

An aerial photograph showing several houses surrounded by deep floodwater. The houses have various roof colors, including green, blue, and grey. Some houses have solar panels installed on their roofs. The water is a muddy brown color, and some trees are partially submerged. The scene depicts the aftermath of a severe weather event, likely a rain bomb or flash flood.

A SUPERCHARGED CLIMATE: RAIN BOMBS, FLASH FLOODING AND DESTRUCTION

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Cover image: FLOODS NSW. A supplied image shows flood-affected properties in Lismore, NSW on Monday, February 28, 2022. (AAP Image/Supplied by the Department of Defence, Bradley Richardson).

The Climate Council acknowledges the Traditional Custodians of the lands on which we live, meet and work. We wish to pay our respects to Elders past, present and emerging and recognise the continuous connection of Aboriginal and Torres Strait Islander people to Country.

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Key findings

1

Climate change is firmly embedded in the 2022 flooding emergency that swept through southeast Queensland and New South Wales with some regions experiencing rainfall that was simply off the charts.

- a. The intense rainfall and floods devastating communities in Queensland and New South Wales is taking place in an atmosphere made warmer and wetter by climate change, which is driven by the burning of coal, oil, and gas.
- b. The pattern of more intense rainfall events is well established in Australia. In recent decades, the intensity of short duration (hourly) extreme rainfall events has increased by 10 percent or more in some regions. Daily rainfall totals associated with thunderstorms have increased over the past 40 years.
- c. For each 1°C rise in global average temperature, the atmosphere can hold approximately 7 percent more moisture. A warmer atmosphere also means there is more energy to fuel storms that generate heavy rainfall. These factors increase the likelihood of extreme downpours.
- d. The higher that global temperatures rise, the worse such events become. Globally, the frequency of intense rainfall events is likely to almost double with each degree of further warming.
- e. While the occurrence of extreme events unfolding in Queensland and New South Wales is the result of several shorter-term meteorological factors, including the influence of La Niña and a particular combination of weather systems, the likelihood and intensity of extreme and highly destructive events such as these is increasing with climate change.

2

The relentless deluge that has flooded towns and cities in Queensland and New South Wales is one of the most extreme disasters in Australian history, and the devastation is wide ranging.

- a. At least 18 people have died and tens of thousands have been forced to leave their homes during the crisis that is devastating parts of Queensland and New South Wales.
- b. A “rain bomb” hit Brisbane and southeastern Queensland with 80 percent of the region’s average annual rainfall occurring within three days. Brisbane received more rain in one week than London in the UK typically does over an entire year.
- c. Compared with the floods of 2011, much more water poured into catchments within a shorter space of time. The Brisbane River below Wivenhoe, for example, gained about 1,450 billion litres of water in under three days – enough to fill Sydney Harbour three times over.
- d. The economic costs of extreme weather events are rising, with flood disasters the costliest. At time of publication, the estimated current cost of insurance claims for this 2022 flooding emergency in Queensland and New South Wales is now \$1.45 billion.
- e. The speed and severity of the flooding emergency caught many people by surprise with flood record levels previously set for some rivers smashed, and a record number of rescues carried out by emergency services.

3

For many communities dealing with flood emergencies, this is the latest in a long line of climate-fuelled extreme weather events they have faced recently.

- a. Climate change is driving sharp increases in both the frequency and severity of many extreme weather events.
- b. While Queensland and New South Wales have been hit with historic rainfall and floods, Tasmania endured its driest summer in 40 years and Perth has smashed its previous record number of summer days at or over 40°C.
- c. The recovery time for communities and emergency services between events is shrinking. Prior to the 2022 floods, the NSW coast was hammered by five severe rainfall events with daily totals exceeding 400mm over the past decade.
- d. Climate change also increases the probability of simultaneous disasters occurring in multiple locations, stretching emergency services personnel and resources.

4

Extreme weather events are worsening under accelerating climate change. Global efforts to cut greenhouse gas emissions this decade will determine how much worse things become.

- a. Governments, such as the Morrison Government, which have failed to substantially reduce emissions earlier have sentenced communities in Australia and around the world to more dangerous extreme weather events.
- b. The latest assessment from the world's most eminent climate scientists warns that a gradual or slow response is not enough to avoid catastrophe.
- c. At this point, truly transformative climate action is required. This means at least halving global greenhouse emissions over the coming decade, and reaching net zero emissions globally by 2040 at the very latest.
- d. The Climate Council recommends Australia triple its efforts and aim to reduce its national emissions by 75% by 2030, and reach net zero by 2035. Failing to rapidly and deeply reduce global emissions will severely increase risks to Australian lives and livelihoods, communities and ecosystems. We must do our fair share to tackle the climate emergency.

1. Introduction

Climate change is embedded in the current flooding emergency in southeast Queensland and New South Wales because rising ocean and atmospheric temperatures are increasing the intensity of storms. This report provides an overview of how climate change is intensifying extreme rainfall.

The relentless deluge that has lasted days and flooded towns and cities along southeast Queensland and northeast New South Wales is record-breaking. It has caused tragic loss of life and submerged tens of thousands of homes and businesses. The devastation was compounded further south in New South Wales on 3 March 2022, when almost half a million people were under evacuation orders or warnings as floods hit Sydney. At the time of publication, the flooding event was still unfolding. The loss of lives, damage to property, economic losses, and impact on human and animal health and well-being will only be fully accounted for over time.

For many communities dealing with flood emergencies, this is the latest in a long line of climate change-driven extreme weather events they have faced in recent years, including unprecedented drought, unprecedented Black Summer bushfires, unprecedented powerful storms, and unprecedented scorching heatwaves.

Flood disasters, such as those currently unfolding in Queensland and New South Wales, are made more likely by climate change. Global action over this decade will determine how much worse things get. Australia is out of step with the rest of the world, and it must take much stronger, bolder commitments to global climate change action.

A supercharged climate driven by the burning of coal, oil and gas is worsening extreme weather events.

BOX 1: FLOODING FACTS AND STATISTICS

- › At least 18 people have died and tens of thousands have been forced to leave their homes during the crisis that devastated parts of Queensland and New South Wales (ABC 2022a; The Times 2022).
- › The estimated current cost of insurance claims related to the Feb/March 2022 Queensland and New South Wales flooding disaster is \$1.45 billion (as of 8 March 2022) (Insurance Council of Australia 2022).
- › In Queensland, the Government is estimating rebuilding costs, predominantly of damaged infrastructure, at \$2.5 billion. Thus far, Queensland Treasury's initial estimates of the loss of economic activity are in the order of \$1 billion or 0.25% of Gross State Product (AFR 2022; ABC 2022b). At time of publication there were no reliable estimates on NSW economic costs because the flooding crisis is still unfolding, with evacuation orders issued for some suburbs in Sydney as a second east coast low in one week struck the region.
- › Brisbane and southeast Queensland were hit with 80 percent of the region's annual rainfall within three days, as a "rain bomb" lingered over the region (SMH (2022a), causing thirteen deaths (Brisbane Times 2022a) and flooding more than 20,000 homes (ABC 2022c).
- › Brisbane received more rain in one week than London in the UK receives over an entire year on average (New Scientist 2022).
- › The Brisbane River below Wivenhoe gained about 1,450 billion litres of water in under three days – roughly three Sydney Harbours' worth of water. Compared with the floods of 2011, this is about 50% more water pouring into the dam in about half the time (The Guardian 2022a).
- › More than 20,000 homes in Brisbane were flooded in the disaster (ABC 2022c). Preliminary assessments indicate that more than 4,200 homes were destroyed, 1,778 severely damaged and 2,430 moderately damage (Brisbane Times 2022c).
- › The Wilsons River in the Northern Rivers district of New South Wales, which peaked at 14.37 metres in Lismore, broke the previous flood level record by more than 2 metres. (In 1954 the river reached 12.27 metres at Lismore and in 1974 it reached 12.15 metres.) (Nine News 2022, The Guardian 2022b).
- › Further south, the Richmond River at Bungawalbin peaked at 7.32 metres, breaking its previous high of 6.1 metres (ABC 2022a).
- › Downstream at Woodburn, the river topped 7.18 metres, nearly 50 per cent higher than its previous record of 4.92 metres (ABC 2022a).
- › Towns were inundated that had not experienced major flooding before, such as Casino in New South Wales (ABC 2022a).
- › Prior to the 2022 floods, the NSW coast has been impacted by five heavy rainfall events in the past decade with daily totals exceeding 400mm (Gergis 2021).
- › As of 8 March, insurers had received over 96,844 claims related to the flooding in Queensland and New South Wales (ICA 2022).
- › On 3 March in Sydney, a total of half a million people were under evacuation orders or evacuation warnings, and over 250 schools were closed (SMH 2022b).
- › Rising waters have led to record numbers of New South Wales SES flood rescues - 932 over a 24 hour period (28 Feb - 1 March 2022) (SMH 2022c).
- › On 8 March 2022, the second east coast low in just one week caused significant rainfall over Greater Sydney. Thousands of people in south-west Sydney were ordered to evacuate and an evacuation warning was in place for Manly (ABC 2022d).

BOX 1: CONTINUED

AUSTRALIA'S LA NIÑA OF 2021-22: CUMULATIVE RAINFALL V LONG TERM AVERAGES

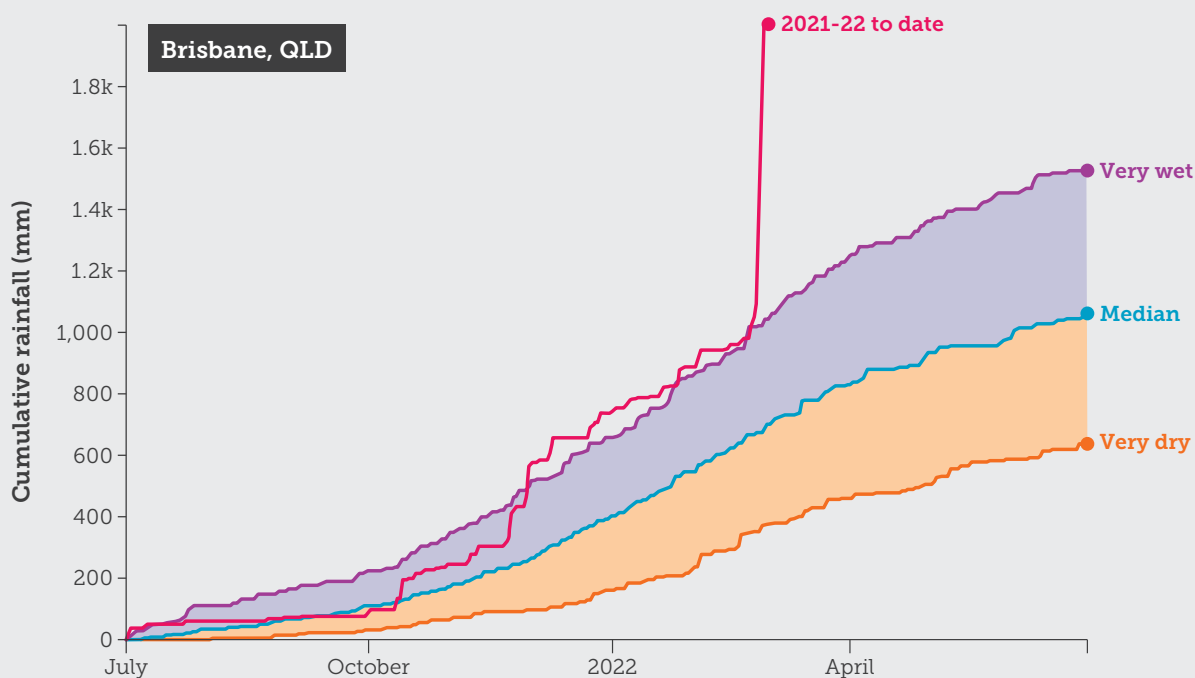


Figure 1: Australia's La Niña event of 2021-22: cumulative rainfall versus long term averages. The figure shows daily cumulative rainfall for 2021-22 versus the median, 10th percentile (very dry) and 90th percentile (very wet) of historic daily cumulative rainfall values. Historical data are from 1900 to 2021. Last updated 3 March 2021. **Source:** Adapted from Guardian graphic (The Guardian 2022a), data from the Bureau of Meteorology.

BOX 1: CONTINUED

HEIGHT OF THE WILSONS RIVER AT LISMORE COMPARED WITH FLOOD THRESHOLDS

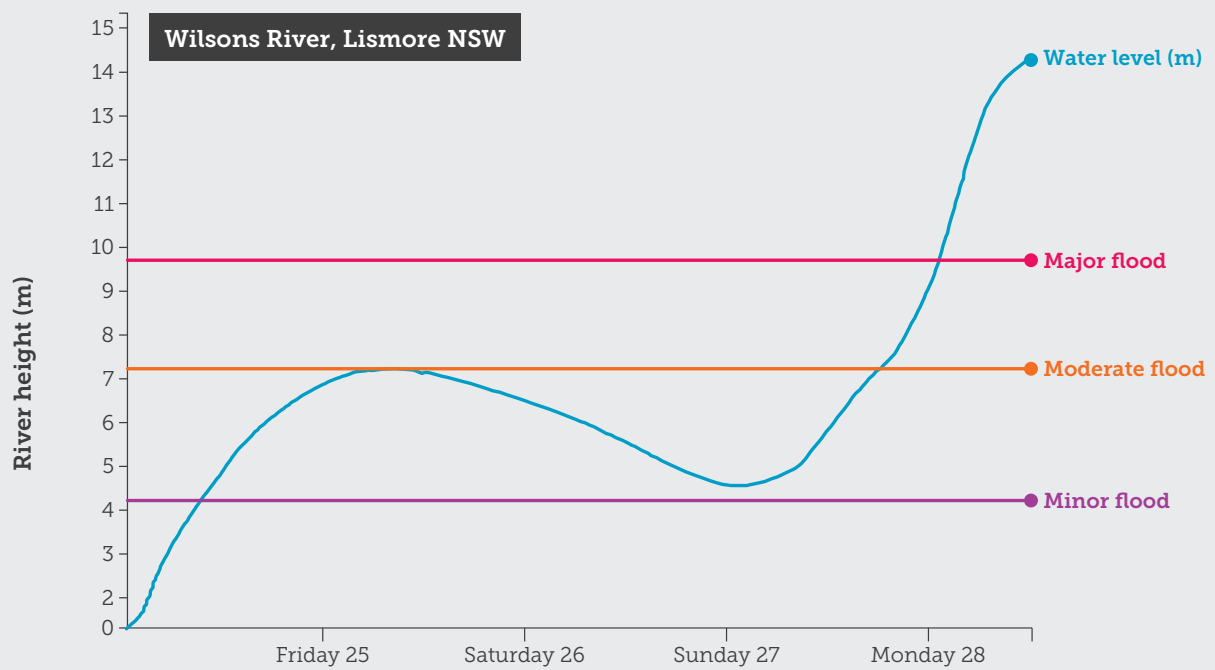


Figure 2: Height of the Wilsons River at Lismore compared with flood thresholds. The Wilsons River at Lismore peaked at more than two metres above the previous record. **Source:** Adapted from Guardian graphic (The Guardian 2022a), data from the Bureau of Meteorology.

BOX 1: CONTINUED

RAINFALL AND FLOODING: QUEENSLAND AND NORTH COAST NSW

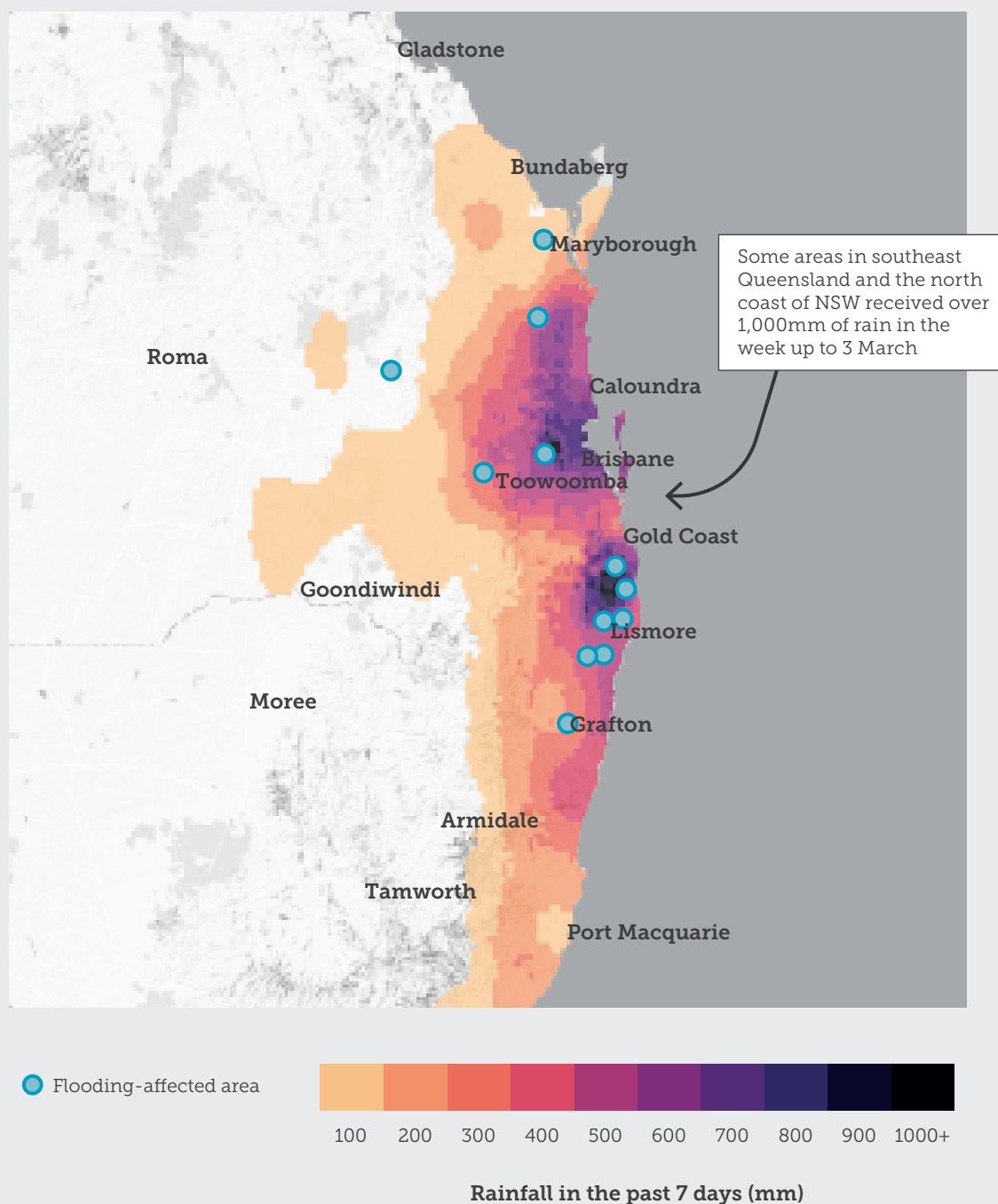


Figure 3: Rainfall and flooding: Queensland and north coast New South Wales, showing total weekly rainfall up to 3 March 2022 for areas with more than 100mm, and the location of flood-affected areas. **Source:** Adapted from Guardian graphic (The Guardian 2022a) and Google Maps basemap, data from Bureau of Meteorology.

2. Flooding and climate change: the facts

- › Climate change is firmly embedded in the current flooding emergency.
- › The intense rainfall and floods that have devastated communities in Queensland and New South Wales are taking place in an atmosphere made warmer and wetter by climate change, which is driven by the burning of coal, oil, and gas.
- › For each 1°C rise in global average temperature, the atmosphere can hold approximately 7 percent more moisture (Trenberth 2011). A warmer atmosphere also means there is more energy to fuel storms that generate heavy rainfall. These factors increase the likelihood of extreme downpours.
- › The pattern of more frequent, intense rainfall events is well established in Australia. In recent decades, the intensity of short duration (hourly) extreme rainfall events has increased by around 10 percent in some regions, with larger increases observed in the north of Australia (CSIRO and BoM 2020).
- › Globally, the frequency of intense rainfall events experienced at the moment is likely to almost double with each degree of further warming (Myhre et al. 2019).
- › Heavy rainfall events seen in recent years that led to catastrophic flooding were made more likely by climate change (IPCC 2022).
- › Floods made worse by climate change are costing our economy billions of dollars. By 2060, this could cost Australians as much as \$40 billion per year (Deloitte Access Economics 2021).
- › Governments, such as the Morrison Government, which have failed to substantially reduce emissions over the past decade have sentenced communities in Australia and worldwide to a far more dangerous future than if they had acted on repeated warnings from scientists.
- › The latest Intergovernmental Panel on Climate Change assessment warns that because of past inaction, a gradual or slow response is not enough to avoid catastrophe (IPCC 2022). At this point, truly transformative climate action is required. By the Climate Council's assessment, that means at least halving global greenhouse emissions over the coming decade, and reaching net zero emissions globally by 2040 at the latest. Given the scale of the global emissions reduction task, and taking into account Australia's very high level of emissions and our huge renewable energy resources, Australia should aim to reduce its national emissions by 75% by 2030, and reach net zero by 2035.
- › Failing to rapidly and deeply reduce greenhouse gas emissions means growing climate risks for communities and businesses.

3. The influence of climate change on extreme rainfall

While the La Niña is influencing our weather this summer/early autumn, it is important to remember that these short-term cyclical drivers now occur in the context of a warming climate. The intense rain and floods in Queensland and New South Wales are yet another reminder of how extreme weather events put lives, property and critical infrastructure at risk. Climate change, driven primarily by the burning of coal, oil and gas, is intensifying many extreme weather events, including extreme rainfall.

3.1 Extreme rainfall

As greenhouse gases increase in the atmosphere, the climate system is warming because these gases are trapping more heat. The oceans are also warming, especially at the surface, and this is driving higher evaporation rates. A warmer atmosphere can hold more water, and with a 1.1°C global average temperature rise that has already occurred (IPCC 2021), together with increasing evaporation, this has led to an increase of over 7% in the amount of water vapour in the atmosphere (Hartmann et al. 2013). Warmer atmosphere and oceans have more energy to fuel storm systems that generate heavy rainfall. These, and other climate-related factors, are causing significant changes in rainfall patterns in Australia and globally. Generally speaking, wet areas are becoming wetter and dry areas are becoming drier. In addition, more of our rain is tending to come in the form of extreme downpours, punctuated by prolonged dry spells.

The pattern of more intense, heavy rainfall events is well established in Australia. In recent decades, the intensity of short duration (hourly) extreme rainfall events, which are often associated with flash flooding, has increased by around 10

percent or more in some regions, with larger increases observed in the north. Heavy rainfall events are often associated with thunderstorms, tropical cyclones, and east coast lows, and there has been an observed increase in the rainfall associated with these systems since 1979 (CSIRO and BoM 2020).

In Australia, extreme rainfall events are projected, with high confidence, to increase in intensity (defined as the wettest day of the year and the wettest day in 20 years) (CSIRO and BoM 2015; Bao et al. 2017). In its latest assessment report, the IPCC concluded, with high confidence, that heavy rainfall events seen globally in recent years which led to catastrophic flooding were made more likely by climate change (IPCC 2022).

The extreme events unfolding in Queensland and New South Wales are the result of multiple factors, including the influence of La Niña, a particular combination of weather systems, and climate change. While determining the extent to which these particular events were more likely or more severe due to climate change is complex, it is clear that climate change is loading the dice towards more severe and more frequent extreme weather events such as these.

Climate change is intensifying extreme weather events, including extreme rainfall. A warmer atmosphere holds more moisture, and a warmer atmosphere and ocean means more energy for storms.

3.2 Compound events

In the most comprehensive assessment of the impacts of climate change ever undertaken, in 2022 the IPCC warned of “cascading and compounding” climate disasters (IPCC 2022).

Australia has always been a land of droughts and flooding rains. However, in the past, extreme weather events were cyclical around a stable average, allowing enough time for recovery between events. Now, the increasing frequency and severity of extreme events increases the chance of a community facing successive disasters with little time in between to recover. For example, some regions severely impacted by the 2019-20 Black Summer fires were hit one year later with severe floods, and some communities were still struggling to rebuild (Nine News 2021).

Climate change is also increasing the probability of compound events, where two or more extreme weather events combine to produce impacts that are worse than the effects of each event were they to occur independently.

The catastrophic events affecting Queensland and New South Wales are a reminder of how the climate crisis is unfolding. Records are being broken all the time, in unprecedented ways, with attendant human misery. Rapid and deep global emissions cuts this decade will strongly limit how much more severe these events become in future.

The increasing frequency and severity of climate-fuelled disasters is shrinking the recovery time between events, as well as increasing the odds of two or more extreme events combining, with devastating impacts.

3.3 East coast lows

Australia is highly vulnerable to increasingly intense storms, especially storm surges associated with tropical cyclones and intense east coast lows, such as the storm that hit Central and Southern New South Wales – including Greater Sydney – on 3 March 2022.

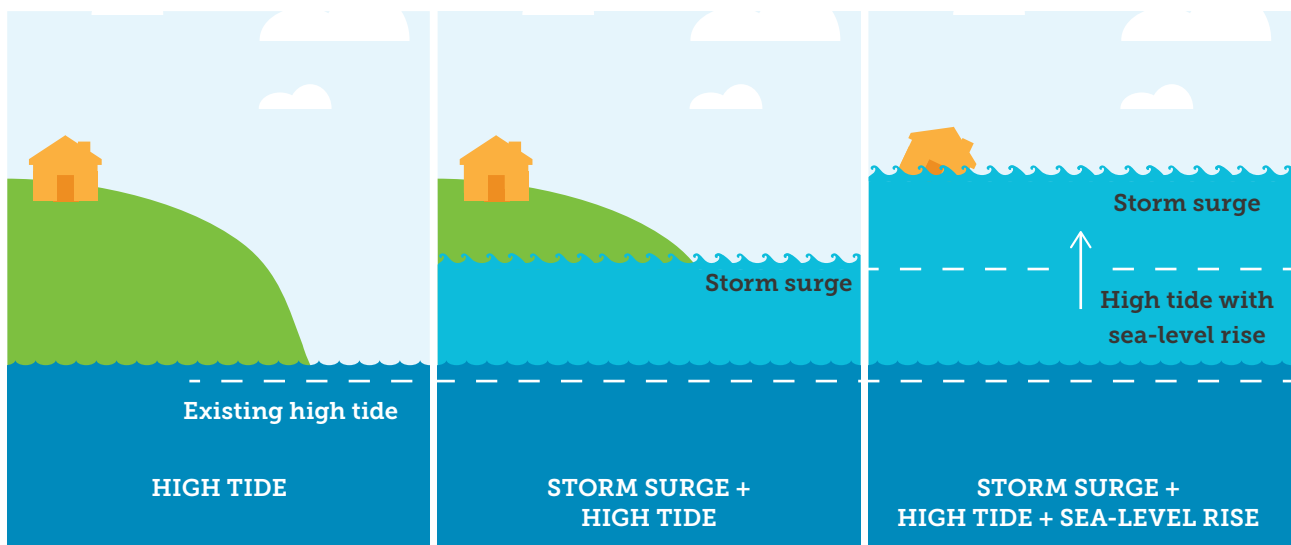
In June 2016, an east coast low brought intense rainfall and coastal flooding to the New South Wales coastline, with widespread damage in Sydney. Wave heights of 17.7 metres, the highest on record for New South Wales, caused severe coastal erosion, leading to significant loss of exposed property and housing, which culminated in an insurance bill of \$235 million (Insurance Council of Australia 2016).

These coastal storms are now occurring in a more energetic atmosphere, stacking the odds towards more intense winds and heavier rainfall. When coupled with higher sea levels as a result of climate change, the storm surges driven by these coastal storms

According to the latest science, with sea level rise of 0.5m, what is currently considered a “one-in-100-year flood event” in Australia could happen “several times a year”.

are becoming more damaging as they are able to penetrate further inland (Figure 4). Global average sea level has increased by about 20 centimetres since the beginning of the twentieth century and is projected to increase under a high emissions scenario by approximately 0.63-1.01 metres by 2100, compared to 1995-2014 levels (IPCC 2021). With sea level rise of 0.5m, what is currently considered a “one-in-100-year flood event” in Australia could happen “several times a year” (IPCC 2022).

Figure 4: Sea-level rise increases the base sea level and thus exacerbates the effects of a storm surge (Climate Commission 2013).



4. Impacts of extreme rainfall

Extreme rainfall has devastating effects on human health and well-being, our environment, and our economy.

Figure 5: A woman holding a small child is seen looking at flood waters in the suburb of Rosalie in Brisbane, 28 February 2022. Climate change, driven by the burning of fossil fuels, is intensifying extreme weather events such as extreme rainfall and floods.



4.1 Harm to our health

Heavy rainfall and flooding affects health in many different ways, and over various timeframes. In the immediate term, floods cause deaths and injuries, and contact with floodwater can cause skin diseases and gastroenteritis. Floods can also contaminate food and water supplies, and cut off access to emergency services. In the weeks and months following a flooding event, vector-borne diseases such as Dengue and Ross River Virus frequently increase, as do respiratory allergies and irritations associated with mould exposure. Emotional and psychological distress and mental health issues affecting flood victims can last for many years after a flood event has passed.

Thirty-three people died in the 2010-2011 Queensland floods alone. Seventy-eight percent of Queensland (an area larger than France and Germany combined) was declared a disaster zone and over 2.5 million people were affected (Queensland Floods Commission of Inquiry 2012). The floods created major health risks, including contaminated drinking water and food and difficulties in accessing health services

and treatments. On 10 January, during the 2011 floods in Queensland, three intense downpours of 40-50 mm in only 30 minutes fell in already saturated catchments in Toowoomba and the Lockyer Valley. This led to burst creeks and caused flash flooding of up to 11 metres through the Toowoomba city centre (Coates et al. 2012); Sadly, 19 people drowned as a result of this flash flooding event in January 2011 (Queensland Floods Commission of Inquiry 2012).

Heavy rainfall and flooding are the most common extreme weather events associated with threats to water quality (Stanford et al. 2014), often triggering outbreaks of gastrointestinal illness and other waterborne diseases due to contamination or disruption of potable water supplies (Cann et al. 2013). During heavy rainfall events, various substances within water catchments can be mobilised into waterways from surface runoff, increasing levels of turbidity (water loses its transparency because of suspended particulates) dissolved organic matter and chemicals in source waters that supply dams (Murshed et al. 2014).

Extreme weather events such as intense rainfall and floods can reduce water quality and availability, jeopardising water security and endangering people's health.



Figure 6: Flooding along the Tweed River along the Queensland-New South Wales border. On 18 February 2022 (top image), the dark water of the river flowed through light-green sugarcane fields and pastures and dark green woodland. By March 1 (bottom image), the swollen river was filled with light brown sediment, and had overflowed its banks covering the fields and inundating some nearby cities and towns.

Heavy rainfall can also cause sewage overflows in urban catchments, significantly increasing the levels of pathogenic bacteria, viruses and trace metals in water sources that flow into storage dams (Yard et al. 2014). The probability of identifying *Cryptosporidium* and *Giardia* in surface waters is two to three times more likely after extreme weather events, and average concentrations are also higher (Young et al. 2015). More extreme rainfall events, resulting in sewage overflow and surface runoff, have been identified as a key pathway through which climate change can increase waterborne pathogens and outbreaks of gastroenteritis (Beaudeau et al. 2011).

Climate change is already taking a profound toll on our mental health (IPCC 2022). Following the 2010-11 floods in Queensland, mental health issues were calculated to be by far the largest economic impact of the floods, with a lifetime cost estimated at \$5.9 billion (Deloitte Access Economics 2017). Reported incidents of family violence increased after the floods, and residents affected by the floods were 5.3 times more likely to report poorer health, and 2.3 times more likely to

report post-traumatic stress disorder, than those not affected. Flood victims in regional, remote and economically disadvantaged areas were more likely to report emotional impacts caused by the floods (Deloitte Access Economics 2017).

The extent of the psychological distress caused by those experiencing the 2022 flood event is yet to be realised. Many people were taken by surprise by both the extent of the flooding and the speed at which it occurred. Areas not prone to floods went underwater, and so many people who initially considered themselves out of harm's way suddenly had to take urgent action and evacuate. Hundreds of people taken by surprise by the speed of the flood water were trapped on roofs, some for more than 24 hours, with many having to rely on civilians for rescue. Family and friends lost contact with each other which increased the panic and emotional distress.

Loss of loved ones, homes and family treasures, cars, businesses and livelihoods, and also loss of livestock and pets, cause both acute and long term mental trauma.

Climate change is deeply affecting our mental health and well-being.

4.2 Economic impacts

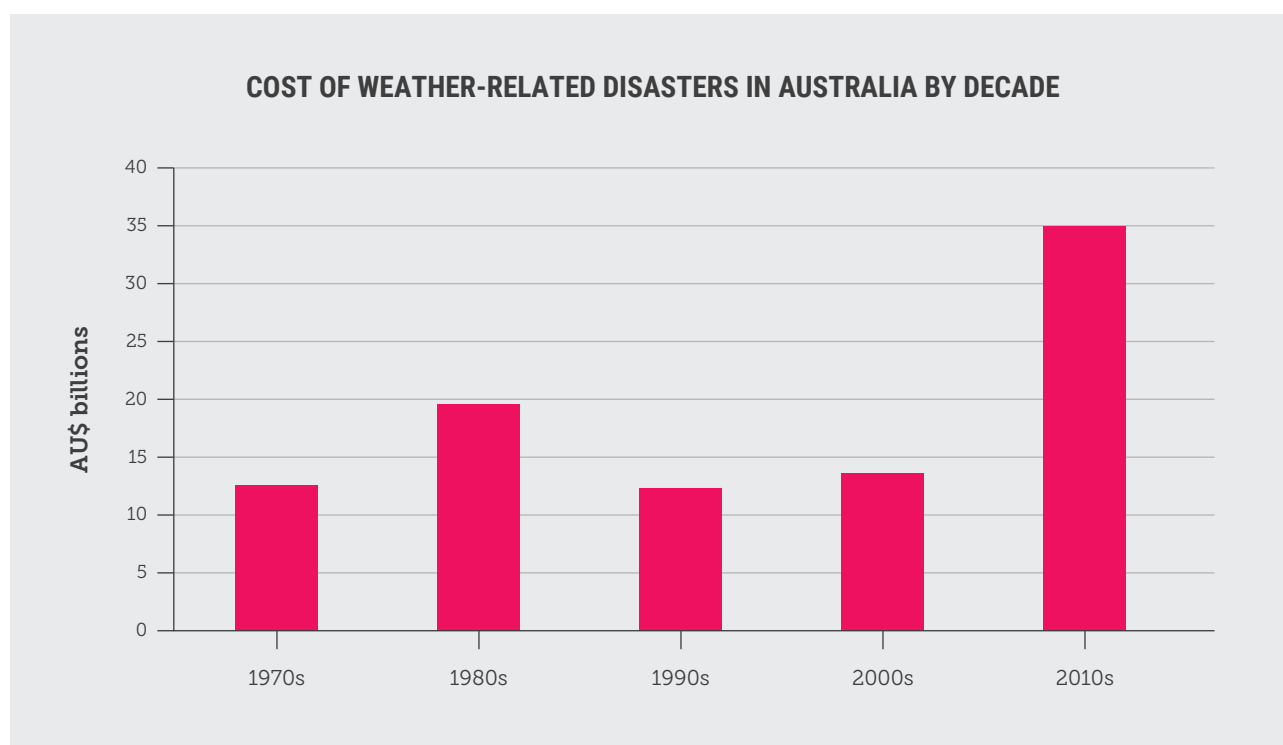
An analysis of data from the International Disaster Database maintained by the Centre for Research on the Epidemiology of Disasters (EM-DAT) shows a significant rise in the cost of weather-related disasters in Australia. After adjusting for inflation, the costs have more than doubled since the 1970s (Figure 7) (Climate Council 2021a).

Floods are our nation's most expensive extreme weather event, making up the greatest proportion (29%) of economic damages in Australia over the past decade (Climate Council 2021a; Figure 8). Between 2010 and 2019, floods caused more than \$10 billion in damages.¹ Immediate impacts

include loss of life and hospital admissions, property damage, destruction of crops and livestock, clean up costs, loss of productivity and emergency response.

The economic fallout from the floods has many dimensions. Insurance claims -- which cover only a portion of the total cost of private property damage and business disruption -- are heading towards \$2 billion. Lack of insurance and underinsurance mean the actual figure will be many times higher. In Queensland, the Government is estimating rebuilding costs, predominantly of damaged infrastructure, at \$2.5 billion.

Figure 7: Cost of weather-related disasters in Australia by decade. Based on data from EM-DAT, the International Disaster Database: <https://www.emdat.be/> (See Appendix 1 for more details).



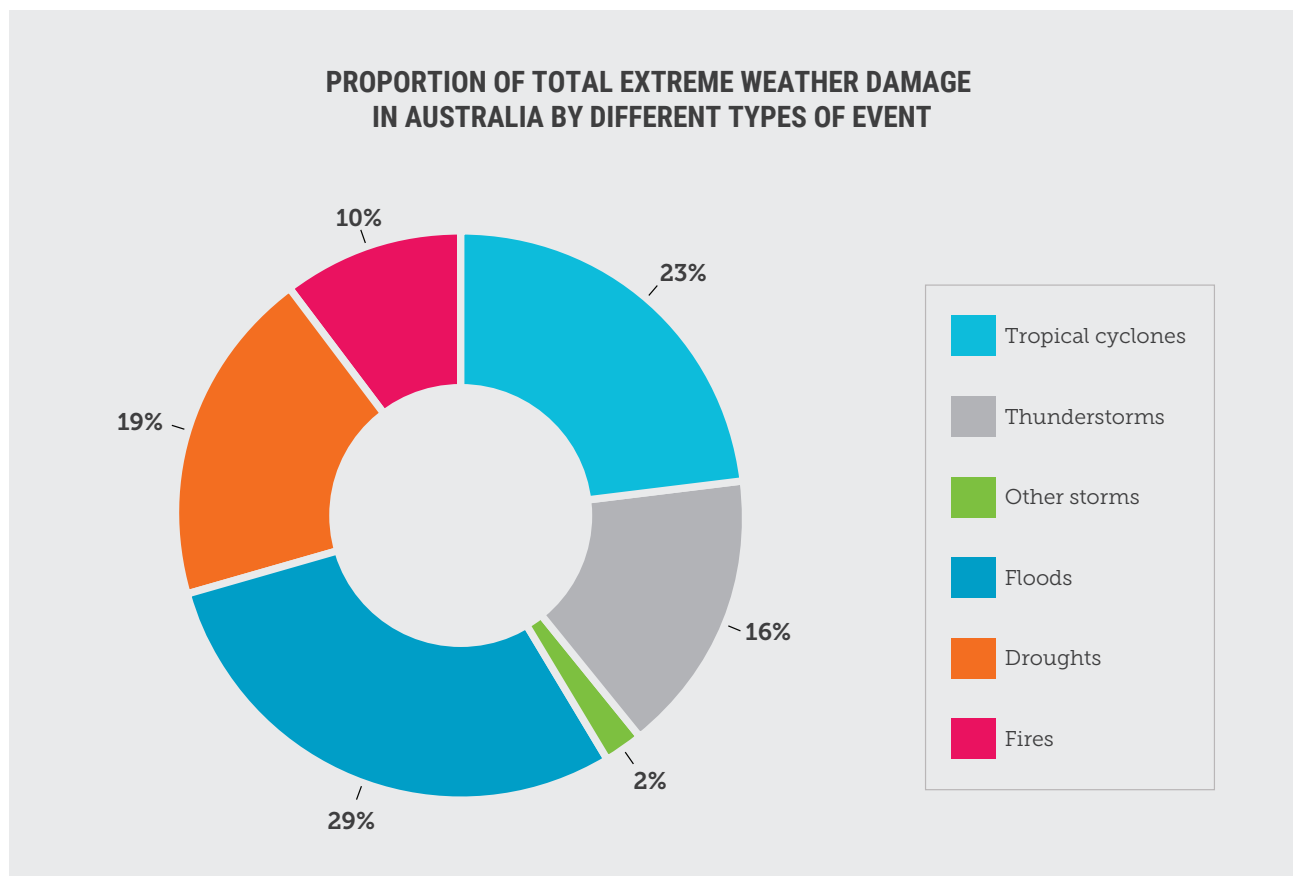
¹ Based on data from EM-DAT, Climate Council calculated the cost of extreme weather disasters in Australia between 2010-2019 to be \$35bn (Climate Council 2021a). Floods accounted for 29% of this total, or over \$10bn.

Thus far, Queensland Treasury's initial estimates of the loss of economic activity are in the order of \$1 billion or 0.25% of Gross State Product (AFR 2022; ABC 2022b). However, we know that tangible losses (directly measurable) are only a small portion of insured losses. Using the Black Summer Fires as a benchmark, the total tangible economic and social costs could be as much as 40 times insured losses (Quiggin 2020), even before intangible (difficult to measure) costs such as increases in mental health costs, incidence of domestic violence, and environmental damages are accounted for (Read and Denniss 2020; Deloitte Access Economics 2021). At time of publication there were no reliable estimates on NSW

economic costs because the flooding crisis is still unfolding, with evacuation orders issued for some suburbs in Sydney as a second east coast low in one week struck the region.

In January/February 2019, heavy rainfall caused widespread flooding across north and far north Queensland, affecting more than half of the state. At the time, it was one of the worst disasters in the region's history. The total social and economic costs were estimated at \$5.68 billion, or around 14 percent of the region's annual economic output. This included damage to homes and infrastructure, impacts on health and wellbeing, and the loss of half a million cattle (Deloitte Access Economics 2019).

Figure 8: Proportion of total extreme weather damage in Australia (2010-2019) by different type of event.² Based on data from EM-DAT, the International Disaster Database: <http://www.emdat.be/>



² 'Floods' includes coastal floods, flash floods and riverine floods.

Australia is experiencing more intense, heavy rainfall. In 2019, heavy rainfall caused widespread flooding affecting more than half of Queensland – one of the worst disasters in the region's history.

Preliminary calculations by the Australian Bureau of Statistics estimate that the combined number of cattle in the regions affected by the 2022 flooding would amount to about 475,000, or 2 percent, of the national herd. Even dairy farmers whose cattle had not been washed away were facing problems. Without power, milking sheds cannot be operated. This increases the risk that cows develop mastitis (a three-day sickness that can lame a cow) (The Guardian 2022).

There are substantial, ongoing impacts including business closures, loss of productivity through absenteeism and presenteeism,³ reduced agricultural productivity, increased emotional stress, and physical illnesses (for example, from waterborne diseases). Floods frequently damage power transmission and sometimes power generation, which also have knock-on effects.

Recent modelling suggests that the economic cost of climate change to Australia will rise much higher over the coming decades. Annual damages from extreme weather, along with sea-level rise and other impacts of climate change upon Australia, could exceed \$100 billion by 2038 (Kompas 2020).

By 2060 it is estimated floods could cost our national economy \$40 billion each year (Deloitte Access Economics 2021). Floods are already the costliest type of disaster in Australia (Figure 8). The scale of losses from the floods across eastern Australia in the summer of 2010-11 led to a special 12-month flood levy being placed on all Australians earning more than \$50,000 a year, to help cover the estimated \$5.6 billion damage bill (SMH 2011).

Flooding and other disasters tend to exacerbate inequality. Vulnerability to climate change impacts, including weather-related disasters, is underpinned by intersecting inequalities, including across genders, ethnicities and income groups (IPCC 2022). Lower-income households are more likely to live in areas exposed to flooding and other hazards, such as on the flood plains of Western Sydney or the flood-prone suburbs of South Lismore and Grafton. They are less likely to have adequate insurance because they cannot afford it and they are more likely to experience extreme weather disasters, and have fewer resources with which to bounce back after a disaster strikes.

³ Presenteeism occurs when workers attend work but are working at below usual levels of productivity due to anxiety and distress and/or having to deal with insurance claims, homelessness and so forth.



Figure 9: Recovering from one of the most extreme disasters in Australian history will be slow and costly.

The cost of extreme weather disasters in Australia has more than doubled since the 1970s. Floods are Australia's most costly type of extreme weather disaster.

In Australia, far more money is spent on disaster recovery than is spent on efforts to reduce their impacts before they occur. Only 3 percent of funding is spent on disaster mitigation that would limit the impact of natural disasters, with 97 percent

going towards post disaster reconstruction (Productivity Commission 2014). This is despite research that shows that investing in levees, for example, produces positive and significant benefit-cost outcomes (Insurance Business Australia 2014).

Floods and other disasters exacerbate inequality in Australia.

4.3 Insurance

In Australia, flooding along our densely populated coasts is a significant societal risk. The most damaging events are likely to arise when inland flooding, storm surges and high tides – all of which are exacerbated by climate change⁴ – occur simultaneously. Climate change poses significant long-term risks to the insurance industry. This is made worse by continuing migration to risky and disaster-prone areas of Australia. In March 2017, Australia's chief financial regulator, the Australian Prudential Regulation Authority, warned that banks and insurers must "rise to the challenge" of climate change.

As of 8 March 2022, insurers had received 96,844 claims related to flooding in southeast Queensland and New South Wales - 69 percent of these claims are from Queensland and 31 percent from New South Wales. 80 percent of total claims relate to people's homes, 17 percent related to motor vehicles, with the remainder commercial property claims. The estimated collective cost of claims is at least \$1.45 billion (Insurance Council of Australia 2022).

The scale of losses from the current disaster prompted some concern from investors about how it could hit major ASX-listed insurers, who may face higher reinsurance bills (Herald Sun 2022).

Many people are either inadequately insured for these types of events or do not have any insurance. In particularly high-risk areas, properties may become "uninsurable" with premiums prohibitively expensive. People on low incomes or in highly exposed areas – those who are most in need of insurance – are the least likely to have insurance (IPCC 2012). This is a further reason why flooding and other disasters exacerbate and further entrench existing inequalities.

Properties in high-risk areas may become uninsurable due to the escalating impacts of climate change.

⁴ Rising sea levels mean that storm surges and high tides are higher than they would be in the absence of climate change.

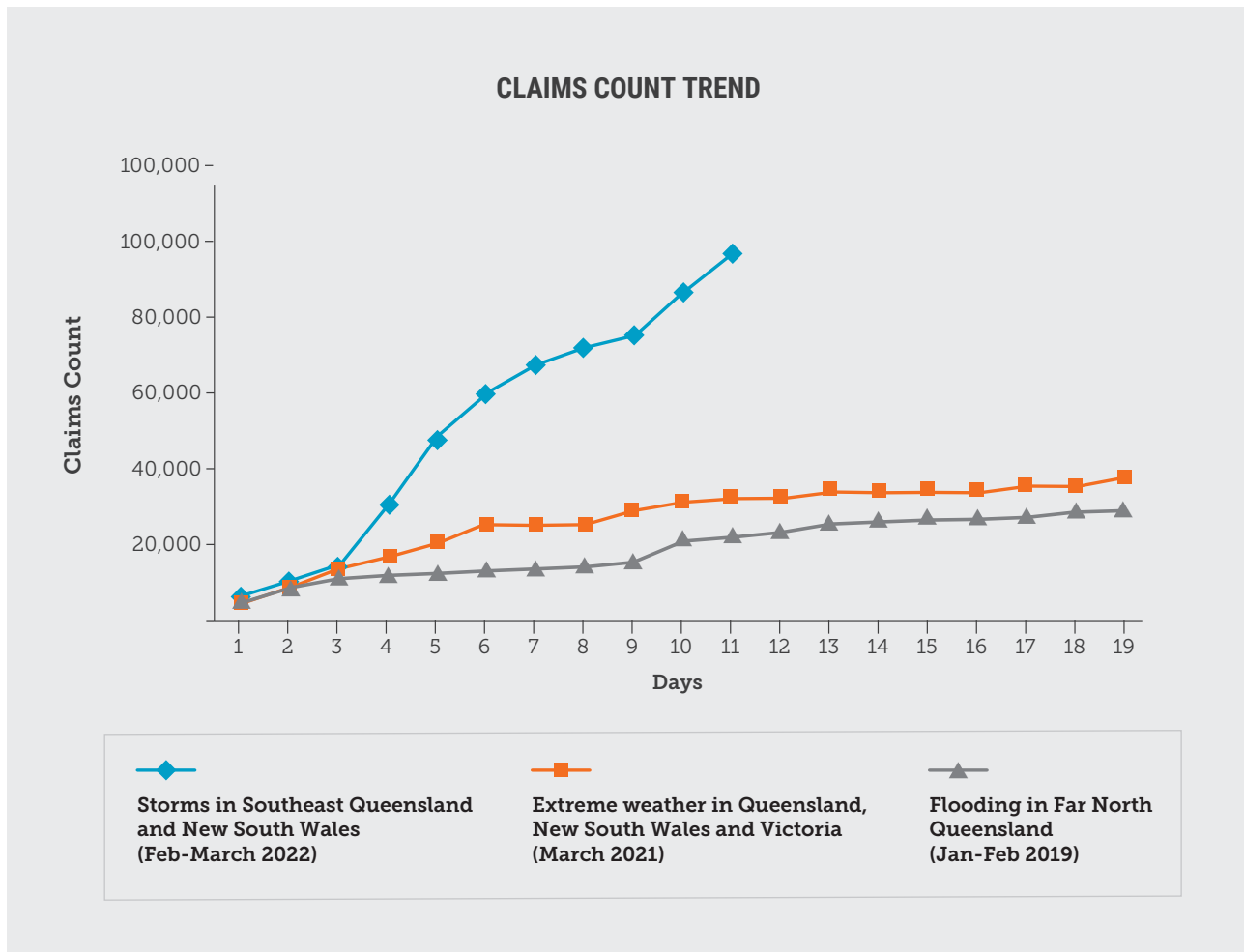


Figure 10: Comparison of insurance claims count of recent extreme weather events in Australia. **Source:** Adapted from Insurance Council of Australia, last updated 8 March 2022.

5. Slowing the escalating risks of extreme weather

Prior to the flooding disaster that swept across Queensland and New South Wales, Tasmania had endured its driest summer in forty years (BoM 2022a) and Perth had sweltered through 13 days at or over 40°C (BoM 2022b). This smashed Perth's previous record of seven summer days of at least 40°C set in 2015-2016. Australians are living in a supercharged climate which worsens extreme weather events and increases the dangers to us all.

Extreme weather events such as intense rainfall and consequent flooding are very likely to become more severe and destructive over the next couple of decades because past greenhouse gas emissions have "locked in" certain levels of climate change. However, we can still influence how much worse things become. The severity of many extreme weather events that young people today, our children and grandchildren will face later this century depends on how fast and how deeply greenhouse gas emissions can be reduced now, next year and within the next decade.

Climate change is harming the health, wellbeing, and livelihoods of so many Australians. We are racking up billions of dollars in economic losses, and damaging many of our unique ecosystems. It is time for a step change in the approach of all levels of government and all types of businesses in their climate action efforts to protect people, the environment and the economy.

How bad things get depends strongly on how fast Australia and the world cut emissions now and within the next decade.

We must take decisive action this decade to bring climate change under control. Global action is ramping up after the landmark UN Climate Change Conference in Glasgow in 2021, and Australia must join this effort by reducing our emissions sharply. Australia must set a new 2030 target to reduce emissions before the next UN Climate Change Conference – in November this year. Given the scale of the global emissions reduction task, and taking into account Australia's very high level of emissions and our huge renewable energy resources, Australia should aim to reduce emissions by 75% below 2005 levels by 2030 and achieve net zero by 2035 (Climate Council 2021b). This means accelerating efforts to shift away from coal and gas to a fully renewables-powered economy. The Australian Government must also take additional concrete steps to support Australian communities with building their

resilience to the escalating impacts of climate change. This includes ensuring that towns, cities and communities are rebuilt in ways that take into account the impacts of climate change that, owing to past inaction, can no longer be avoided; and adequately preparing and equipping emergency services and communities for inevitable climate-fuelled disasters.

Coping with a supercharged climate with more intense rainfall and floods is costly, and will become progressively more challenging into the future. Investing in resilience and adaptation is essential to reduce and prevent losses in the coming decades. Transformative climate action is needed to protect Australians from catastrophic climate impacts such as the flooding disaster in Queensland and New South Wales.

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Image credits

Front Cover: FLOODS NSW. A supplied image shows flood-affected properties in Lismore, NSW on Monday, February 28, 2022. (AAP Image/Supplied by the Department of Defence, Bradley Richardson).

Page 11 - Figure 5: A women holding a small child is seen looking at flood waters in the suburb of Rosalie in Brisbane, Monday, February 28, 2022. Queensland's southeast is set to endure more wild weather as the state grapples with a days-long flood crisis. (AAP Image/Darren England).

Page 13 - Figure 6: Gold Coast Flooding. Coolangatta, Australia. Source: PlanetScope. Attribution-NonCommercial 2.0 Generic (CC BY-NC 2.0).

Page 18 - Figure 9: vivid.shotts.Lozz Wright_Murwillumbah_3 march 2022.

Appendix A: Cost of weather-related disasters in Australia by decade

The calculations in Figures 7 and 8 were based on data from EM-DAT, the International Disaster Database: <https://www.emdat.be/>

This analysis covers all weather-related events in the EM-DAT database for Australia between 1970 and 2019, in accordance with the following classifications: storm (convective storm, extra-tropical storm, tropical cyclone), flood (coastal flood, flash flood, riverine flood), wildfire, drought, extreme temperature (cold wave, heat wave, severe winter conditions) between 1970 and 2019. Costs were first converted from US\$ to AU\$ using the exchange rate of the day, and then adjusted for inflation so as to be equivalent to AU\$ in 2019. Historical exchange rates and data on inflation was accessed EM-DAT: <https://www.emdat.be/>

› Exchange rate data: <https://www.rba.gov.au/statistics/historical-data.html>

› Inflation data: <https://www.rba.gov.au/calculator/annualDecimal.html>


The rise in cost is likely due to both climate and non-climate-related factors. The latter include growth in population and the number of people living in exposed areas.

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The Climate Council is an independent, crowd-funded organisation providing quality information on climate change to the Australian public.

The Climate Council acknowledges the Traditional Custodians of the lands on which we live, meet and work. We wish to pay our respects to Elders past, present and emerging and recognise the continuous connection of Aboriginal and Torres Strait Islander peoples to Country.

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