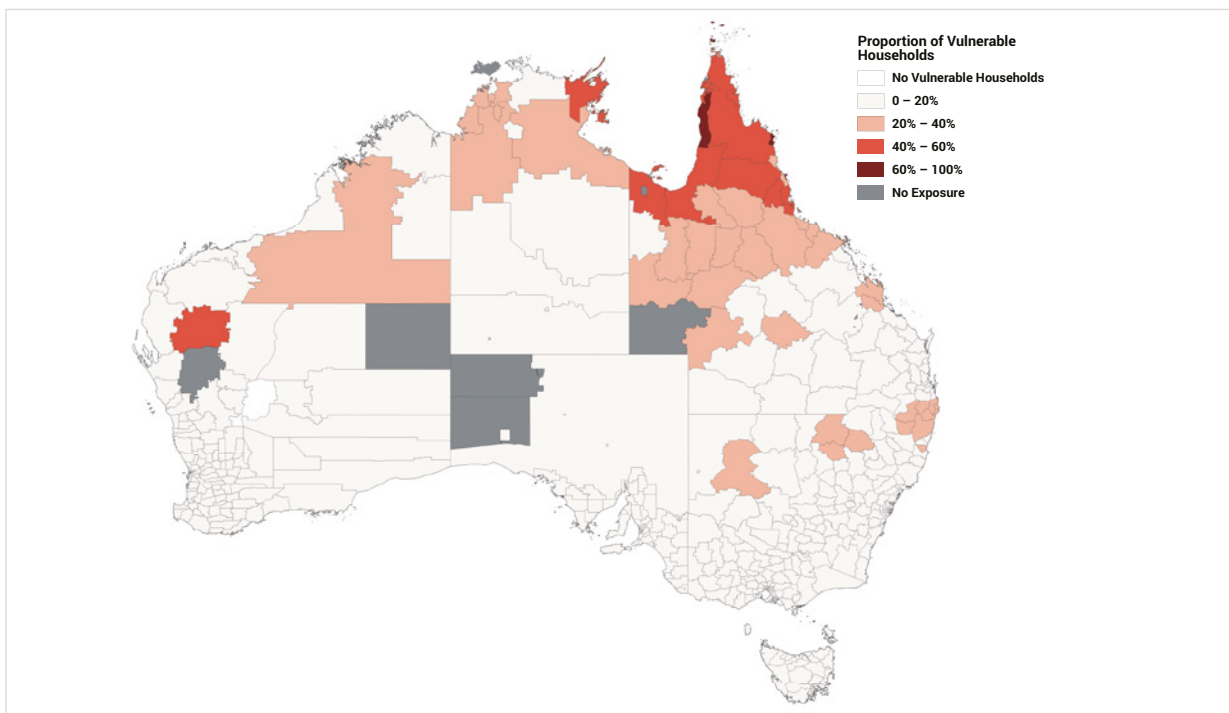
5.2.2 Low emissions scenario

Figure 5.6 compares the impact of the low emissions climate scenario on the median AAHIA between base and vulnerable households.

Figure 5.6 – Increase in median AAHIA under a low emissions scenario
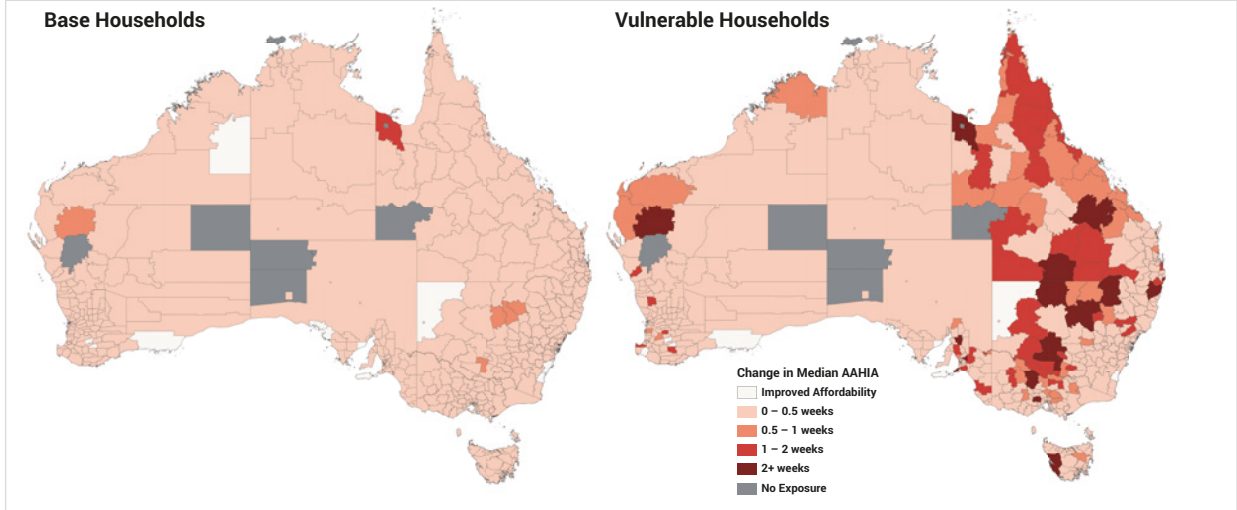
There is a general increase in home insurance affordability pressure across Australia of up to half a week of household income under the low emissions scenario, and only a few LGAs where the median AAHIA increases by up to one week. For vulnerable households, there is a clear increase in affordability pressure in Northern Australia and inland NSW, including LGAs where the median AAHIA increases by more than two weeks.

Figure 5.7 shows the impact of the low emissions climate scenario on the median home insurance premium between base and vulnerable households by CRESTA zone.

Figure 5.7 – Median increase in annual home insurance premiums under a low emissions scenario by 2050

Across all CRESTA zones, vulnerable households face a higher median premium increase when compared to the base households. There is significant variation in the additional premium required between and within states. Consistent with the increases in the median AAHIA, the regions with the highest premium increases are in Northern Queensland, particularly Cairns, Townsville and Mackay.

5.2.3   High emissions scenario

Figure 5.8 compares the impact of the high emissions climate scenario on the median AAHIA between base and vulnerable households.
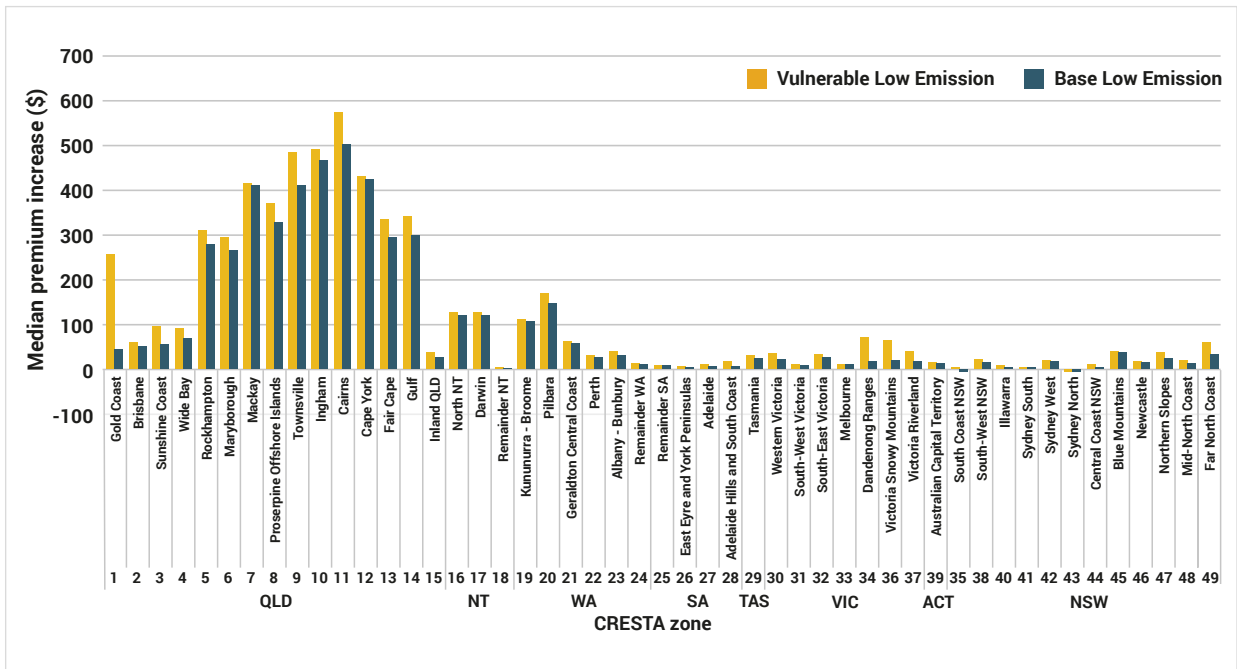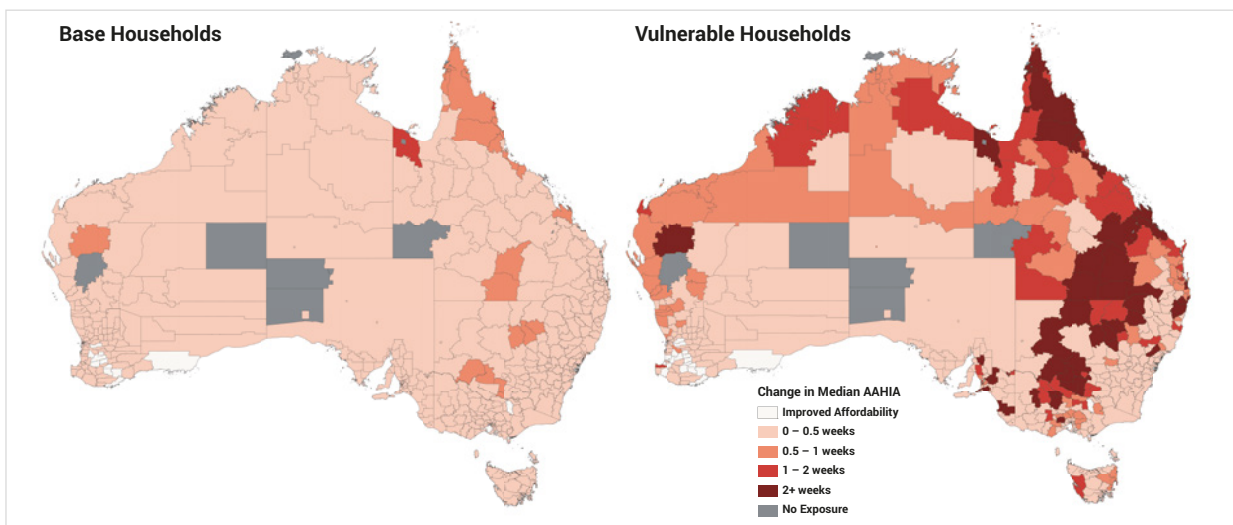
Figure 5.8 – Increase in median AAHIA under a high emissions scenario

The impact of climate change is more pronounced under the high emissions scenario. In the base population, while the majority of the country will see increases of up to half a week of income, parts of Northern Queensland will face additional affordability pressures. In the vulnerable population, Queensland will face the highest median AAHIA increases, but other regions in Northern Australia and central NSW will also see greater home insurance affordability pressure.

There are a few small areas where we have projected improved affordability, which is driven by in some cases an expected reduction in frequency of events that is larger than the expected increase in severity under the climate scenarios considered. For example, as discussed in Section 4.1.5, storms such as East Coast Lows are expected to reduce in frequency under the climate scenarios considered.

Figure 5.9 compares the impact of the high emissions climate scenario on the median home insurance premium between base and vulnerable households.

Compared to the low emissions scenario, the magnitude of the premium increase is larger (around three times across all CRESTA zones). Further, the difference between the vulnerable and non-vulnerable populations is much more noticeable, not only in Far North Queensland, but also in the Gold Coast, Adelaide, Central Coast and Far North NSW Coast CRESTA zones.

Figure 5.9 – Median increase in annual home insurance premiums under a high emissions scenario
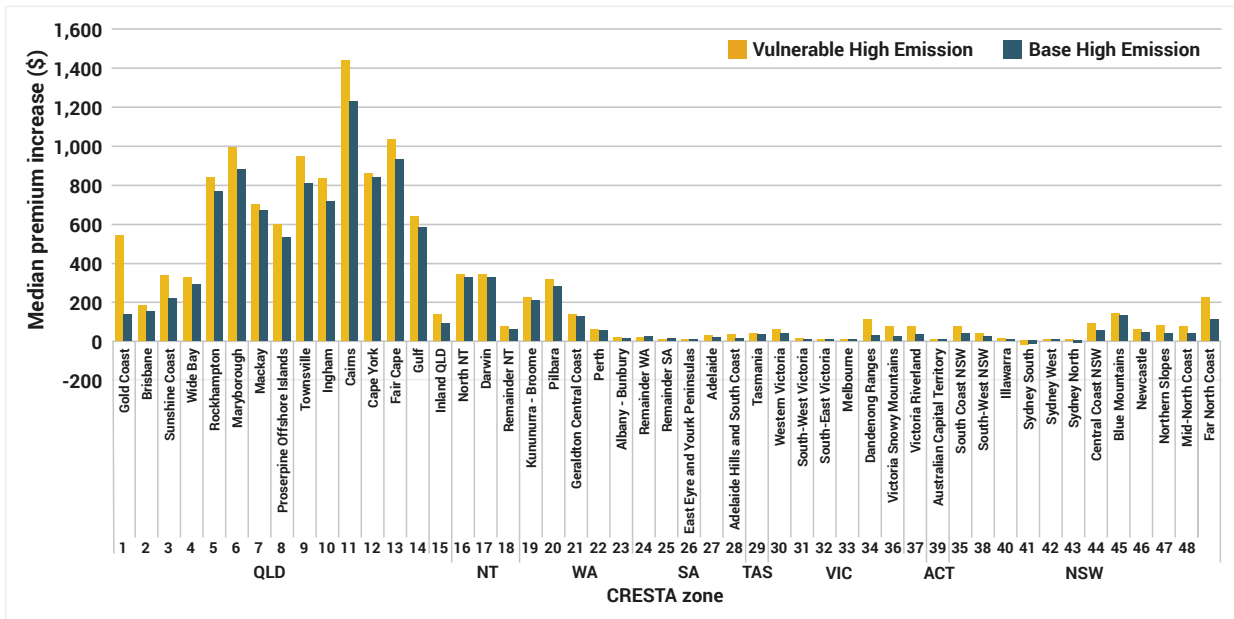
5.3 Socioeconomic distributions of home insurance affordability pressure

The current median AAHIA for base households is 1.0 week of gross household income. In comparison, the current median AAHIA for vulnerable households is 7.4 weeks – seven times the median for the base population.

Climate change will increase the AAHIA for most households, and the impact will be greater on vulnerable households. Under the low emissions scenario, the median AAHIA will increase by 0.2 days for base households and 7.6 days for vulnerable households. Under the high emissions scenario, the median AAHIA will increase by 0.4 days for base households and 10.7 days for vulnerable households.

Figure 5.10 summarises some key population characteristics of vulnerable and base populations, based on data from *Defin'd*.

> **Vulnerable households face seven times greater affordability pressure than other households.**

Figure 5.10 – Population characteristics of vulnerable and base households
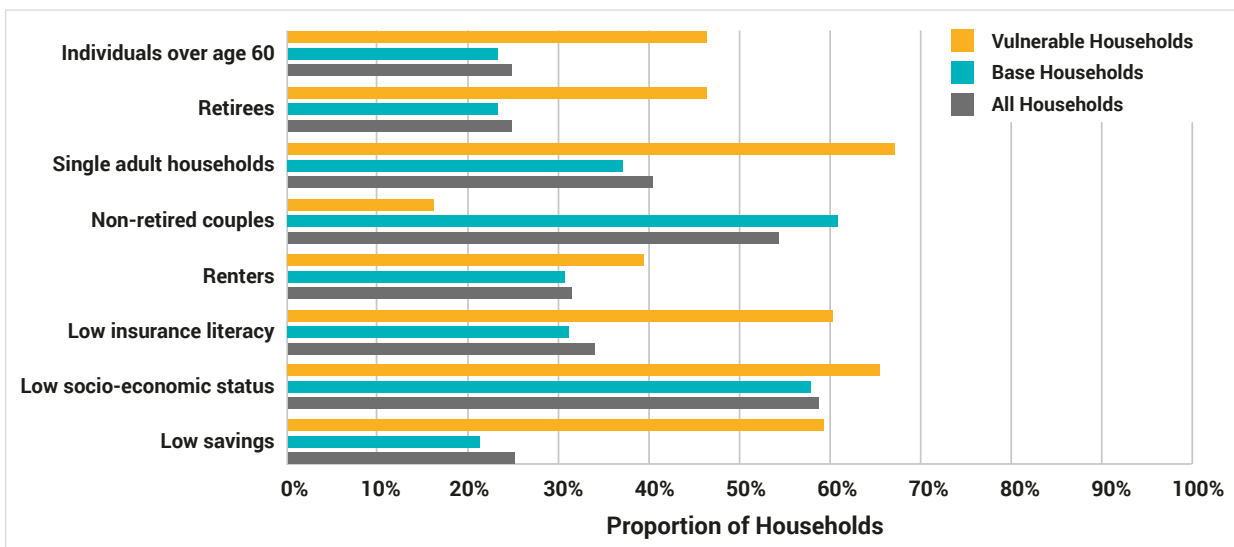
Vulnerable households are more likely to be older, single adult and have low savings.

The following population demographics are over-represented in the vulnerable population.

▶ Individuals aged over 60, particularly retirees.
▶ Single-adult households, including lone persons and single parent families. There is a direct relationship between the number of income-earning people in a household and the AAHIA Index. Conversely, non-retired couples face the lowest affordability pressures.
▶ Renters. While renters do not directly purchase buildings insurance, higher premiums will likely translate into higher housing cost.
▶ Households with low insurance literacy and low socioeconomic status (SEIFA rank).
▶ Households with low savings.

The remainder of this section discusses in further detail how the AAHIA Index varies by ages, life-stage, housing tenure, socioeconomic position, occupation and insurance literacy, based on data from *Defin'd*.

5.3.1 Age

Figure 5.11 – Median AAHIA by age – base vs vulnerable populations
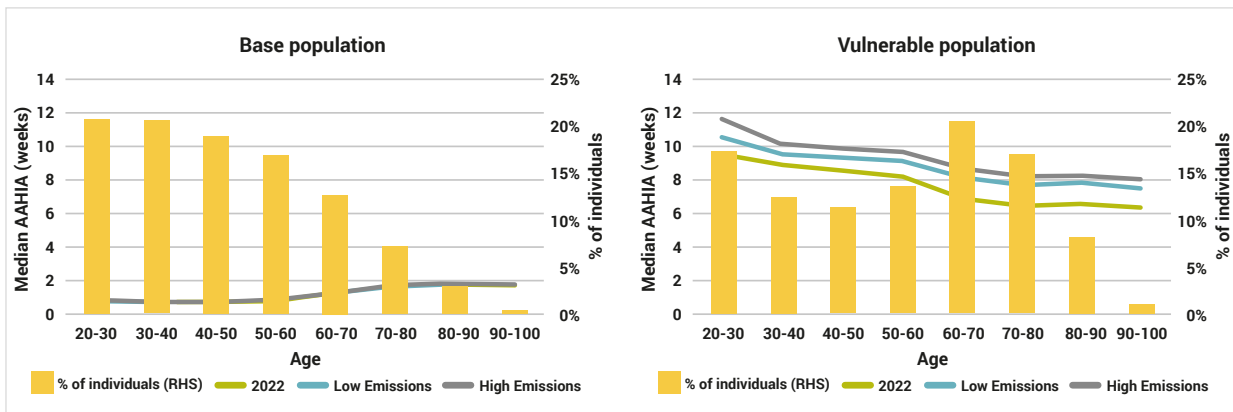
Figure 5.11 shows how the median AAHIA varies by age, for base and vulnerable households and how that changes under low and high emission climate scenarios. It illustrates the following.

▶ For the base population, home insurance affordability pressure increases with age. Individuals aged 60 or younger in the base population have a median AAHIA of less than one week, but individuals aged 70 and older have a median AAHIA of almost two weeks.
▶ For the vulnerable population, the relationship between age and the AAHIA is reversed, with affordability pressures reducing with age. However, 46% of individuals in the vulnerable group are aged over 60 years, compared to only 23% in the base population.
▶ Climate change will impact the base and vulnerable populations in different ways. For the base population, the climate change has little impact on the median AAHIA. For the vulnerable, climate change will particularly impact the older population.

5.3.2 Life-stage

Figure 5.12 shows how the median AAHIA varies by life-stage, for base and vulnerable households, and under low and high emission climate change scenarios. It illustrates the following observations.

▶ The AAHIA for households differs depending on life-stage. In the base population, single retirees face the highest affordability pressures, with a median AAHIA of 2.5 weeks. Single-adult households and retirees face the highest affordability pressures, while non-retired couples have the lowest pressures. Clearly, there is a direct relationship between the number of income-earning people in a household and the AAHIA.

▶ Retired lone persons are the most vulnerable group, with 35% of vulnerable population made up of single retirees. Vulnerable single people under 40 face the highest affordability pressures currently and under climate scenarios, with median AAHIA of 14 weeks currently and increasing to 15 weeks under the high emissions scenario.

Figure 5.12 – Median AAHIA by life-stage – base vs vulnerable populations
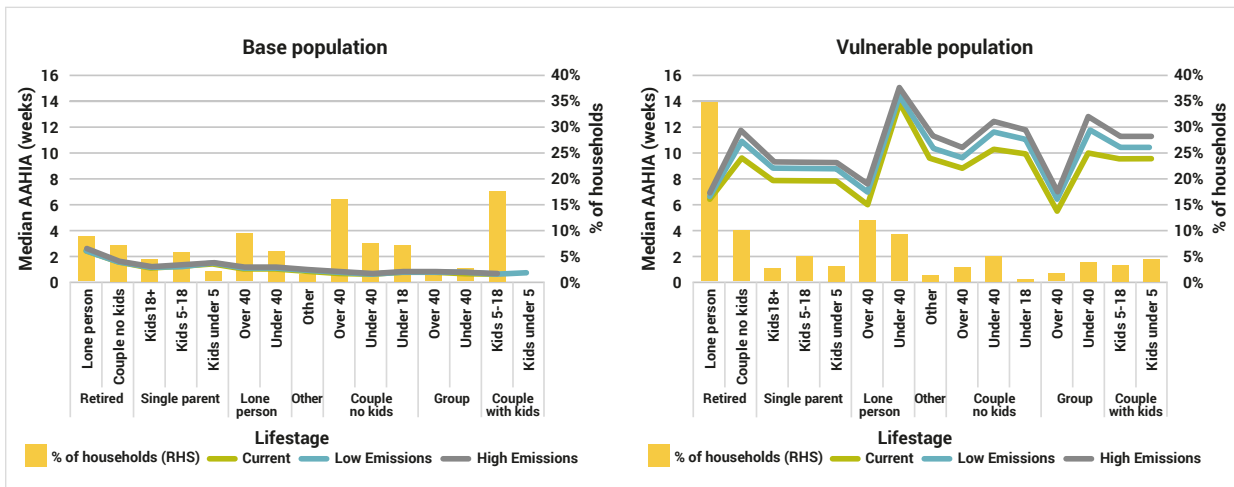
We note that the AAHIA Index uses household income as a proxy for economic resources. Retirees, who are likely to have low income, may have access to savings or other assets, which increases their ability to pay insurance premiums or absorb disaster losses. The comparison between household income and savings is shown in Section 4.2.

5.3.3 Insurance literacy

**Figure 5.13 – Median AAHIA by insurance literacy – base vs vulnerable populations**

Figure 5.13 shows how the median AAHIA varies by insurance literacy, for base and vulnerable households, and under low and high emission climate change scenarios. It illustrates the following observations.
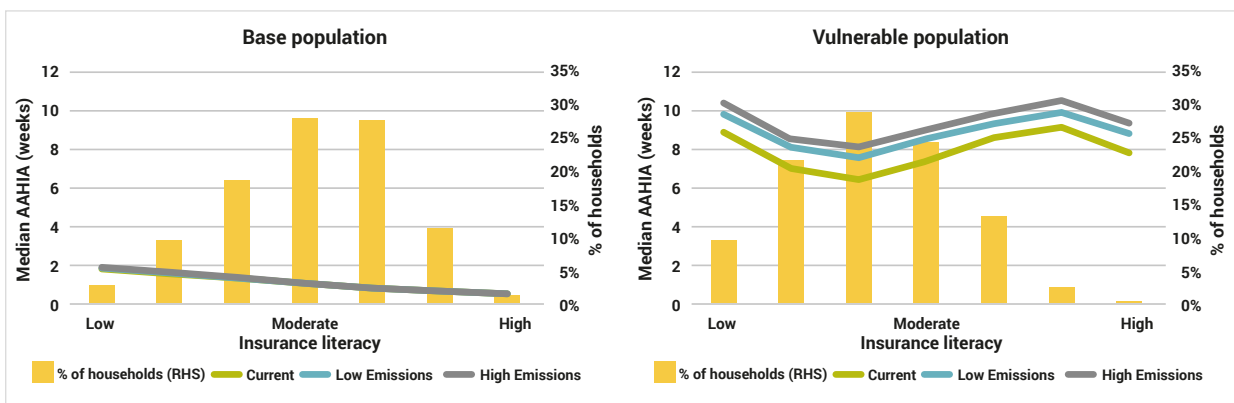
- In the base population, households with the strongest understanding of insurance literacy also face the lowest affordability pressures.
- The relationship between insurance literacy and the AAHIA is less clear in the vulnerable population.
- 69% of the base population have at least a moderate level of insurance literacy. This compares to only 40% in the vulnerable group.
- The impact of climate change does not materially differ between households with differing levels of insurance literacy.

5.3.4 Housing tenure

Figure 5.14 – Median AAHIA by housing tenure – base vs vulnerable populations

Figure 5.14 shows how the median AAHIA varies by housing tenure type, for base and vulnerable households, and changes under low and high emission scenarios. It illustrates the following observations.

- In the base groups, households who own their home with a mortgage face lower home insurance affordability pressures.
- Renters are more likely to be represented in the vulnerable population (39%) compared to the base population (31%). While renters do not directly purchase buildings insurance, higher premiums will likely translate into higher rental costs.
- There are significantly more households who own their homes outright in the vulnerable population (41%) compared to the base population (31%). This is possibly related to the life-stage of homeowners, with retirees more likely to have paid off the mortgage on their homes.
- The impact of climate change does not materially differ between households of different tenure types.

5.3.5 Socioeconomic status

Figure 5.15 shows how the median AAHIA varies by socioeconomic status, for base and vulnerable households respectively. The figures also show how the AAHIA changes under low and high emission climate change scenarios. The socioeconomic measure used is the SEIFA Index for Relative Advantage and Disadvantage, with higher SEIFA ranks correlating to higher access to resources. It illustrates the following observations.

- The median AAHIA generally reduces with higher SEIFA deciles in the base population.
- There are more households in the two highest SEIFA deciles in base population (42%) compared to the vulnerable population (35%).

▶ The impact of climate change is more variable and pronounced in the vulnerable population.

Figure 5.15 – Median AAHIA by socioeconomic status – base vs vulnerable population
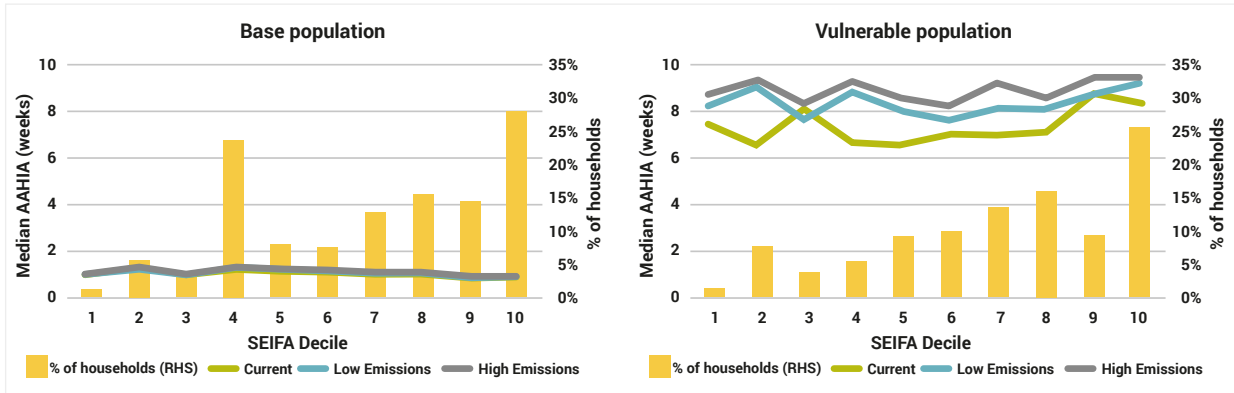
5.3.6 Savings

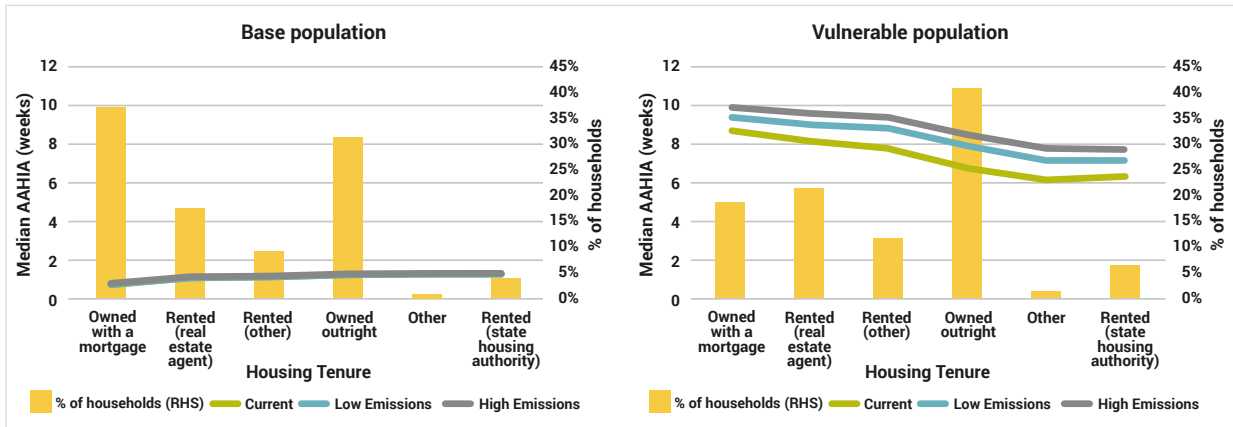**Figure 5.16 – Median AAHIA by household savings – base vs vulnerable populations**
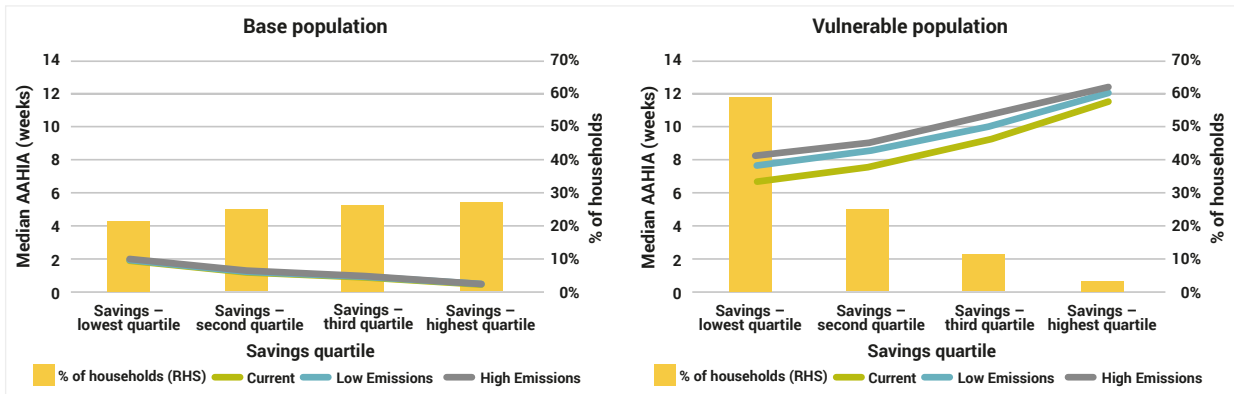
Figure 5.16 shows how the median AAHIA varies by the household savings level, for base and vulnerable households and under low and high emission scenarios. We make the following observations.

▶ For the base population, as the level of household savings increases the median AAHIA reduces.
▶ Over half of the households in the vulnerable population have savings in the lowest quartile. However, for these households, the AAHIA increases as the levels of savings increases. This could indicate that vulnerable households with the highest AAHIA have a greater ability to pay insurance premiums or absorb disaster losses than is suggested by household income.

6 Policy implications and measures to address home insurance affordability

Figure 6.1 – Policy considerations for home insurance affordability and resilience measures
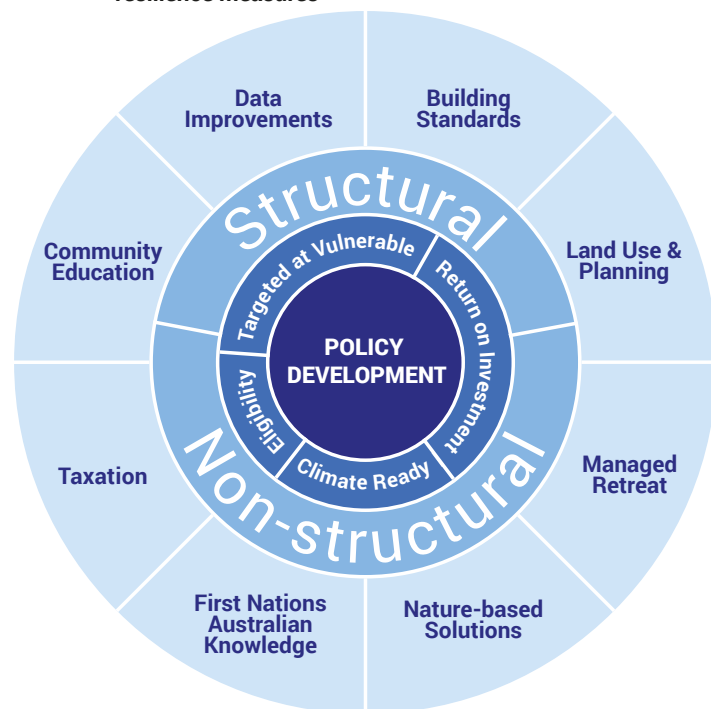
Pre-disaster investment in resilience can be far more efficient than post-disaster funding.

In line with the Productivity Commission's 2014 recommendations, the Commonwealth Government elected in 2022 has made the commitment to invest $200 million p.a. in resilience, thereby increasing pre-disaster funding of resilience measures, rather than post-disaster recovery, which is inefficient compared to investment in resilience (Productivity Commission, 2014).

This investment in resilience will not only protect communities from the impact of natural hazards, but in the long term can reduce home insurance premiums, improve the availability of insurance cover and reduce non-insurance costs for governments and households (Finity Consulting, 2022). Naturally, households that are most vulnerable to home insurance affordability pressure should expect to see significant benefits from investments in resilience, in the form of improved home insurance affordability, reduced health and social costs, and less reliance on governments for recovery payments. Conversely, the failure to adequately prepare communities for disaster risk will likely impact greatest on the most vulnerable, compounding existing inequity between communities, increase health and social costs, and place greater reliance on governments post-event recovery payments.

In this section, we discuss possible policies to increase the resilience of Australian population to natural hazards, with a focus on home insurance affordability and equity. From our analysis in Section 3, policies that meet the following criteria are most likely to be efficient (lowest cost) and effective (greatest improvement in home insurance affordability).

▶ Policies targeting vulnerable households, which face the greatest home affordability pressures.
▶ Policies that do not exclude vulnerable households through eligibility criteria.
▶ Policies that allow for the impact of climate change.

Importantly, any policy changes will require strong collaboration between multiple parties, including local, state and Commonwealth governments, insurers and banks, builders and developers, and First Nations Australians.

6.1 Structural solutions

Structural solutions relate to hard infrastructure measures that improve disaster resilience. This includes the construction of mitigation infrastructure to control natural hazards, and the adaptation of homes to better withstand extreme weather events.

> **Structural solutions are effective at managing current natural hazard risks and improving home insurance affordability for vulnerable groups. However, resilience measures must consider how climate change will alter the profile of natural hazards – more frequent and severe events, as well as catastrophes in areas that have historically been unaffected. Care must also be taken to explicitly consider equitable access to government resilience investment, as the large upfront cost required has the potential to exclude vulnerable communities with low household savings. Instead, policies with direct subsidies for communities with socioeconomic disadvantage are likely to be more effective and efficient at addressing home insurance affordability pressures (ACCC, 2020).**

6.1.1 Return on investment

Hard mitigation solutions are expensive, but can provide a significant return on investment. There are many examples across Australia where levees, floodways, sea-walls and other mitigation infrastructure have significantly reduced losses from natural hazards, with a secondary benefit of savings in insurance premiums. For example, the initial cost of $28 million for the Roma flood levees in Queensland has resulted in savings of over $130 million in avoided damage, a five time return on investment to date (Finity Consulting, 2022). In the case of Roma, the installation of the levees restored insurance availability a period of over a year where some insurers had stopped writing new business in the area.

With careful allocation of resilience funds, infrastructure resilience measures could yield savings of up to 10 times the initial investment (Finity Consulting, 2022).

6.1.2 Targeted measures

The US has committed $1USD billion into the Federal Emergency Management Agency Hazard Mitigation Grant Program, which provides funding for

Infrastructure resilience measures can yield savings of up to 10 times the initial investment.

Investment in resilience measures for individual homes can provide significant benefits for homeowners.

structural measures that reduce or eliminate risk to people or property from natural disasters including structural elevation, flood risk reduction measures and retrofitting[31]. In the initial implementation of the program, economically disadvantaged rural communities struggled to access the funds, and changes have since been made to improve the equitable distribution of funds. Changes included adjustments to the eligibility scoring system to better target disadvantaged, rural communities, as well as reductions to the cost-sharing requirements for these communities (Rachal, 2021). In addition to consideration of return on investment, we recommend that government funding in Australia explicitly consider equity for Australia's most disadvantaged areas, as this will ensure that the resilience measures provide the largest relief to home insurance affordability across Australia, resulting in efficient and effective resilience programs.

6.1.3   Funding community wide measures

The cost of building new mitigation measures has in the past been shared between Commonwealth, State and Local governments. In some cases, the cost is split equally between the three governing bodies. The portion of cost funded by local councils is commonly passed onto homeowners through a council levy. In communities already vulnerable to natural hazards, this could significantly stress financial resources especially if the mitigation feature is being built in the wake of a recent catastrophic event. In financially disadvantaged areas, this model of cost-sharing could result in communities being unable to afford infrastructure funding. In addition, the benefits of mitigation structures are localised; levies charged across an LGA may mean some homeowners who are minimally impacted by the natural hazard risk are subsidising the cost for those who heavily benefit. If not fully funded by state and Commonwealth governments, where the cost is spread over a larger population base, then the funding for mitigation may stress financial and social resilience.

6.1.4   Individual property resilience

Investment in resilience measures for individual homes can also provide significant protection against cyclones, storms and flood for homeowners. Retro-fitting homes for stronger roof connections, roof replacements, reinforcing window and door frames and installing impact-resistant screens can limit the impact of cyclone damage. Flood-proofing could include creating wet flooding zones, and raising houses above the flood-line. In 2017, the Commonwealth and Queensland governments launched a $21 million Household Resilience Program which retrofitted 3,100 existing homes in the 'recognised cyclone risk area' of Northern Queensland.

6.1.5   2022 Floods and planning for climate change

Following the 2022 floods, the Queensland Government is proposing a $771 million flood relief plan, which includes grants to retrofit 5,500 flood-impacted homes and to raise 1,000 homes. To be effective, the design for these adaptation initiatives should be considered in the context of the changing climate, with awareness that weather events will become more frequent and more severe. For example, many Lismore homes that were built on stilts that were well above previous flood markers, were still flooded (Zhuang, 2022). To be equitable, the eligibility criteria to access grants must include consideration that communities not previously impacted by natural hazards will increasingly face climate change impacts. One such example is the poleward shift of the cyclone zone, where communities in south-east Queensland and northern coastal NSW may see increasing and more severe cyclone events.

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31   https://www.fema.gov/sites/default/files/documents/fema_hma-trifold_2021.pdf

6.1.6 Eligibility criteria

Another consideration for equitable implementation of the program is any up-front funding by the household. The 2017 Household Resilience Program required homeowners to contribute a 25% co-payment. For socioeconomically disadvantaged households this co-payment is likely to be unaffordable. The co-payment requirement could also mean that renters are less likely to benefit from the program. A possible approach here is to means test the allocation of grants from the program.

6.2 Managed retreat

In areas where mitigation and adaptation systems cannot adequately manage the losses suffered from persistent severe weather events, communities may need to consider relocating some or all of its people and assets, especially in cases where home insurance premiums become unaffordable. Throughout Australian history there have been a number of examples of managed retreat from flood-prone areas, following devastating and deadly flooding events – including Bega (1851), Clermont (1916), Tallangatta (1956) and Grantham (2013), considered one of the most successful town relocation examples globally (Coates, 2012). Over the last 30 years, around 1.3 million people globally have relocated through strategic managed retreat (Hino, Field, & Mach, 2017). By the end of the century, the impacts of climate change might create hundreds of millions of climate migrants – whether through strategically planned managed retreat or forced displacement.

6.2.1 Government planning and eligibility

Managed retreat requires significant government support and planning, and if not carefully managed could leave behind vulnerable households. The land-swap initiative in Grantham in 2013 – financed by a $18 million loan from the state government for purchase of the land – required homeowners to pay for the building of their new home. In some cases, this left behind families who lacked the financial capacity to rebuild a new home, exacerbating existing financial inequalities.

More commonly, local and state governments are implementing voluntary buy-back of at-risk homes, with the Queensland government proposing $350 million of funds to buy-back up to 500 homes, and Tweed Shire Council in Northern NSW offering house buy-backs at market rate. However, market house prices in these regions already factor in the high disaster risk, meaning that those who sell are likely unable to afford housing in less vulnerable regions. The take-up of the Northern Rivers buy-back scheme has been low (Barbour, Doyle, & Gribbin, 2022).

6.2.2 Community support and financial education

Another key challenge in the implementation of managed retreat is the lack of community support. Homeowners who are not directly impacted by buy-back or land-swap schemes might see reductions in the house prices, which directly impacts a community's financial capacity. In 1988, Byron Bay council adopted a retreat policy triggered by erosion of the coastline, however the policy was retracted after the council was sued by homeowners for lowering property prices (Hino, Field, & Mach, 2017). There are also strong psychological and social ties to home and land, which might outweigh the perceptions of disaster risk.

> State governments are implementing voluntary buy-back of at-risk homes, but those who sell are generally unable to afford housing in less vulnerable regions.

Managed
retreat remains
an important
consideration in the
risk management
against extreme
events and
climate change.

> In these instances, it is imperative that homeowners are sufficiently educated in order to make an informed decision about continuing to live in their current homes.

The equity implications of government-funded disaster recovery for those who choose to remain in or move into high-risk homes is discussed in Section 4.3.

6.2.3   Cost-benefit analysis

Despite the challenges, managed retreat remains an important consideration in the risk management against extreme events and climate change. Cost-benefit analysis over the long term shows that managed retreats can provide better value than other resilience options, and clearly provides a better option than continuous disaster recovery or forced climate displacement. The Government should advance frameworks for planning managed retreats. A useful reference could be the bill currently in consideration by the New Zealand Government, which intends to support managed retreat in the Christchurch post-earthquake red zone by the end of 2023. The framework will include (New Zealand Ministry for the Environment, 2022):

▶ Setting roles, responsibilities and processes for managed retreat from areas of intolerable risk.
▶ Providing tools for councils to modify or extinguish existing uses of land
▶ Providing clear criteria for when central government will intervene in managed retreat.
▶ Providing clarity on tools and processes for acquiring land and related compensation.

6.3 Land use and planning

Much of the devastating flooding in Australia can be attributed to failures in land use and planning (Productivity Commission, 2014).

6.3.1   Future development

Policymakers need to ensure that future development occurs in areas with low vulnerability to natural hazards, and to avoid policy that enables development in high-risk areas.

Where protective infrastructure is built, rather than restrictions put on land use, this can encourage further development in high-risk areas. For example, raising the height of a dam could reduce the risk of downstream flooding, but potentially encourage further development that undoes any reduction in risk from raising the height of the dam.

In recent years, policymakers have taken positive action towards land-use reforms to reduce future development in areas with high exposure to natural hazards. For example, the NSW government's Flood Prone Land Package give local councils more flexibility and support in making land-use decisions for new development. Policymakers should continue to consider natural hazards risks in land-use decisions, allowing for the expected impacts of climate change[32].

6.3.2   Addressing legacy issues

For existing communities on flood plains, land-use approval by governments in the past arguably provided implicit support that these areas were suitable

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32 Further detail around the changing profile of bushfire, cyclone, flood and storms under climate change is provided in Section 3.4.

for residence. However, many of these communities have faced multiple flooding events and extensive rebuild and repair costs, funded in part through disaster recovery support from taxpayers. Allowing communities to rebuild on flood plains may not be equitable, given the knowledge that more frequent and extreme events will occur due to climate change.

In developing policy on addressing legacy issues, we recommend that policymakers consider:

▶ **What information on natural hazards was available and accessible to households?** If the introduction of address-based insurance pricing has resulted in a sudden increase in insurance premiums after an initial period of pricing based on risk pooling, then there is a stronger argument for taxpayer funded support for affected households. The rationale here is that these households may not have been aware of the risk associated with the property in the absence of risk-based pricing of insurance.

▶ **What cost-effective adaptation measures are available that do not incentivise poor risk behaviours?** For example, the Florida government increased housing affordability, but failed to couple that with restrictions on future land use. This resulted in extensive development in floodplains, and increased catastrophe losses (Lin, McDermott, & Michaels, 2021; Staletovich, Brutus, Munoz, & Rivero, 2021).

6.4 Building standards

The National Construction Code, overseen by the Australian Buildings Codes Board (ABCB), provides the minimum safety, health, amenity, accessibility and sustainability requirements for all new buildings. These minimum standards are designed to preserve life in the case of a catastrophe. These standards are not specifically designed to limit damage to property assets.

The ABCB is in the process of consulting on changes to the building codes to include energy efficiency provisions, following endorsement in 2019 by the Council of Australian Governments Energy Council. The Government and ABCB should also consider stronger building standards which consider preservation of both life and assets, which will limit the impact of natural disasters and increase resilience of communities. Changes to the National Construction Code should:

▶ recognise that climate change will bring more frequent and severe weather events;
▶ consider both new builds and renovations or retrofits of existing properties; and
▶ apply to both privately owned homes, as well as social and affordable housing.

In addition, any assessment of the costs and benefits of changes to the National Construction Code should consider the lifecycle costs of the dwelling – not just the initial build costs, but include the cost of repairs over the expected lifetime of the property. Any discount rates should reflect current market conditions, such as through current interest rates on construction loans, rather than being based on historically higher interest rates.

By incorporating energy efficiency standards and encouraging the use of lower

Current minimum building standards are designed to preserve life not to limit damage to property assets.

emissions building materials, building standards can also reduce emissions and mitigate the potential impact of climate change. Care must be taken to ensure that energy efficiency measures do not reduce the resiliency of the building to natural hazards and fire.

6.5 Nature-based solutions and First Nations Australian knowledge

Nature-based Solutions (NbS) is an approach to reducing damage from natural hazards that has become a more prominent component of disaster risk management in recent years. It encompasses actions that protect or restore ecosystem services that reduce the impacts of natural hazards. Ecosystem services are the benefits that society gleans from nature, such as flood control and wave attenuation that is provided by a coastal wetland, and carbon storage provided by forests and mangroves. The inclusion of soft landscape areas in built environments can replicate natural water cycle management, which reduces pollution and flooding. By protecting, restoring and maintaining these ecosystems through green infrastructure, the impact of natural hazards on homes can be reduced.

One of the appeals of NbS is the potential to not only improve resilience, but also to provide a myriad of co-benefits across domains such as health, recreation and the local economy. However, NbS has the potential to exacerbate existing inequalities. For example, urban greening projects may lead to increased rent prices, which in turn causes financial stress for vulnerable populations and may lead to their displacement.

Equitable implementation of NbS requires explicit recognition of how access and control over resources influences economic, environmental, and social outcomes (Stockholm Environment Institute, 2022). This is particularly relevant in colonised countries like Australia, where much of the land and resources have been taken from First Nations Australians. The Stockholm Environment Institute proposes five principles for implementing NbS in an equitable way.

1   Ensure that design, governance and implementation processes are inclusive and transparent.
2   Tackle root causes of marginalisation, inequality and injustice at all stages.
3   Limit the creation of economic and non-economic losses, and avoid the unjust redistribution of risks and costs. This includes redistribution across geography, sector, social group, time and generation.
4   Prioritise interventions for the most at-risk places and communities.
5   Devise and use valuation and measurement tools that assess social and political change and consequences.

Partnering with First Nations Australians when designing and implementing NbS has the potential to not only ensure that these principles are followed and the most equitable outcomes are achieved – it may also improve the solutions themselves. First Nations Australian and other local communities often have extensive knowledge of their environment and how to manage and mitigate natural hazards within it (Reed, et al., 2022). This can inform which NbS should be pursued and how they are best implemented. The Royal Commission into National Natural Disaster Arrangements recommended that Commonwealth, state and local governments should engage with First Nations Australians to explore Indigenous land and fire management, to increase natural disaster resilience as well as to inform

public land development, planning, and land management activities. These recommendations were supported in principle by the Commonwealth Government.

However, drawing upon First Nations Australian or traditional ecological knowledge for NbS also has the potential to reinforce existing power structures and inequities. Examples of this include when First Nations Australians contribute knowledge without the ability to determine how and by whom it will be used; when these groups struggle to secure funding for their solutions because they do not fit within the established structures of knowledge and action; and when First Nations Australians are forced to express themselves in such a way as to conform to the practices of the state, rather than according to their own values (Nadasdy, 1999).

In their report on Aboriginal Peoples and the Response to the 2019-2020 Bushfires, the Centre for Aboriginal Economic Policy Research emphasised that First Nations Australians should be involved in disaster management "across the PPRR spectrum: planning, preparation, recovery and response" (Williamson, Markham, & Weir, 2020). This highlights the need for collaboration at every stage for equitable outcomes to be achieved.

NbS provides an opportunity to limit the impact of natural hazards and climate change while supporting biodiversity and the well-being of communities. It is imperative that the solutions are led by the communities most affected. For example, implementation of traditional Indigenous solutions must emphasise the self-determination and sovereignty of First Nations Australians. Otherwise, they run the risk of being extractive and exploitative.

6.6 Tax

State government taxes and levies add 10-30% to the insurance premium, varying between states, as shown in Table 4.1, with the stated intention of funding emergency services. Taxes are applied as a multiplicative loading to the insurance premium. This means that policyholders who face the highest natural hazards risks and pay the highest insurance premiums also pay the most tax. This regressive tax exacerbates home insurance affordability pressures. Various government reviews, including the Henry Tax Review in 2010 and the Thodey Review of Federal Financial Relations in 2020, have found that insurance taxes are inefficient and should be abolished. Most states have now moved to a different funding arrangement for emergency services including through council rates.

Our analysis suggests that state tax charges contribute $2.1 billion to annual home insurance premiums (assuming no non-insurance and no under-insurance). The removal of all tax charges would reduce the median AAHIA across Australia from 1.1 weeks to 0.9 weeks, and reduce the median AAHIA for vulnerable households from 7.4 weeks to 6.6 weeks.

We recommend that remaining State based taxes on insurance be replaced with alternative revenue sources that are more equitable and efficient.

6.7 Cyclone reinsurance pool

The Commonwealth Government is implementing a reinsurance pool commencing 1 July 2022 covering cyclone and related flood damage. The CRP is intended to improve insurance affordability, particularly in Northern Australia, and to encourage additional insurers into the market. The CRP,

It is imperative that disaster management solutions involve the input of those communities most affected.

managed by the ARPC, will provide cyclone reinsurance to insurers, which will exclude any profit margins and be backed by a $10 billion guarantee from the Commonwealth Government.

A key consideration for policymakers is how effectively the CRP addresses the cyclone risk for those most vulnerable – those currently impacted, as well as populations who will become exposed as climate change impacts on cyclone risk. Figure 6.2 shows the intended operation of the CRP pricing, whereby margins on cyclone risk will be removed, and low risk properties will subsidise high risk properties. To the extent that this is successfully implemented by the CRP, it will reduce the home insurance premium for higher risk households (estimated as a 28% or 38% reduction in premiums for medium- or high-risk properties respectively (Finity Consulting, 2022)). However, it is unclear if this will improve affordability, which also depends on the income of the household.

Figure 6.2– Cyclone Reinsurance Pool[33]

The CRP may also reduce the risk signal provided by insurance premiums that typically drive investment in adaptation and resilience measures to reduce risk. However, the ARPC pricing includes discounts for properties that undertake cyclone and flood mitigation measures such as roof replacements or upgrades, window protection through cyclone shutters, and replacement or bracing of roller doors. One co-benefit of this is that it will allow the government to build up a central database of the extent and location of mitigation measures deployed in Australia's current housing stock, which would enable the assessment of future programs to encourage mitigation.

While the ACCC will monitor insurers to ensure that any savings on reinsurance costs are passed on to customers, the Government should also set up regular and ongoing monitoring to understand the efficacy of the CRP over time. For example, how the CRP alleviates affordability pressures particularly in high risk populations, whether the CRP is encouraging undesired behaviours like building on flood plains, and how well the discounts provided have incentivised consumers to invest in increasing the resilience of their homes and businesses to cyclone risk.

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33 Figure 1.2 of Finity Consulting, 2022.

The CRP represents a systemic intervention in the pricing of home insurance for Australian households and small businesses exposed to cyclone, including those with low exposure. While this may appear to be equitable, our analysis in Section 3.7.1 shows that cyclone risks, and consequent pressures on home insurance affordability, are highly concentrated in relatively small sections of the community. The policy is therefore not well targeted at vulnerable households, and risks being a less efficient and effective solution compared to direct subsidies to vulnerable households, or investment or funding for resilience measures for affected households.

The current CRP is intended to be cost-neutral to government, with no cash subsidy from the taxpayer. (The Government guarantee to the CRP is a non-cash subsidy.) We recommend that options to subsidise home insurance for lower income households be explored, in order to improve the effectiveness of the CRP in improving affordability. By encouraging take up of home insurance, this will also reduce the burden post-event on governments in supporting recovery for communities and households.

6.8 Data improvements

The availability of appropriate data can help households, insurers, public institutions and academics make better informed risk-based decisions. However, current challenges include the following.

- Central government databases in Australia do not currently include measures of insurance cost. Importantly, indices of housing affordability in Australia, such as the Housing Occupancy and Costs data from the Australian Bureau of Statistics[34], do not include home insurance premiums in the assessment of housing affordability.
- While insurance can be a method of communicating risk to these stakeholders (Rumson & Hallett, 2019), the risk signal provided by insurance is often difficult to understand and inaccessible for households. There are inconsistencies between industry knowledge and consumer practice, and often difficulties involved in integrating risk knowledge into decision-making of the general population (Sapountzaki, 2022).
- Insurers do not have access to an adequately detailed industry database to accurately assess and reflect risk across the country. In particular, data on extreme weather events is sparse, with contributes to uncertainties in the premium estimates (Paddam, 2020).

Improvements in data availability and accessibility will improve household awareness of disaster and insurance risk, allow better assessment of natural hazards by insurers, and enable better identification of vulnerable households for governments to enable policy development, resource and recover planning, emergency planning and risk assessment. We suggest the collection of the following data into a central, publicly available database.

- Inclusion of insurance costs into government housing affordability measures. Including insurance costs in housing affordability metrics makes it clear that insurance is a key component of housing cost, which will benefit households as well as policymakers. Some global examples of housing affordability datasets with consideration of insurance costs are the New Zealand Housing Affordability Measure[35] and the American Housing Survey[36].

34 https://www.abs.gov.au/statistics/people/housing/housing-occupancy-and-costs/latest-release#data-download

35 https://www.hud.govt.nz/research-and-publications/statistics-and-research/housing-affordability-measure-ham/

36 https://www.census.gov/programs-surveys/ahs.html

The collection and availability of relevant data will allow Australians to better understand and actively manage the natural hazards risk facing their homes.

▶ Public availability of flood hazard maps across Australia (driven by individual councils), including a consistent specification for such studies (currently different councils use different definitions). This would improve consumer awareness and more importantly help better inform vulnerable populations.

▶ Improved open-source modelling of natural disaster risks incorporating climate change impacts that is consistent and complete across Australia. This would help provide more readily available information to the public about their natural hazard risk.

▶ Publicly available high-quality up-to-date exposure and vulnerability data across Australia for all buildings and infrastructure. This would include critical data on property location, value, construction type, roof type, year of build, compliance with code and other vulnerability information. This would enable much better assessment of climate and disaster risk across Australia and the targeting of resilience and mitigation activity. This would also help individuals understand the relative risk of their current or potential future home.

▶ Development of a national strategy to address resilience in existing buildings and infrastructure (such as urban drainage systems, levies and dams) and, in conjunction with the insurance industry and other stakeholders, development of a prioritised list of resilience building projects. This would include implications for building codes required in regions where the vulnerability of buildings to hazard is changing, e.g. changes in flood or cyclone zones may require changes to building codes appropriate for a location. Such information would allow actuarial assessment to include future changes in vulnerability, and to assess the costs and benefits of each project.

▶ Development of a national strategy to embed climate and disaster risk considerations into land use and planning, including close consultation with insurers. This would be followed by projections of future property development in line with that strategy in order to allow the industry to understand future exposure growth and its impact on climate and disaster risk, which can then be incorporated into actuarial assessments.

The collection and availability of the above data will allow the Australian population to understand and actively manage the natural hazards risk facing their homes. This data will enable homeowners to improve the resilience of their homes, and allow prospective homebuyers to factor natural hazard risks into purchasing decisions (subject to financial and insurance literacy constraints). Collection of the above data will also facilitate effective policy decisions around public protective infrastructure, building codes, land use and planning, managed retreats, nature-based solutions, and assessment or adjustments to the CRP.

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Appendices

A

Projected changes in the Australian climate

Figure A.1 illustrates the carbon dioxide emissions and concentrations for each RCP, while Figure A.2 illustrates the resulting projected temperature anomalies (on a global basis).

Figure A.1 – Carbon dioxide emissions and concentrations for each RCP[37]
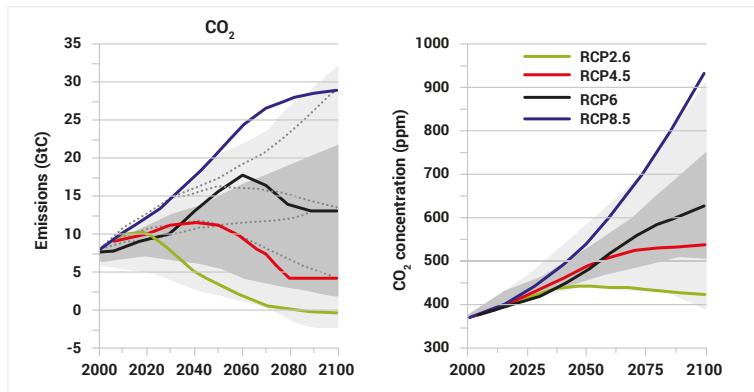
37 From Figure A5.1 in (ESCC, 2020)

38 From Figure 2.1 in (ESCC, 2020).

Figure A.2 – Global average annual temperature relative to 1850-1900[38]
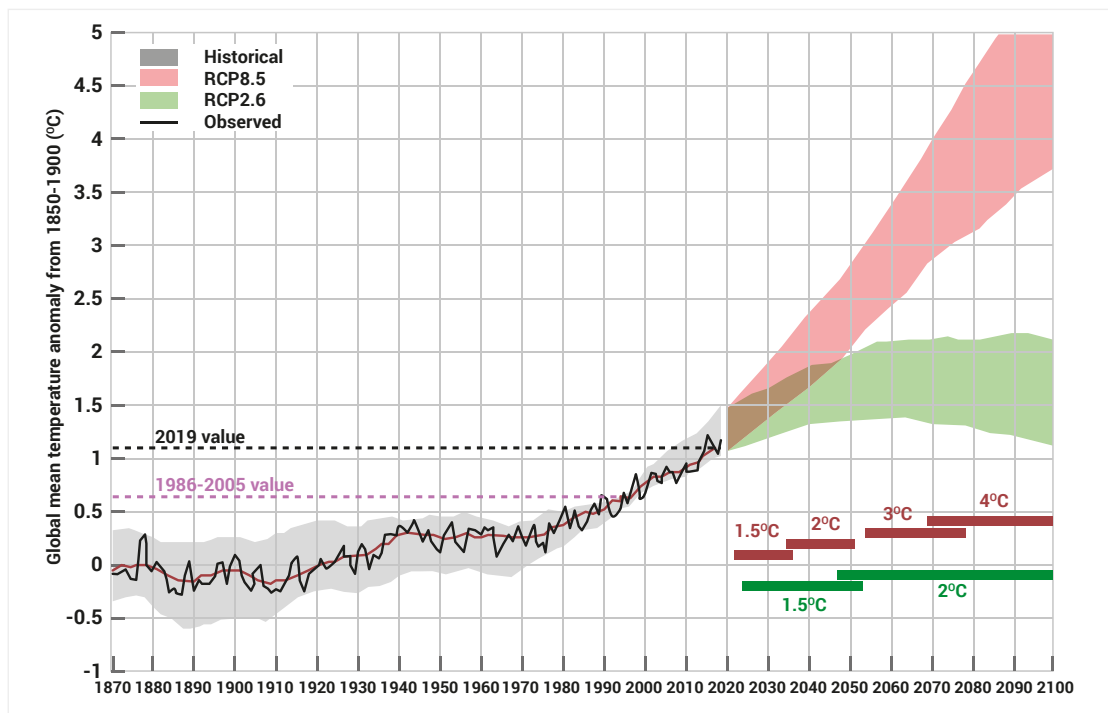
Table A.1 shows the assumed impact of the low and high emissions scenarios on each hazard we have modelled.

Table A.1 – Projected changes in key climate variables for hazards in Australia as at 2050[39]

Hazard	Low emissions scenario	High emissions scenario	Confidence
Cyclone frequency	East: -4% (-8% to 1%) West: -6% (-10% to -2%)	East: -8% (-15% to 2%) West: -12% (-20% to -4%)	Medium
Severe cyclone frequency (Category 4-5)	Little change or small increase	Little change or increase	Low-Medium
Cyclone location	Little change or small poleward expansion	Little change or poleward expansion	Low
East Coast Low frequency	-10% (-15% to -5%)	-20% (-30% to -10%)	• Low for summer • High for winter
Extreme rainfall intensity (20-year return period)	+10% (5% to 15%) hourly +7% (4% to 10%) daily	+20% (10% to 30%) hourly +15% (8% to 20%) daily	• High for direction of changeMedium for magnitude of change
Large hail (>2.5 cm diameter)	Little change, but potential increase in east and poleward shift in features		Low
Extreme fire weather intensity (95th percentile of Forest Fire Danger Index)	• East: 15% (0% to 30%) • Rest of Australia: 20% (5% to 35%)	• East: 30% (0% to 60%) • Rest of Australia: 40% (10% to 70%)	• High • East: Medium • Low for lightning ignition and fuel load

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39 From Table TS1 in (ESCC, 2020)

B Key assumptions, uncertainty, and limitations

The results discussed in this report are based on several models, each of which makes several assumptions. Consequently, these results are subject to significant uncertainty, due to:

- ▶ Model uncertainty: the models are an approximation for complex physical processes such as flooding or cyclone formation, human behaviour such as decisions to insure, behaviours of markets such as property values and insurance markets, or based on statistical assessments of historical results, and these approximations may not adequately reflect the underlying processes.
- ▶ Parameter uncertainty: each model makes several assumptions, and these assumptions may be incorrect
- ▶ Process uncertainty: weather-related extreme events are rare and highly volatile, and the underlying events are inherently uncertain.
- ▶ Data uncertainty: the models rely on a range of data sources and undetected and uncorrected errors in this data may result in incorrect results.

We emphasise the following uncertainties in the models used and the consequent limitations of the results.

1   Model limitations

a   In line with the recommendations of the CMSI, the analysis is based on a static portfolio of risks (Climate-KIC Australia, 2020). This means no change is assumed in the following between now and 2050:
   i   Number and location of households.
   ii   Socioeconomic characteristics of households.
   iii   Property characteristics (sum insured, building age, roof type, construction type, insurance rates).
   iv   No change in the vulnerability of each property to natural hazards – i.e. no new adaptation or resilience measures applied to each property.

b   No change in the home insurance products, including no changes in policy excesses or coverage of natural hazards, or other changes in insurance contract terms.

c   No explicit allowance for inflation in construction costs for buildings, so that our results for the climate scenarios are in 2022-dollar values. Actual construction cost inflation may exceed growth in household income, leading to unmodelled increased pressure on home insurance affordability.

d   No changes in home insurance premiums for non-hazards related components between now and 2050, including for claims such as earthquake, theft, taxes and duties, insurer's allowance for expenses and profit etc.

e   No allowance for the impacts of the CRP, which is intended to improve insurance affordability particularly in Northern Australia, by removing any margin for reinsurers from the pricing of cyclone risks.

f   The buildings and contents sum insured for each residential property is estimated using Finity's *Rebuild* product, which is described in Appendix D.2.

g   The AAHIA Index only examines the impact of climate change on bushfire, cyclone, flood and storm on insurance premiums. It does not consider the impact of other climate-related issues, such as coastal inundation and erosion, drought, heatwaves, air pollution or climate migration which may also impact on households.

h   Finity's *Finesse* product, described in Appendix D.4, is used to calibrate technical costs to retail premiums. However, the basket of quotes is a market representative pool of insurable Australian Household risks. Uninsurable risks will return with no premium, reflecting insurers' individual underwriting exclusions and pricing frameworks. As such, the calibrated retail premiums for addresses with extreme hazard risks, may be understated given that these risks will not be captured in the *Finesse* batch.

i   Calibrating retail premiums to *Finesse* will only provide a view on new business premiums. In reality actual insurance premiums paid by households will vary on renewal, subject to capping/cupping, tenure and base rate changes. The magnitude of these differences can be significant but will vary vastly between insurers.

2   Household income

a   The household income estimates are based on 2011 Census figures, and so are potentially out of date. In particular, the 2011 economy was recovering from the Global Financial Crisis and experiencing a mining boom, which may mean the metric used is

not reflective of current income distributions. The 2011 household income figures have been inflated to 2022 dollars.

b The household income data is provided in bands. The mid-point of the band has been adopted as the estimate of household income.

c The household income estimates do not consider COVID-19 impacts and any changes in the types of work undertaken, the composition of the workforce, and widespread adoption of working from home, which could have long term impacts on household income.

d There is no allowance made for income and other taxes on the household.

e There is no allowance made for household expenses, which could also vary due to socioeconomic factors we have not considered.

3 AAHIA Index

a Household incomes have been matched with individual addresses, which have estimated home insurance premiums. The ABS income data is provided at an aggregate level, and sampling is used to map individual household to addresses. In addition, the dataset used for individual residential addresses is based on the Geoscape Geocoded National Address File, which does not perfectly match the number of households in the ABS data at SA1 level. This may result uncertainty at the household level, which is why our results are aggregated to an LGA level.

4 Climate scenarios

a The climate models used in this report are based on two scenarios representing the highest and lowest RCPs considered in the fifth assessment report of the IPCC. However, they do not represent maximum or minimum outcomes, and it is possible, though unlikely, that emissions may be higher or lower than the range we have considered, resulting in higher or lower physical climate risk than considered in this report. We note that current emissions are trending closer to the High emissions scenario than the Low emissions scenario. The actual future emissions scenario will depend on global actions to reduce emissions, the extent of which is unknown.

b Each RCP is a summary of multiple GCMs, each of which results in different climate projections. Figure A.1 and Figure A.2 illustrate the variation in emissions and temperatures within the low and high emissions scenarios we have considered. We note that the range of forecasts is very wide, with the

highest temperature forecast for the low emissions scenario at 2050 being almost the same as the lowest temperature forecast for the high emissions scenario at 2050.

c The results are based on the average projection (ensemble mean) for each RCP, and this means that the actual range of results under the full range for each RCP could be wider than shown in our results – i.e. actual physical climate risk could be higher or lower than the results of our models but still be consistent with the RCPs used.

d The GCMs underlying each RCP primarily provide estimates of the changes in averages (means) of climate variables such as temperature, rainfall and windspeed. However, damage to properties is almost always due to extreme events rather than average events. We have therefore also relied on advice from the CMSI on the impact of climate change on extreme events. Table A.1 summarises these impacts, together with the confidence associated with each change, which in many cases are low. While the broad impact of climate change is well established, and climate models have a track record of accurately predicting average impacts at a continental level, significant uncertainties remain about the behaviour of weather-related extreme events at an individual address level. As the understanding of climate improves over time, climate models may change, and the expected behaviour of weather-related extreme-events may also change.

5 Data quality

a We have relied on several data sources, as described in Appendix A, and any errors in this data will result in errors in our results.

b The estimates of home insurance premiums are based on estimates of historical industry wide attritional losses.

c The vulnerability of each property to natural hazards will depend critically on the design and construction of each property and any resilience or adaptation actions taken by homeowner. This information was not available for residential properties in Australia. Instead, we have assumed that each property has the same features as the average house within each geographical area. Due to this, and also due to 4d above, our results are not accurate at an individual house level, but can be used to assess portfolios of risk at an LGA level, as has been done within our analysis.

Characteristics of vulnerable households

The table below summarises the characteristics of household with an AAHIA above four weeks (vulnerable households), compared with households with an AAHIA below four weeks (base households).

Table C.1 – Characteristics of vulnerable and base households

Characteristic	Vulnerable households	Base households
Definition	Households in highest 10% of AAHIAs	Households in lowest 90% of AAHIAs
Current median AAHIA	7.4 weeks	1.0 weeks
Geographic location	Concentrated in Northern Queensland, NT and Northern NSW	Concentrated in capital cities
Age	Average age 45	Average age 35
Life-stage	• Proportion retirees 42% • Proportion couples with children 13% • Proportion couples without children 10% • Proportion single parents 12%	• Proportion retirees 9% • Proportion couples with children 37% • Proportion couples without children 24% • Proportion single parents 11%
Socioeconomic rank (SEIFA)	Higher proportions of population in the lowest 80% of SEIFA scores • Proportion SEIFA decile 1-5: 27% • Proportion SEIFA decile 6-8: 38% • Proportion SEIFA decile 9-10: 35%	Higher proportions of population in the highest 20% of SEIFA scores • Proportion SEIFA decile 1-5: 21% • Proportion SEIFA decile 6-8: 59% • Proportion SEIFA decile 9-10: 15%
Insurance literacy of a household	• Proportion low insurance literacy: 55% • Proportion moderate insurance literacy: 42% • Proportion high insurance literacy: 3%	• Proportion low insurance literacy: 27% • Proportion moderate insurance literacy: 38% • Proportion high insurance literacy: 35%
Renting/owning household	• Proportion renting: 37%	• Proportion renting: 30%
Household savings levels	Median annual home insurance premium to savings ratio: 16%	Median annual home insurance premium to savings ratio: 6%

D Home insurance premiums

D.1 Technical cost of hazards

Finity has developed a suite of proprietary models for Bushfire, Flood, Storm and Cyclone risks to estimate the annual average loss from each hazard at an individual home address. Individual addresses are sourced from the Geoscape Geocoded National Address File[40], with classification of residential addresses based on the Australian Statistical Geography Standard Mesh Blocks[41] from the ABS.

An allowance was also made for earthquake risk at a postcode level.

Both buildings and contents insurance were included, and assumed no cover for coastal hazards except for cyclone related storm surge in line with coverage currently provided in the market.

D.2 Sum insured estimates

Finity has estimated the buildings sum insured for each residential dwelling using their *Rebuild* model, with the exception of units, and properties with secondary buildings (e.g. sheds and granny flats). The *Rebuild* estimates are based on:

- ▶ The internal area of the building (size and number of stories).
- ▶ Allowances for natural hazard driven construction standards.
- ▶ Allowances for logistical and labour constraints given the property's location.
- ▶ Allowances for how easy the property is to access e.g. slope.
- ▶ Allowances for additional features e.g. pools, solar panels, sheds.

The contents sum insured amount was assumed to be 16% of the buildings sum insured, based on industry benchmarks.

For units and homes with secondary buildings, we have assumed an average sum insured which varies by CRESTA zone for both buildings and contents.

D.3 Annual average losses for weather-related perils

Finity has used their suite of proprietary perils models to estimate the average annual loss paid out by an insurer under a standard home insurance policy in the event of a loss from the peril concerned. This section will discuss the drivers of risk for each peril and how the risk varies under different climate scenarios.

D.3.1 Cyclone

Cyclone is a material risk in Queensland, the NT and WA. The magnitude of cyclone risk across these regions varies materially according to location,

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[40] https://data.gov.au/dataset/ds-dga-19432f89-dc3a-4ef3-b943-5326ef1dbecc/details

[41] https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/main-structure-and-greater-capital-city-statistical-areas/mesh-blocks

with the highest risk areas concentrated around coastal Northern Australia. For example, areas such as Townsville in Queensland and Pilbara in WA have a high level of cyclone risk, while Perth and Brisbane have low risk of cyclone. Cyclones form off the coast of Australia before making landfall, and generally decrease in severity, or decay, as they move away from the coast. To quantify the cyclone risk around Australia, Finity has divided the coastline into a number of cyclone gates through which cyclones have made landfall in the past. The historical and simulated cyclone tracks are then analysed to determine the frequency, severity, angle of approach and rate of decay of cyclone events for each gate.

Location specific cyclone risk is then assessed by:

▶ Assessing the risk at the gate itself based on the assumed frequency and severity of cyclones passing through it, and
▶ Assessing the risk of the location based on its distance from the gate, accounting for the assumed angle of approach and rate of decay.

Finity then refine the risk assessment further at the address level by considering the impact of topography, including the effect of hill shielding and slope. Winds compress and accelerate as they move uphill, meaning that properties at the top of hills are more vulnerable to cyclone risk. Trees have the potential to uproot and act as a projectile into the property, and so properties with fewer trees in the immediate vicinity are less likely to be damaged in an event. The age of the building, construction type and roof type are also considered. However, as property-specific data relating to these factors is not available, an average profile is assumed. This average profile varies for across the 49 CRESTA zones in Australia. CRESTA zones are commonly used in insurers' rating structures as a broad geographic regional factor.

Finity's estimated cyclone cost also considers the impact of storm surge. In a cyclone event, the low-pressure system generated can cause extreme waves that may result in inundation for properties close to the coastline. Storm surge risk has been estimated using a statistical model that predicts the risk using the distance of the property from the nearest coastline, its elevation and the topography of the surrounding area.

In projecting the change in cyclone cost under different climate scenarios, Finity has reviewed the relevant literature and used the findings to adjust the assumptions underpinning the cyclone model. Simulating future cyclone risk using GCMs is challenging and is limited by coarse model resolution, inconsistencies between outputs and issues regarding cyclone tracking and detection schemes. In the absence of climate model output to assess cyclone risk, Finity has drawn from the latest scientific literature to form a view of how key characteristics of cyclone activity (e.g. frequency, location and intensity) might change in the future. While current scientific literature does not offer definitive conclusions on future cyclone risk, there are areas for which enough level of consensus has been reached, which are discussed below.

To generate the future view of cyclone risk, Finity has reviewed the following factors and adjusted to allow for the impacts of climate change:

▶ Cyclone frequency: changes in the occurrence of landfalling cyclones under warming scenarios for each cyclone-prone region identified along the Australian coastline.

▶ Cyclone intensity: changes in the distribution of wind intensity and associated cyclone category.

▶ Poleward shift: expansion of cyclone activity towards the south

▶ Storm surge: the effect of rising sea levels coupled with changes in cyclone intensity and frequency in the region, causing coastal inundation from cyclone activity.

Cyclones are projected to decrease in frequency (Knutson, et al., 2019) but increase in intensity (with medium confidence (Strazzo, Elsner, & LaRow, 2015)) with this change driven by an increase in temperature projected with climate change (i.e. studies have projected a ~5% increase in wind gust intensity per 1°C per warming). Furthermore, tropical cyclones in the Pacific Basin have been found to track southerly at a rate of 50km per decade (Kossin, Emanuel, & Vecchi, 2014). As such the modelling indicates that cyclones have the potential to reach further south (south of 25° south) over time.

Figure D.1 depicts the average cost by SA1 and shows the cumulative results of the adjusted assumptions. High cyclone risk areas are projected to incur increased costs in area around the coastal areas of Northern Australia, while low cyclone risk areas are projected to extend down to south-east Queensland. The cost of cyclone is expected to increase by over 60% for the whole of Australia under the High Emissions scenario by 2050.

Figure D.1 – Cyclone risk under the High Emissions scenario
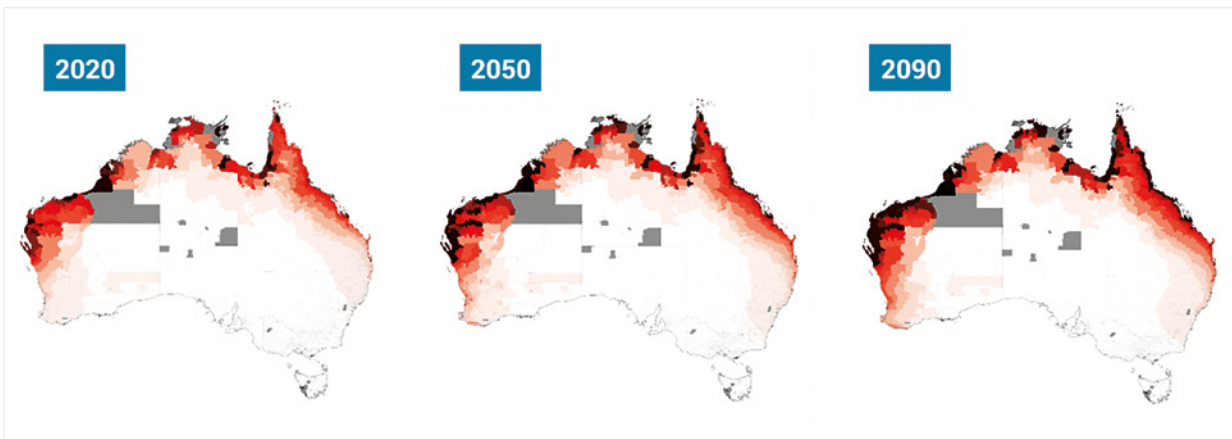
D.3.2   Bushfire

Bushfire risk impacts many rural areas of Australia, and is highly dependent on the proximity of a given property to vegetation. The Finity bushfire model uses satellite imagery to assess the quantity and type of vegetation surrounding a property. Bushfire risk varies by vegetation type due to differences in fuel load and flammability. Bushland containing eucalypts and other vegetation that has adapted to prolonged periods of dryness and heat is much more prone to severe bushfires than areas with grasslands or rainforests. Finity has classified the bushfire risk for over 1,500 vegetation types and uses machine learning to detect the presence of vegetation and classify its type from the satellite data. Figure D.2 shows how Finity analyses the area up to 2km around the property by dividing it into segments, and assessing each individually. Each segment is weighted according to its size and distance to the property and then combine to form an overall view of the vegetation risk.

Figure D.2 – Vegetation risk assessment
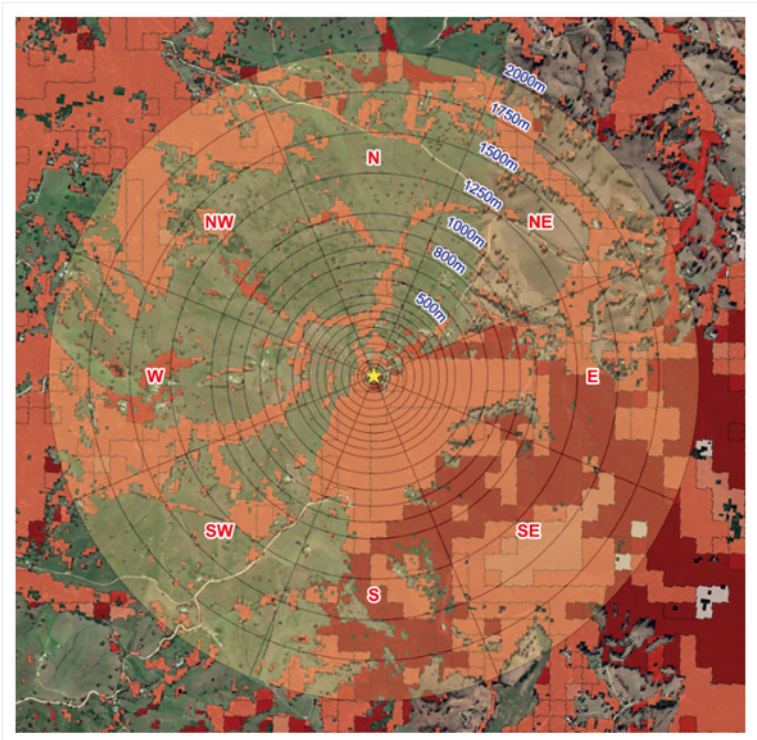
Additionally, Finity considers the regional climate in our bushfire model. Regions that have predictable wet and dry seasons (such as the tropical regions of northern Australia) are more likely to have more frequent but less severe fires, as fuel loads have less time to accumulate between events. Temperate regions generally have fewer bushfires, but are more likely to have extreme events that cause material property damage and loss of life. The weather conditions in these areas are more dependent on climate cycles that occur over multiple years, meaning that fuel loads will accumulate significantly over the lengthy wetter period, aiding the propagation of major fires.

Other location specific factors that are accounted for in Finity's bushfire cost include:

▶ The prevailing wind direction on dangerous fire days.
▶ Grasslands surrounding the property.
▶ Slope of the property as fires accelerate uphill.
▶ Roadbreaks that may act as protection from fires.

Climate models generally agree that the Australian climate will get warmer and dryer, leading to more days of extreme fire weather. This is particularly likely for areas that are already prone to bushfire risk, such as southern and eastern Australia. Changes in bushfire cost are driven by:

▶ Drought: More frequent drought conditions are projected across Australia due to warmer and drier conditions. In Southern Australia this is projected with high confidence, decline with a decline in rainfall. In other regions, drought is projected with medium or low confidence.
▶ Temperature: Increase in temperature and frequency of extreme heat days is expected to occur with very high confidence. There is strong

agreement under amongst GCMs on the direction and magnitude of change.

▶ Humidity: Changes in humidity are linked to rainfall variability. Projections show a tendency for decrease across Australia for all seasons.

Finity has used the MacArthur Forest Fire Danger Index (FFDI), which is an index of temperature, wind, humidity and a drought factor, as an indicator for changes in bushfire risk. Extreme bushfire events historically (losses above $1b) have a strong correlation with catastrophic FFDI scores (i.e. 100+). Finity have used projections of the FFDI produced using downscaled GCM outputs to estimate the change in bushfire risk.

The change in the number of high risk FFDI days is used to estimate the change in bushfire risk for our Low and High Emissions climate scenarios. Bushfire risk increases across all time periods for both scenarios, but is most severe under a High Emissions scenario due to the larger temperature change under this scenario. Figure D.3 shows the average risk by SA1, both current and projected to increase over the next 70 years. Finity expects bushfire cost to increase by 30% by 2050 under the High Emissions scenario for the whole of Australia.

Figure D.3 – Bushfire risk under High Emissions scenario
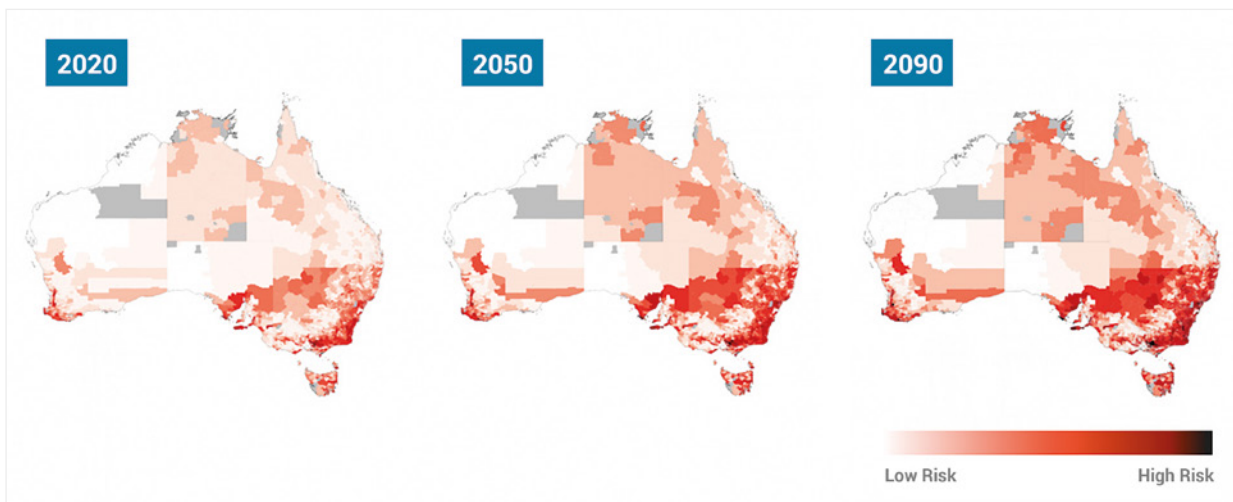
D.3.3 Storm

Storms can generate strong winds, heavy rainfall and flash flooding, and hail. In Australia, storm risk is primarily concentrated on the East Coast and can be caused by warmer weather, tornadoes, and the formation of East Coast Lows (intense low-pressure systems which develop off the coast multiple times per year). Since the majority of properties in Australia are situated in this area where storm events are most common, a high proportion of assets are exposed to storm risk.

Finity has assessed wind speed, wind gusts, wind direction and rainfall data from Bureau of Meteorology weather stations across Australia. These weather variables are combined into a single measure of how much storm activity each area has experienced historically.

Finity also incorporates property specific information, including:

- ▶ Topography: hills may protect a property by shielding it from the impact of wind. Finity considers slope in relation to prevailing wind direction.
- ▶ Property shielding: properties next to parks or open spaces may be more at risk from damage from high winds. Finity considers neighbouring properties in the context of the distribution of wind direction.
- ▶ Tree coverage: tree limbs may act as projectiles during high winds, and can lead to a higher level of damage. Finity has analysed the vegetation coverage using satellite imagery.

With climate change, changes in storm risk will be influenced by multiple factors:

- ▶ Changes in rainfall: Across Australia there is low confidence on how rainfall will change spatially and temporally. There is however high confidence that the intensity of extreme rainfall events will increase due to higher temperatures (CSIRO and Bureau of Meteorology, 2015).
- ▶ Wind intensity: Wind speed is projected to increase in tropical areas of Australia. In South Eastern Australia, GCM ensemble results project a decrease in the 20-year wind speed. For the Southern region of Australia, there is a large spread in the direction and magnitude of model results indicating a level of uncertainty in wind projections.
- ▶ East coast low frequency: East coast lows are projected to decrease in the future, however there is uncertainty around the future severity of East Coast Lows (Bruyère, et al., 2020).

Across Australia, higher temperatures from climate change will result in more intense storms. Some reduction in storm risk on the eastern coast of Australia is projected due to a reduction in the frequency of East Coast Lows, however this may be offset by increasing intensity of rainfall events. Similarly, in the southern regions, a reduction in storm risk is driven by reductions in projected rainfall for this region. Finity has adjusted the model input to allow for these changes in rainfall, wind and event frequency and intensity. Figure D.4 shows the projected change in storm risk under the High Emissions scenario over time, summarised to an SA1 average. Due to the offsetting factors, the change in storm risk is not material overall. Finity projects a 1% decrease in cost for Australia at 2050 under the High Emissions scenario.

**Figure D.4 – Storm risk under High Emissions scenario**
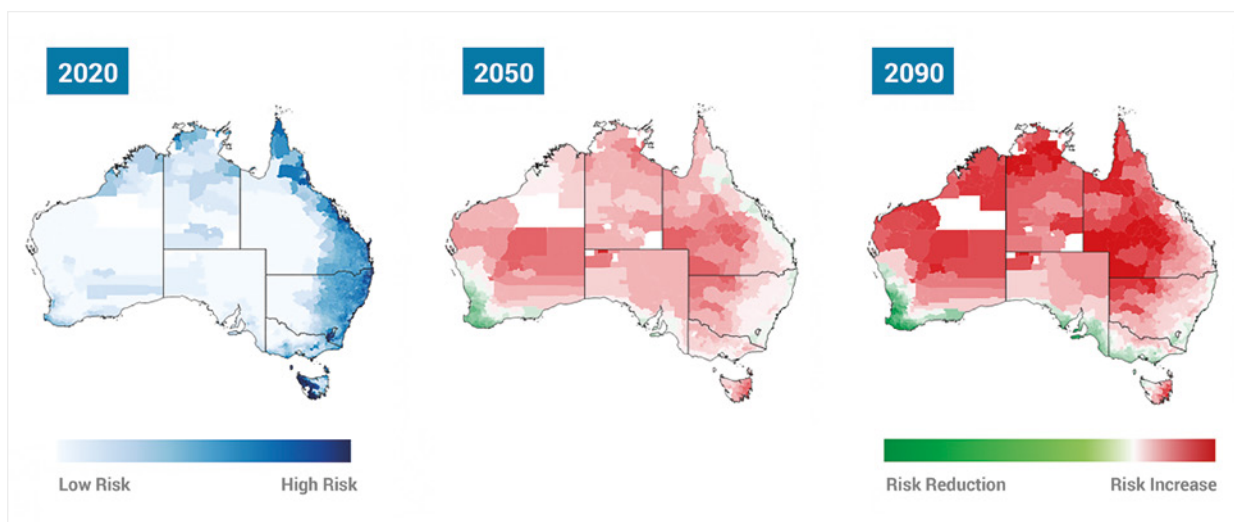
D.3.4 *Flood*

Riverine flooding tends to occur in low lying areas close to rivers and streams. It is driven by both heavy rainfall within a catchment and the land's ability to absorb water (i.e. if the ground is saturated or very dry it is more likely to run-off the land rather than be absorbed). At a given property, the exposure to riverine flood risk is also dependent on localised factors such as the property's elevation and distance relative to a water source/drainage.

With climate change, floods are projected to increase in frequency in northern Australia and along the east coast. A reduction in flood risk is projected in the south and south west regions of Australia due to lower rainfall trends projected for these regions. The change in flood risk in these regions driven by multiple factors:

▶ Changes in daily rainfall: Flood risk relies heavily on projected rainfall. Changes in mean annual rainfall can influence the overall catchment moisture whereby both dry soils and saturated soils can promote run off. In Australia, there is low confidence in how rainfall will change spatially and temporally with climate. This high level of uncertainty is driven by the difficulties of simulating cloud variables within GCMs. Reductions in rainfall are projected in Southern Australia with medium confidence. (CSIRO and Bureau of Meteorology, 2015)

▶ Extreme rainfall intensity: The impact of extreme rainfall on flood risk can depend on the tipping point at which spillover occurs for existing flood defences. An increase in extreme rainfall events is projected across Australia with high confidence. (CSIRO and Bureau of Meteorology, 2015)

▶ Temperature: Temperature can influence flood risk in two ways: (1) higher temperatures can increase the water holding capacity of air, leading to more intense rainfall events which subsequently raise flood risk and (2) higher temperatures can promote evaporation from soils and subsequently influence runoff. These counteracting impacts of temperature can result in an increase or decrease in flood risk. Increases in mean, daily minimum and maximum temperatures are projected with very high confidence.

Figure D.5 shows average flood risk by SA1 for the High Emissions scenario. The map shows how Finity projects flood risk to change over this century under the High Emissions scenario. Flood risk increases in most areas of the

Figure D.5 – Flood risk under High Emissions scenario
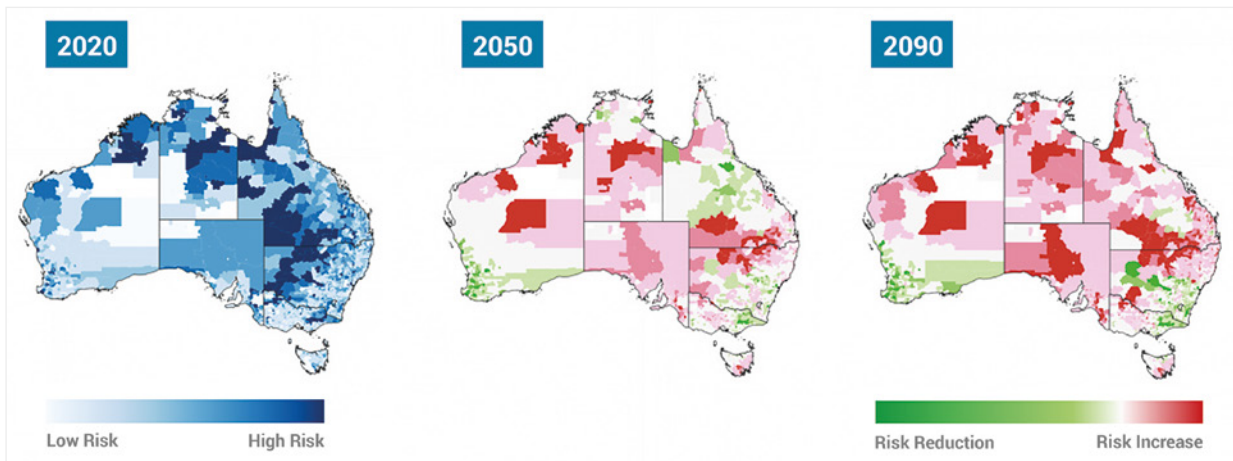
country, but decreases in some areas due to projected decreases in rainfall. Finity expects total flood cost for Australia to increase by around 50% under the High Emissions scenario by 2050.

D.4 Technical cost of attritional claims

Using the methodology from Andrews and Lau (2019), a component was added at a CRESTA zone level for non-hazard risks (including theft, accidental damage, specified items etc). No change in the cost of attritional claims is assumed under climate change.

D.5 Calibration to insurance market premiums

The remaining components (insurer expenses, statutory expenses and taxes, net cost of reinsurance, and the insurer's profit margin including any cost of capital) are estimated by comparing the combined technical costs (for natural hazards and non-hazards) with 10,000 insurance quotes from across the Australian home insurance market using Finity's *Finesse* product. This approach helps calibrate the technical view of combined hazard and non-hazard costs to what is actually paid by customers.

The batch of 10,000 quotes is a market representative pool of household risks, by state, and is collected quarterly.

The median retail premiums by region at January 2022 is summarised in Figure D.6.

Figure D.6 – Median retail premiums by region at January 2022
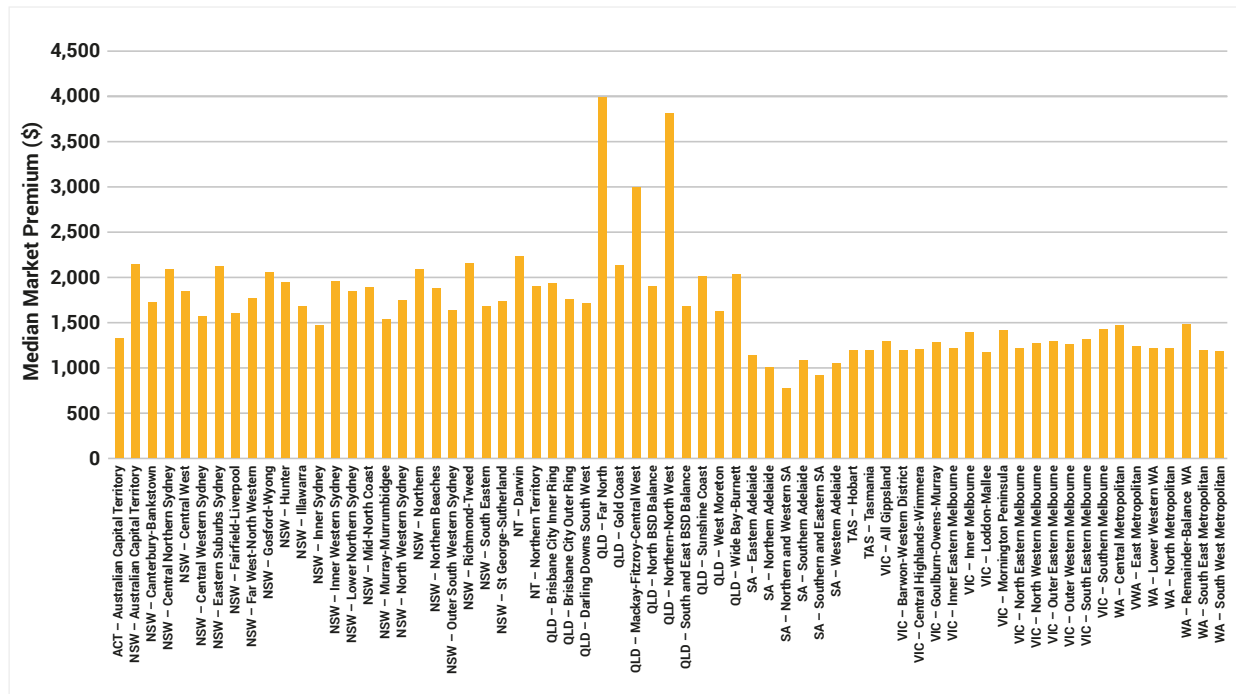
D.6 Taxes

Stamp duty, levies and tax rates are explicitly applied to home insurance premiums, as shown in Table 4.1.

E Defin'd

Defin'd is Finity's model of the Australian population, which comprises profiles of households and individuals which when aggregated replicate the actual known multi-dimensional characteristics of Australians in each local community. Defin'd uses Census and ABS data to construct representative distributions of household and motor vehicle characteristics at SA1 level, which inform the allocation to individual households within the SA1.

The version of Defin'd used in this Green Paper is constructed based on the 2011 Census distributions, projected forward to the 2018 population.

E.1 Household income

Household income is simulated based on the Total Family Income as Stated (weekly) (FINASF) data sourced from the 2011 Census[42]. A Generalised Linear Model was trained on the ABS Confidentialised Unit Record File (CURF) data, which provides data on 1% of the Australian population. Key variables include birthplace, education level, family type and age. This was scored onto the remainder of the Australian population.

The table below compares the median gross household income assumed in our modelling, and against Census and ABS data.

Table E.1 – Median weekly gross household income (2011)

	Median gross household income at 2011	Comments
AAHIA Index	$1,125	Response band is $1,000 to $1,250
2011 Census	$1,237	
ABS Survey of Income and Housing	$1,514	The ABS survey produced a higher median income than the 2011 Census

The AAHIA Index is constructed based on the 2011 Census[43]. The mid-point of the range has been assumed, with the exception of the highest response level where we have adopted a weekly household income of $4,000.

The median gross household income is inflated to 2022 values, indexed based on the ABS Survey of Housing and Income. Specifically, the percentage increase in the median gross household income between 2011/12[44] and 2019/20[45] from the ABS Survey has been applied by income quintile. Inflation from 2019/20 to 2022 is based on the WPI index in preference to AWE, as COVID-19 resulted in many distortions to the AWE data.

E.2 Household savings model

Household savings is simulated based on the 2020 Nielsen Consumer and Media View survey responses on the balance in respondents' everyday transaction, savings, high interest savings, and other interest-bearing accounts. A Generalised Additive Model was used, and key variables include household income, home ownership, age and education level.

E.3 Insurance literacy

Finity has developed an insurance literacy index. High levels of insurance literacy represent an ability to understand the product disclosure statements and their implications on individual situations. The index is determined based on an individual's financial savviness (from Nielsen survey data), life-stage, education level, household ownership, birthplace, number of vehicles owned, and age.

42 https://www.abs.gov.au/websitedbs/censushome.nsf/home/statementsfamilyfinasf?opendocument&navpos=430

43 https://www.abs.gov.au/census/find-census-data/quickstats/2011/1

44 https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6523.02013-14?OpenDocument, download 1

45 https://www.abs.gov.au/statistics/economy/finance/household-income-and-wealth-australia/latest-release#data-download , download 6

F Australian Actuaries Home Insurance Affordability Index

The AAHIA Index has been derived for each residential dwelling in Australia, including both houses and units.

The AAHIA is the ratio of:

▶ Annual home insurance premiums, to
▶ Annual household income.

In some cases, the household income recorded in the Census was very low or nil, due to temporary or full-time unemployment, or retirement. This produces extremely high or infinite AAHIA results which are not interpretable. An AAHIA of infinity is considered to be in the 100th percentile of the AAHIA Index.

As discussed in Appendix B, household incomes have been matched with individual addresses, which have estimated home insurance premiums. However, the dataset used for individual residential addresses is based on the Geoscape Geocoded National Address File, which does not perfectly match the number of households in the ABS data at SA1 level. We have matched income to addresses as follows:

▶ We consider the Census data to be our 'source of truth'.
▶ In SA1s where the number of households in the Census is greater than the number of residential GNAFs, we sample the GNAFs onto the Census data with replacement. This assumes that the natural hazard risks within an SA1 are similar.
▶ In SA1s where the number of households in the Census is less than the number of residential GNAFs, we sample the GNAFs onto the Census data without replacement.

We have conducted sensitivity analysis on the sampling process, as shown in Appendix G.

Sensitivity analysis

We have run a number of scenarios to understand the sensitivity of the AAHIA Index to key assumptions, namely:

1. Different samplings of households to GNAF addresses.
2. Adopting an assumed sum insured per CRESTA zone, instead of the *Rebuild* SI estimate (see Appendix D.2).
3. 5% increase to gross household incomes for households earning less than $800 per week.
4. Gross household income reflecting 2016 distributions at postcode level
5. The insurance premiums for bushfire, flood, cyclone and storm increase by 1 standard deviation. The premiums for these hazards have been calibrated to historical average losses, however the inherent variability mean that the results have significant uncertainty. Overall this is a 29% increase to the total home insurance premiums.

The table below shows how the affordability pressures faced by households vary under the scenarios tested.

We note that the proportion of households experiencing extreme pressure (vulnerable households) and the median AAHIA varies little between the sensitivity tests, except for test 5, which results in an increase of approximately 50%.

Table G.1 – Affordability pressures under scenarios tested

	Base	1. Resampling	2. Assumed sum insured	3. 3.5% increase to low wage	4. 2016 income distributions	5. Natural hazards + 1 Standard Deviation
No Pressure	50%	55%	50%	54%	55%	43%
Low Pressure	19%	19%	19%	16%	19%	19%
Medium Pressure	10%	6%	10%	10%	6%	12%
High Pressure	11%	10%	12%	11%	10%	12%
Extreme Pressure	10%	9%	10%	9%	10%	15%
Median AAHIA	1.1	11	1.1	1.1	1.1	1.3
90th percentile AAHIA	4.0	3.8	4.1	3.8	3.9	5.1