Understanding climate threats to the Great Barrier Reef

Science and impacts in a warming world

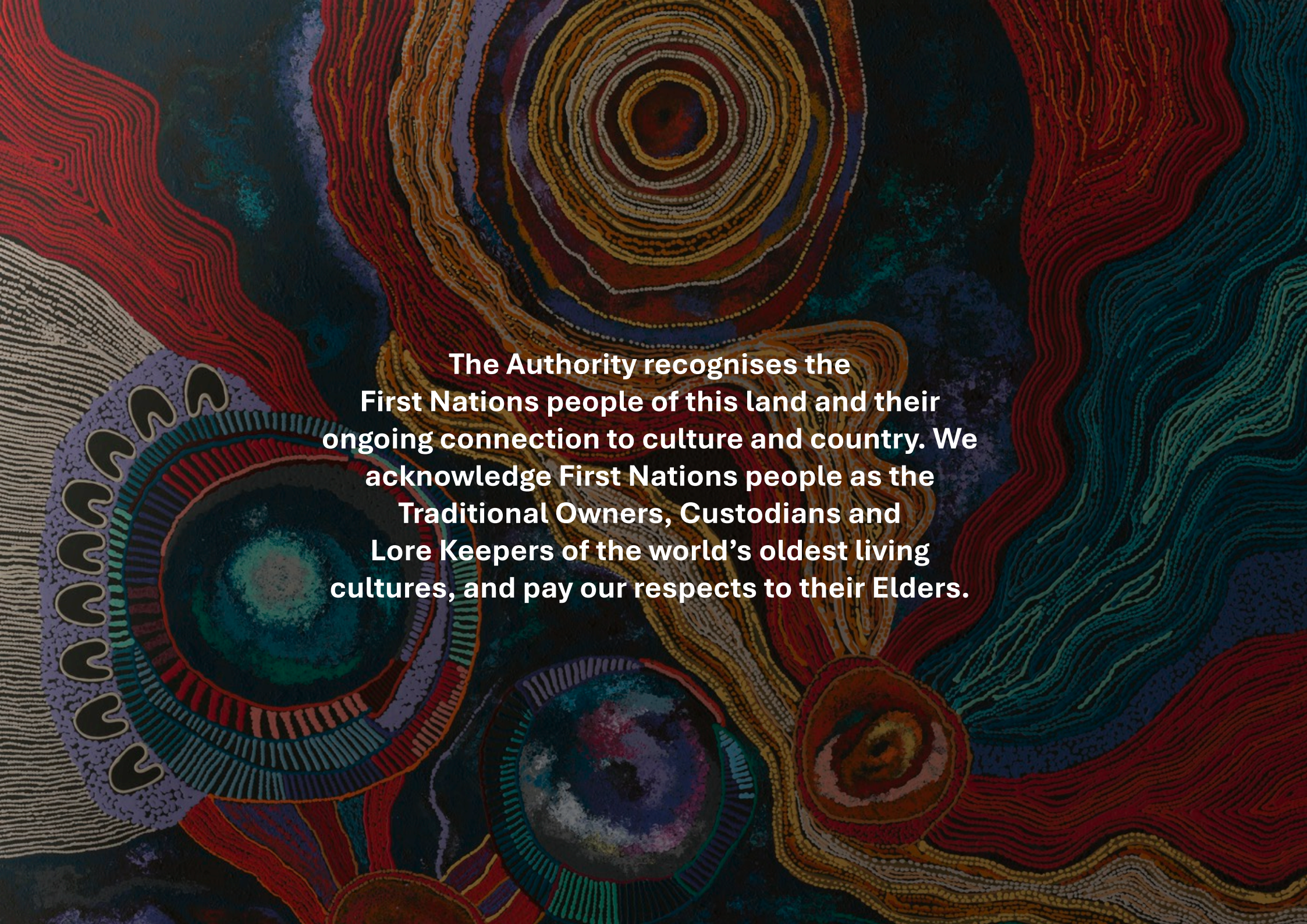
July 2025

CLIMATE CHANGE AUTHORITY

Ownership

Published by the Climate Change Authority
www.climatechangeauthority.gov.au

ISBN: 978-0-6486349-1-1



The Authority recognises the First Nations people of this land and their ongoing connection to culture and country. We acknowledge First Nations people as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living cultures, and pay our respects to their Elders.

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Executive summary

The Great Barrier Reef is one of Australia's most significant natural assets, supporting extraordinary biodiversity, regional economies and deep cultural heritage for First Nations Australians. However, the Reef faces escalating risks – including ocean warming, acidification and more frequent extreme weather events. These pressures are already driving widespread coral bleaching, weakening reef structures and disrupting broader marine ecosystems. These challenges compound other risks to the Reef such as pollution from land runoff and unsustainable fishing practices.

Scientific assessments are clear that the underlying driver of these threats is global greenhouse gas emissions, primarily from fossil fuel combustion and land-use change. Without near-term, coordinated international action to reduce emissions, the window to avoid broadscale loss of the Great Barrier Reef's ecosystems is closing.

Globally, coral reefs are projected to decline by 70 to 90% if climate warming remains at 1.5 °C above pre-industrial levels for an extended period. At 2 °C of warming, up to 99% of corals may be lost or fundamentally altered. In 2024 global temperatures spiked above the 1.5 °C threshold for the first time, highlighting the urgency of action to prevent escalating warming becoming the norm.

Australia and international partners will need to work together to address these challenges. Ultimately, climate risks to the Great Barrier Reef can only be addressed through coordinated, collaborative action to cut global emissions, which were still rising as of 2024.

Australia has two important opportunities to spearhead shared efforts for deeper and faster emission reductions. With ambitious domestic targets for 2035, the nation can demonstrate credible pathways to lower emissions and engage international partners to drive greater action globally. Addressing both domestic and offshore emissions will be critical.

The COP31 climate conference, which Australia is bidding to host in partnership with the Pacific in 2026, provides a timely platform to drive international momentum – including on fossil fuel phase-down and short-lived climate pollutants — which improve the odds of holding warming as close as possible to 1.5 °C.

Acting now to increase emissions reductions is a 'no-regrets' strategy. While parts of the Great Barrier Reef have already been significantly altered by climate warming, deeper and faster reductions will maximise the chance of preserving this natural asset for the future. Limiting further warming will also protect much more than the Reef; it will safeguard environments, species and communities across Australia and around the world that are facing similar climate threats.

Introduction

The Great Barrier Reef is stunningly beautiful – an environmental, economic and cultural region of priceless world heritage value that many species and communities rely on.

From its iconic coral reefs to its sun-drenched cays, seagrass meadows, coastal mangroves and wetlands, its habitats are home to a stunning array of species. This treasure includes over 1,600 species of fish, more than 450 species of coral, 900 types of algae and seagrass, and threatened species like the dugong and 6 of the world's 7 species of sea turtle. The sheer size, diversity and complexity of its ecosystems are what makes the Great Barrier Reef one of Seven Natural Wonders of the World, and a unique global asset recognised by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) as a World Heritage area.

The teeming and diverse coral reef ecosystems we know today are under critical pressure from climate change and the greenhouse gas emissions which cause it.

Together, climate warming and emissions are disrupting the delicate balance of life on the Great Barrier Reef – and all other reefs globally – in several important ways:

- Warmer oceans place corals under heat stress.
- Ocean acidification strips the environment of materials for building and repairing reefs.
- Extreme weather events such as cyclones and storms cause direct physical damage, while flooding drives in sediment, nutrient and chemical pollution. These impacts disrupt the health, access to food and light of the organisms living there.

In recent years UNESCO has considered adding the Great Barrier Reef to the global list of world heritage sites 'In Danger' because of the impacts of climate change and other risks. This listing has not yet occurred, but the more the climate warms, the higher the risk of broadscale – potentially irreversible – damage to the Reef.

This short report summarises the latest science on how the Reef is faring today, and the future risks it faces in a changing climate. The Reef is also under threat from outbreaks of coral-eating crown-of-thorns starfish and other human activities including marine pollution, agricultural runoff, coastal development and instances of unsustainable fishing.

The Australian and Queensland governments are investing a combined $5 billion from 2014 to 2030 to address direct threats to the Reef, and improve its long-term resilience (DCCEEW, 2024). This approach has supported improvements in water quality, encouraged industry to adopt more sustainable fishing practices, and enabled ongoing mapping and management of priority ecosystems (Australian Government, 2025).

These actions reflect a shared commitment by national and state governments to reduce risks to the Reef within Australia's direct control. Australia has also played an active role with international partners, via UNESCO, in developing policies and action plans to address climate risks across all World Heritage-listed properties (UNESCO, 2023a; UNESCO, 2023b).

While these management efforts are welcome, the outlook for the Reef in a warming climate is very concerning and the science is unambiguous. Limiting emissions and further climate warming is essential to reduce the risk of losing the Reef as we know it – and help protect other vital ecosystems along with it.

Global warming threatens the Great Barrier Reef

The impacts of greenhouse gas emissions and warming of the world's oceans are among the best-established relationships in current climate science. These change the marine environment in 3 critical ways outlined below. Scientists have observed escalating impacts on the Great Barrier Reef and on coral reefs around the world.

Heat stress from ocean warming threatens coral survival

The world's oceans have absorbed 93% of the excess heat in the atmosphere caused by human activities: climate warming is effectively ocean warming (TERN, 2024). In 2024, global ocean temperatures were the warmest ever recorded by humans, surpassing the previous records set in 2023 (Cheng et. al., 2025). Long-term observations indicate this warming trend is accelerating – sea surface temperatures have risen more than 4 times faster since 2019 than the rate of warming observed in the late 1980s (Merchant et. al., 2025).

Warmer ocean temperatures directly impact the Great Barrier Reef by causing more frequent and widespread coral bleaching. Corals get their nutrition and vibrant colour from algae that live in their tissue. Warmer ocean temperatures put corals under heat stress, causing them to expel these algae and revealing the coral's white skeleton beneath. If periods of ocean heat are relatively short-lived, the algae can repopulate the coral tissue and the corals can gradually recover. However, sustained periods with prolonged or extreme temperature stress prevent this from happening. The corals remain bleached and can starve; in the worst case, leading to the death of the coral colony (GBRMPA, 2024a).

Scientists can observe the frequency and severity of past bleaching events through stress bands which are visible on corals even after they recover. This is similar to using tree rings to understand past environmental conditions and climate change. Research indicates mass bleaching events were rare and localised during most of the last 2 centuries but have become increasingly frequent and much more widespread (Henley et. al., 2024). The Australian Institute of Marine Science documented 5 mass bleaching events between 2016 and 2024 (AIMS, 2024a). These all occurred during seasons with historically high ocean temperatures in the Coral Sea, which hosts the Great Barrier Reef (Henley et. al., 2024).

Recent coral surveys indicate a sixth mass bleaching event occurred during the summer of 2025, with extensive bleaching of shallow-water reefs off the coast of north and far north Queensland (GBRMPA, AIMS & CSIRO, 2025). This is only the second time the Reef has experienced widespread coral bleaching over consecutive summers. Simultaneous coral bleaching was also detected on the northern and southern coral reef systems in Western Australia for the first time, a result of a widespread marine heatwave (de Kruijff, 2025).

Emissions are making oceans around the Reef more acidic

The oceans are absorbing around 30% of carbon dioxide (CO_2) emissions from human activity. This is estimated to see 3 billion tons of CO_2 a year added to the marine environment (Shadwick et. al., 2023) – equivalent to the emissions from over 650 million cars.

This carbon dioxide reacts with seawater to change its chemistry, a process called ocean acidification (NOAA, 2025). Current ocean CO_2 concentrations are estimated to be the highest in 800,000 years, with the Pacific[1] among the most severely affected regions from the resulting acidification (WMO, 2025).

Acidification reduces the availability of calcium minerals in the ocean that corals – and other animals – use to build their skeletons and shells. Scientists have linked ocean acidification to a significant decline in the density of some types of corals on the Great Barrier Reef, leaving them structurally weaker (Guo et. al., 2020).

Coral bleaching and ocean acidification interact with each other to compound climate risks. Corals which start to experience bleaching because of heat stress use the minerals in seawater to rebuild and recover will have less access to these materials because of increasing ocean acidity. The weakened corals are then less resilient to future heat stress and bleaching, driving a negative feedback loop which is adversely affecting the health of all the world's coral reefs – including those which make up the Great Barrier Reef.

[1] The Great Barrier Reef is located in the Coral Sea, which is part of the Pacific Ocean.

Extreme weather events are disrupting the Reef's fragile ecosystems

Storms, flooding and other extreme weather events are becoming more frequent and severe as the climate warms. Cyclones and storm surges can directly damage the Great Barrier Reef, while flooding can drive fresh water, sediment and other pollutants into its delicate ecosystems. This exacerbates ongoing issues with runoff from fertiliser and other onshore land management practices.

For example, back-to-back cyclones in northern Queensland in late 2023 and early 2024 resulted in flood plumes stretching more than 700 kilometres along the coastline and reaching into parts of the Reef (James Cook University, 2024). These inflows alter water nutrients, block light, smother corals, and impact important food sources for other species living on the Reef. Exposure to floodwaters has been found to correlate with slower rates of recovery for coral cover after bleaching events (GBRMPA, 2024a), again demonstrating how climate impacts cause compounding damage to the Reef.

The Great Barrier Reef is like a human body under extreme stress. Warmer oceans act like a high fever, pushing corals well past safe limits. Ocean acidification disrupts the Reef's chemistry, much like a blood imbalance that blocks healing. Extreme weather delivers repeated trauma, battering an already weakened system with destructive waves, pollutants and sediments.

Without stronger action to address emissions and climate warming as the underlying causes of this stress, there is now a very high risk of broadscale loss to the Great Barrier Reef's ecosystems as we know them. While scientists recognise the Reef may persist in some adapted form in a warmer climate, it will no longer resemble the diverse, thriving system that holds critical environmental, economic and cultural value today.

Ecosystems and communities rely on the Great Barrier Reef

The Great Barrier Reef has incredible natural beauty, but its value extends well beyond the scenic. The Reef is deeply interconnected with surrounding ecosystems and the world's marine environments, directly supports regional economies, and is an important cultural heritage site for First Nations Australians. Working to avoid the broadscale loss of the Reef's present ecosystems means working to limit negative impacts on all the species, habitats and communities which depend on them today, and for generations to come.

The Great Barrier Reef is a complex marine environment

The vast, diverse Great Barrier Reef is formed by a rich web of interactions between different kinds of marine life. It provides shelter and food for thousands of aquatic plant and animal species (Figure 1) and serves as a breeding ground and nursery to support the revival of marine populations. Its corals, sponges and algae contribute to healthy oceans by oxygenating and filtering water.

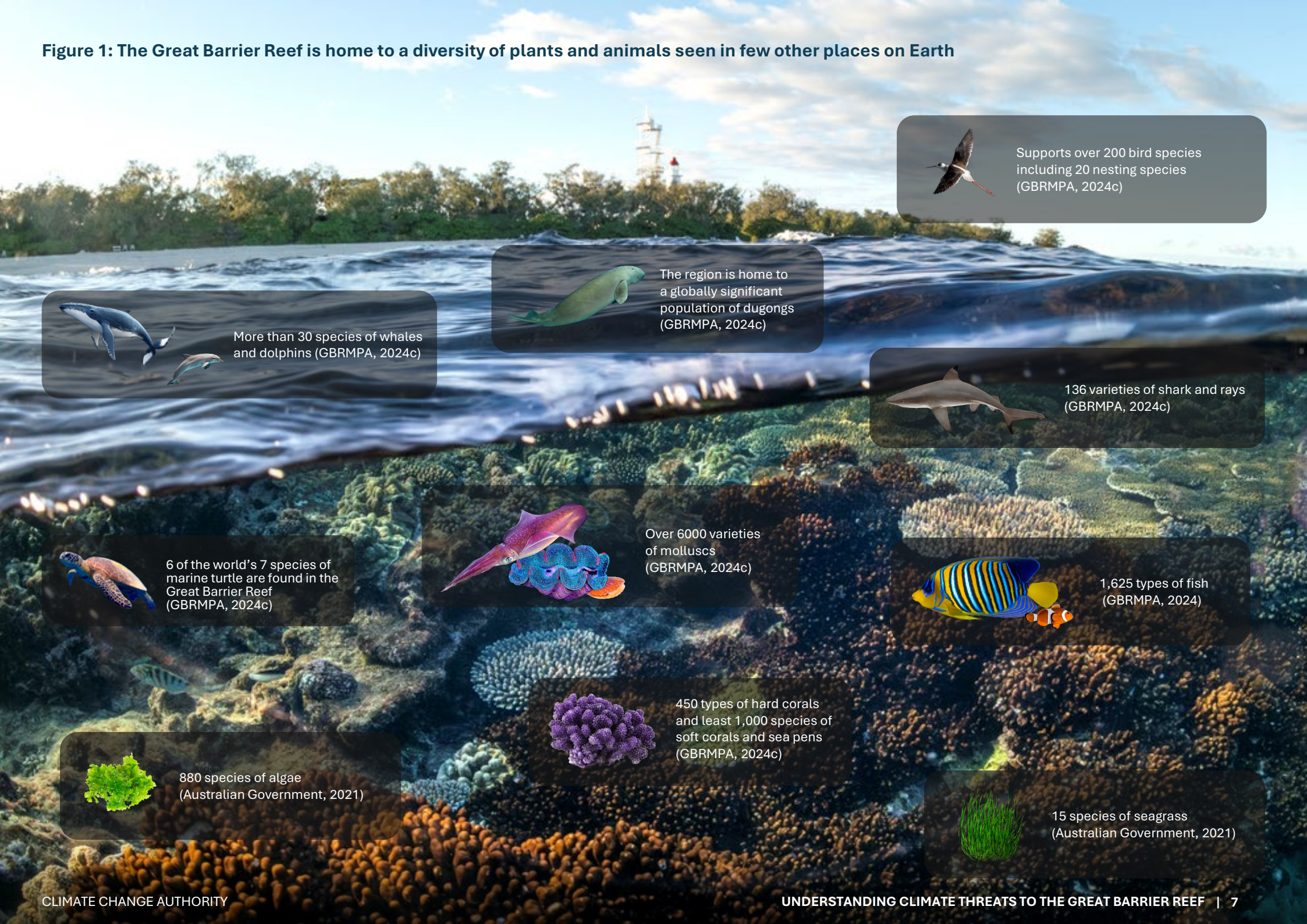
So far, the Great Barrier Reef has shown some resilience in the face of repeated mass coral bleaching events, flooding and cyclone damage, and other threats such as pollution from agricultural runoff.

However, if the foundational components of the Reef's ecosystems continue to be severely impacted, there is a growing risk of permanent, irreversible damage. The consequences of this would be felt far beyond the Reef's boundaries.

Conservation groups working on the Great Barrier Reef are particularly concerned about population declines for fish and other species, migratory birds, reduced marine biodiversity and the possible extinction of threatened species like dugongs and sea turtles. Many whale species, including humpbacks, dwarf minke whales, and sperm whales, are also dependent on the Great Barrier Reef for breeding, calving, and nursing their young (Great Barrier Reef Foundation, 2025b).

Reefs also act as natural barriers, absorbing over 90% of wave energy that would otherwise strike coastlines. As reefs weaken and lose complexity, extreme waves could become 50 times more frequent because of the loss of the buffer they provide (Carlot et. al., 2023). If such permanent weakening occurred across the Great Barrier Reef, this would increase erosion and flooding risks for communities along Queensland's coast. Important carbon stores could also be lost.

Figure 1: The Great Barrier Reef is home to a diversity of plants and animals seen in few other places on Earth



Communities depend on the Reef for income, food and wellbeing

Industries based on and around the Great Barrier Reef collectively contribute billions to the Australian economy each year, underpinning livelihoods and local ways of life.

Tourism is one of the Reef's largest economic drivers, with local and international visitors drawn to its distinctive biodiversity and vibrant ecosystems. In 2024, over 1.9 million people visited the Southern Great Barrier Reef tourism region alone, with domestic travelers alone spending $1.6 billion in nearby communities such as Gladstone, Bundaberg and the Capricorn Coast (Capricorn Enterprise, 2024).

Commercial fishing is another local industry reliant on the Reef's health, with over 900 Queensland businesses supporting almost 3,000 jobs (BDO, 2024). Sustainable commercial fishing makes an important contribution to domestic and international food supply; businesses on the Reef produce around 5,000 tons of fish, prawns, crabs and more a year (GBRMPA, 2024a).

The recreational fishing, science and research, and conservation industries all make further contributions to local jobs and economic activity across north and far north Queensland.

Broadscale deterioration and permanent loss of the Reef's present ecosystems will have a significant impact on these coastal towns and communities. In surveys conducted by the CSIRO in 2023, more than half of those living in the regions bordered by the Great Barrier Reef said it was part of their identity, and 86% said living near it contributes positively to their overall wellbeing. Along the coastline from Bundaberg and Cape York, 23% of residents depend on it for some of their household income (CSIRO, 2023). Research conducted following the 2016 and 2017 mass bleaching events identified significant stress and concern in coastal communities with a strong reef tourism base – including Cairns, the Whitsundays, Mackay and Bundaberg – regarding the future of the Reef and the livelihoods it supports (Prideux et. al., 2018).

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The Reef is an important site for First Nations culture and heritage

First Nations communities have maintained stewardship of the Reef for thousands of years. Today, there are 70 Aboriginal Traditional Owner groups with authority for Sea Country management in the Great Barrier Reef Marine Park (GBRMPA, 2025).

As well as being part of the local industries and communities discussed above, First Nations people have unique connections to the Reef as an important site of cultural knowledge and practice. Local animal species on and around the Reef serve as community totems and indicators of ocean health in traditional management practices. Shared cultural memories are also linked to specific landmarks and sites (Girringun Aboriginal Corporation & WWF, 2022).

Our connections with the Reef are deep and enduring and form part of our identity. Through our custodianship the Reef remained healthy and provided for us.

(Reef Traditional Owners & Queensland Government, 2022)

For First Nations people, broadscale loss of the Reef's ecosystems threatens this enduring cultural heritage and lore, exacerbating economic and social impacts that would be felt across local communities. In June 2025, the Australian Government announced a $30 million initiative to harness the skills and knowledge of First Nations Australians in caring for the Reef by improving water quality (PM&C, 2025). While welcome, initiatives like this one can only be effective as part of broader efforts to address climate change as a primary threat to the Reef.

These diverse dependencies highlight how much would be lost alongside the direct ecosystems and natural beauty of the Great Barrier Reef if global emissions and temperatures continue to rise. Some locals are already experiencing 'reef grief' in response to the projected decline in the Reef's health (Marshall et. al., 2019).

Holding warming as close as possible to 1.5 °C is key to addressing threats to the Reef

Reducing global emissions and limiting further climate warming are essential to keep open the possibility of avoiding broadscale loss to the Great Barrier Reef's present ecosystems. While the window for action is narrowing, coordinated emissions reductions will help minimise coral losses, support recovery and buy time for natural adaptation processes. Direct interventions on the Reef, such as those led by the Australian and Queensland governments, can support its resilience and adaptation. But coordinated global action to address climate risks is vital for these efforts to work in the long-term.

Limiting the buildup of emissions in the atmosphere will curb climate and ocean heating

Globally, coral reefs are projected to decline by 70 to 90% if climate warming remains at 1.5 °C above pre-industrial levels for an extended period. At 2 °C of climate warming, up to 99% of corals may be lost or fundamentally altered (IPCC, 2023).

The extent of future climate warming is determined by the buildup of emissions in the earth's atmosphere. The concentration of these gases is already at the highest level on record and still rising. If emissions continue at the current rate, the buildup of emissions projected to lead to 1.5 °C of continuous warming will be reached within just 6 years (Global Carbon Budget, 2024).

Reducing emissions as steeply as possible in the near term will slow cumulative emissions growth.

This increases the likelihood of holding warming as close as possible to 1.5 °C and curbing the extent of further ocean warming. Doing so will be necessary to limit the severity of impacts on the Reef.

Minimising new emissions will slow ocean acidification

Continued high emissions globally will pour even more CO_2 into the world's oceans, increasing the acidification that is weakening the Great Barrier Reef. With a business-as-usual level of emissions ocean surface waters could be nearly 150% more acidic by the end of this century, compared with pre-industrial times (NOAA Fisheries, 2025).

Rapid reductions in the amount of additional CO_2 in the atmosphere and available to be absorbed into oceans will help minimise harmful changes in ocean chemistry, supporting corals and other species to grow and recover. Oceans can gradually restore chemical levels through dissolution of carbonate sediments in the ocean and the natural weathering of rocks. However, this process takes millennia. Potentially, the direct addition of alkaline materials may help accelerate this transformation (Hook et. al., 2025). These long-term processes can only support recovery once acidification has stabilised and additional deterioration is no longer occurring. The longer countries delay cutting emissions, the more acidification will intensify instead.

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A healthier marine environment will give corals more chance to recover

The Great Barrier Reef's vast size, active management and restoration practices have buffered permanent losses so far, compared with other reefs around the world (GBRMPA, 2024a). Long-term monitoring shows the Reef can recover with a quick rebound of some species of corals following periods of bleaching and loss, although these are not always of the same variety and vigour (AIMS, 2024b). The Reef Authority's *Reef Blueprint 2030 - Great Barrier Reef Blueprint for Climate Resilience and Adaptation* identifies existing and emerging management priorities for local action to promote reef resilience (GBRMPA, 2024b). Actions by the Australian and Queensland governments to improve water quality, better manage fisheries and deal with crown-of-thorns starfish coral predators are also helping to reduce more direct environmental pressures (Australian Government, 2025).

However, longer periods of higher ocean temperatures, ongoing acidification and more frequent extreme weather events all mean that corals have less opportunity and capacity to recover after bleaching does occur. These climate change impacts also jeopardise the effectiveness of other local interventions. Reducing climate pressures will buy time for the Reef's natural recovery processes to work and enable gradual adaptation by at least some of its species (Brown et. al., 2023). This improves the chances of preserving parts of the Reef as we know them today and potentially improving reef resilience through active restoration efforts currently underway (Great Barrier Reef Foundation, 2025c).

Every increment of additional warming will bring additional consequences. Every effective action taken now contributes to a more positive long-term outlook.

(GBRMPA, 2024a)

In summary, without stronger action to address global emissions and warming, there is a very high risk of broadscale loss or change to the Great Barrier Reef as we know it. While scientists recognise the Reef may persist in some adapted form in a warmer climate, this will no longer resemble the diverse, thriving ecosystem that holds the critical environmental, economic and cultural value of today.

Accelerating emissions reductions calls for coordinated global action

Through the 2015 Paris Agreement on climate, almost all countries have committed to work to reduce emissions and prevent escalating climate warming. Emissions are on a downward trajectory in many countries – including Australia – and global momentum is growing for clean energy and other zero emissions technologies (Climate Change Authority, 2024a; 2024b).

While this progress is welcome, country commitments under the Paris Agreement still have the world on track for up to 2.8 °C of warming by the end of this century (UNFCCC, 2023). With this level of temperature rise there is a very high likelihood of catastrophic damage to the Reef and the loss of its ecosystems as we know them. Recent projections indicate a strong probability that global average temperatures will exceed 1.5 °C over the coming 5 years (WMO, 2025), highlighting the urgency of action to try and prevent escalating warming becoming
the norm.

Limiting climate warming as close as possible to 1.5 °C now hinges on rapid, large-scale reductions in global emissions. As the home and custodian of the Great Barrier Reef, Australia can spearhead shared efforts to accelerate these necessary reductions – both through its own actions and in coordination with global partners.

Australia can lead by example in reducing domestic emissions

Accelerating domestic action is a necessary condition for Australia's credibility in driving international cooperation to reduce emissions. By adopting zero emissions energy sources, technologies and practices, Australia can directly reduce emissions and show other countries what is possible – helping to set new global standards for action.

The nation's domestic emissions are small from a global perspective, but among the world's highest on a per capita basis (IEA, 2023). Australia also contributes significantly to global emissions through exports of coal and gas to other countries – 'exported emissions' are approximately triple domestic ones (Climate Change Authority, 2021). Faster reductions in both domestic and exported emissions are necessary, and achievable through strengthened national policies and coordination.

Priorities include continuing to accelerate the decarbonisation of electricity to unlock emissions reductions across the Australian economy and scaling up emerging industries to supply zero emissions goods in place of emissions-intensive ones (Climate Change Authority, 2025; Climate Change Authority, 2024b).

Setting an ambitious and achievable 2035 emissions reduction target, underpinned by a long-term national net zero plan, can align effort across all levels of government, business and communities. The Australian Government will join other signatories to the Paris Agreement in announcing a new target before the end of 2025. This is a critical opportunity to demonstrate Australia's own ambitious commitment to action addressing risks to the Great Barrier Reef – and much else that is threatened by climate change.

COP31 can be a platform for driving accelerated efforts globally

Australia is bidding to host the annual United Nations Climate Change Conference in partnership with the Pacific in 2026 – COP31 – bringing together all Parties to the Paris Agreement. The Great Barrier Reef's vulnerability, paired with Australia's accelerating clean energy transformation, provides a compelling basis to rally international partners around faster, coordinated emissions reductions through this event.

Australia has a proud history of brokering successful international efforts – such as the Fraser Government's role in delivering the global moratorium on whaling, and the Hawke Government's leadership on protecting Antarctica from mining. COP31 can leave a legacy of equivalent standing if the Australian Government secures agreement from global partners to concrete actions which accelerate global emissions reductions. Opportunities include coordinated action by major fossil-fuel exporting countries to replace these energy sources with low and zero emissions alternatives, and stronger action on short-lived climate pollutants like methane which contribute most to near-term climate warming.

Hosting COP31 could be a turning point for the Great Barrier Reef if Australia collaborates with global partners through this significant platform to drive faster, deeper emissions reductions worldwide – backed up by strong domestic action.

Acting now to limit warming is a ‘no-regrets’ course of action

The risks to the Great Barrier Reef are grave, and significant parts of it may already have been irreversibly altered by the effects of emissions and climate warming. This should inspire efforts to protect what remains viable of the Reef’s ecosystems as we know them; unchecked warming makes their broadscale loss almost certain. Reducing emissions now alongside direct preservation actions is a ‘no-regrets’ strategy – offering the best chance to preserve what we can of the Reef, while protecting many other ecosystems, species and communities in the process.

Curbing further climate warming will give the Reef a fighting chance

The outlook for the Great Barrier Reef as a whole is complex, because it is made up of many distinct sections of reef, communities of corals and micro ecosystems. Each has different levels of resilience to a changing climate. It is clear, however, that major and ongoing damage is now occurring and the extent of the Reef’s present ecosystems which can be preserved is diminishing rapidly (Dickson et. al., 2022).

In November 2024, AIMS released the first coral cover surveys of the northern Great Barrier Reef undertaken since a mass bleaching event, flooding and 2 cyclones in the period December 2023 and March 2024. This indicated that coral cover had declined on 12 of 19 reefs surveyed, with losses ranging up to 72% of previous cover (AIMS, 2024c). These declines occur when affected corals cannot recover after bleaching and die off. Those recent losses follow longer-term observed disruptions: the Reef lost over half its coral cover between 1985 and 2012 (De’ath et. al., 2012). This was followed by a period of strong regrowth, demonstrating that coral cover is dynamic and changes in response to environmental conditions (AIMS, 2022). But the Reef is being increasingly challenged by more frequent and severe impacts, which threaten its capacity to recover into the future.

The Great Barrier Reef Marine Park Authority’s latest Reef Outlook report catalogued a growing list of threats and challenges to the Reef’s long-term health, stating: ‘the window of opportunity to secure a positive future for the Reef is closing rapidly’ (GBRMPA, 2024a). We do not know exactly how much of the Great Barrier Reef it will be possible to maintain by curbing emissions and climate warming now.

But we can be confident these efforts offer the best chance of preserving any of it for the future – particularly when combined with action on water quality, predators and sustainable use of the Reef’s resources.

Preventing escalating warming will protect much else that matters

The Great Barrier Reef is far from the only natural asset threatened by rising global temperatures. From rainforests to ice sheets, agricultural land to mangroves, much of the natural world now faces some kind of risk or disruption from climate change. In turn, this threatens important natural resources that communities – in Australia and around the world – depend on.

Working to limit further warming addresses these interconnected risks together, preventing compounding climate losses in the decades ahead. This is particularly urgent for species and ecosystems which are also already facing major disruption, such as those in Australia’s alpine regions and the Murray–Darling basin wetlands (DPIE, 2019; Muller and Whiterod, 2024). For others which are yet to experience major climate impacts, action now will make the difference between continuing to thrive and facing pressures and decline in the future.

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