
NSW Climate Change Adaptation Strategy

climatechange.environment.nsw.gov.au



Treasurer's message

Climate change and how we respond to it will define our century.



The NSW Government is playing its part in taking strong action to address climate change by committing to halve our state's emissions by 2030 and achieve net zero emissions by 2050 in ways that grow the economy, create jobs and lower the cost of living and doing business. Despite global action to reduce emissions to date, NSW has already faced some of the significant consequences of climate change. Recently, we have experienced an unprecedented cycle of heatwaves, droughts, bushfires, storms and floods. Through all of this, we have seen the people of NSW stand together through these challenges with resilience.

It is critical that we take action now to limit further climate change and adapt to the changing climate. To adapt effectively we need to be bold, decisive and focused on the future. By working together, we will also put NSW in a strong position to seize new economic opportunities that will emerge as the world decarbonises and investors seek out climate resilient jurisdictions. We have the opportunity to proactively innovate and create value by capturing new markets that will grow our economy.

This strategy will continue to build on and strengthen our state's legacy of taking decisive and responsible action on climate change. Through long term planning and preparation, this strategy will help protect lives, homes, livelihoods and ecosystems from the impacts of a changing climate.

The generations that came before us rose to the challenges of their times to allow each of us today to benefit from a strong economy with a pristine natural environment to explore. I want to do the same for our children, allowing them to earn a return on our investments and enjoy the beauty of our country. This strategy seeks to create a legacy of prosperity for them, one that they're proud we had the foresight to build.

The Hon. Matt Kean MP
Treasurer
Minister for Energy

Contents

Treasurer's message	2
Introduction	4
Key concepts	5
Context	6
What climate change means for NSW	6
National and international context	12
NSW Government progress to date	13
Adapting now creates economic, social and environmental benefits	18
Objectives and principles	19
Objectives	19
Principles	20
Priorities	21
Priority 1: Develop robust and trusted metrics and information on climate change risk	22
Priority 2: Complete climate change risk and opportunity assessments	25
Priority 3: Develop and deliver adaptation action plans	28
Priority 4: Embed climate change adaptation in NSW Government decision-making	30
Governance	32
Monitoring	32
Reporting	32
Evaluation	32
Strategy actions	33
References	34
More information	35

Acknowledgement of Country

The NSW Government acknowledges the Traditional Custodians of the land and shows respect for Elders past, present and emerging.

Introduction

The NSW Government is committed to decisive and responsible action on climate change.

Priority 1



Develop robust and trusted metrics and information on climate change risk

Priority 2



Complete climate change risk and opportunity assessments

Priority 3



Develop and deliver adaptation action plans

Priority 4



Embed climate change adaptation in NSW Government decision-making

NSW was one of the first Australian jurisdictions to commit to net zero emissions by 2050 and the state is now on track to halve emissions by 2030. The Government has gone beyond just setting targets. We are now delivering a prosperous low carbon economy for NSW and a bright future.

But decisive action on climate change is about more than just reducing emissions. It's also about adapting and building resilience. The NSW climate has already changed, and a level of further change is locked in, driven by past emissions and any future emissions before the world achieves net zero.

The people of NSW have already experienced the first impacts of climate change, through changes to our everyday weather and the weather extremes that drive disasters, such as the recent unprecedented cycle of heatwaves, droughts, bushfires, storms and floods.

Adapting now to this new climate will help protect the things we value most – it will save lives, homes, livelihoods, and our environment. It's also critical for the ongoing prosperity of NSW. Failure to act quickly and effectively will create major costs and impacts for every person and across our economy, society and environment. Climate change will disproportionately impact those who are already disadvantaged or vulnerable, such as the socio-economically disadvantaged. It will also disproportionately impact Aboriginal people, including their connection to Country and cultural heritage. Adaptation is even more critical for these groups. Enabling them to build resilience will help build whole-of-society resilience. NSW will seize the economic and employment opportunities that proactive adaptation offers. This includes delivering more jobs, more investment and prosperity for people in both the cities and the bush, as well as improving the wellbeing of our communities.

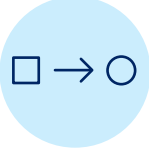






This strategy sets out how the NSW Government will prepare for climate change and will help position NSW as a leader on climate change adaptation. The Government has committed \$93.7 million over the next 8 years to deliver the foundational and critical information and services under this strategy that are needed to help all NSW stakeholders adapt.

The strategy has 4 priorities:

1. Develop robust and trusted metrics and information on climate change risk
2. Complete climate change risk and opportunity assessments
3. Develop and deliver adaptation action plans
4. Embed climate change adaptation in NSW Government decision-making.

NSW Government action will put the state in a strong position to deliver new jobs and maximise social and environmental wellbeing. This strategy and the resources behind it will support making the right decisions now to set up the state for a strong future. The Government's commitments will give NSW families, communities and businesses confidence that the challenges posed by climate change can be solved by improving – not eroding – their prosperity.

Key concepts

	Concept	Definition
	Climate change adaptation	Adjustment to the actual or expected effects of climate change. Adaptation plays a key role in reducing exposure and vulnerability to climate change, and can be proactive, reactive, incremental or transformational (IPCC 2022a).
	Climate change hazard	A potential natural or human-induced physical event, trend or disturbance with negative consequences (IPCC 2018).
	Climate change impact	The consequences of climate change. Impacts are when potential changes, risks or opportunities become reality (IPCC 2018).
	Climate change mitigation	Actions that reduce the rate of climate change. This includes actions that limit or prevent greenhouse gas emissions and activities that remove these gases from the atmosphere (IPCC 2022b).
	Climate change projections	The simulated response of the climate system to a scenario of future greenhouse gas emissions or concentration of greenhouse gases and aerosols. Generally, climate change projections are created using climate models (IPCC 2018).
	Climate change resilience	The capacity of systems (including social, economic, engineered, natural and ecosystems) to cope with a hazardous event, trend or disturbance. Coping means responding in ways that maintain the essential function, identity and structure of a system (as well as biodiversity in the case of ecosystems) (IPCC 2022a).
	Climate change risk	When a hazard creates the potential for negative consequences due to the exposure and vulnerability of human or ecological systems. These consequences can include impacts on lives, livelihoods, health and wellbeing, economic, sociocultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species (IPCC 2021b).

What climate change means for NSW

Climate change has already altered day-to-day weather patterns and increased extreme weather events. Without action to adapt, climate change is expected to affect most parts of the NSW economy, society and environment.



NSW has already warmed by

1.4–1.6°C

which is 1.4 times faster than the global average

The NSW climate has already changed

The last decade was the hottest on record globally, with the title of ‘hottest year’ beaten 8 times. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report confirms global surface temperature has risen by 0.8–1.1°C since the pre-industrial period (1850–1900).

The NSW climate has also changed, with the state warming faster than the global average. Since the pre-industrial period, NSW has already warmed by 1.4–1.6°C (CSIRO 2021) which is 1.4 times faster than the global average.

This means that NSW is already experiencing the impacts of climate change. While these temperature changes might sound small, they have major impacts (EPA 2021). Small changes to average climate conditions and sea levels can create significant changes in day-to-day weather patterns and extreme events. This has contributed to a surge in disasters triggered by extreme weather events, such as floods and bushfires, over the last 2 decades (UNODRR 2020). It has also increased droughts, desertification and coastal erosion and inundation and much more. Examples of the impacts of climate change in NSW are listed in the table below.

Examples of climate change impacts in NSW



Floods

Floods cost people their lives, homes and livelihoods and can have long-lasting impacts on communities. Floods are the most expensive type of disaster triggered by a natural hazard in Australia (Queensland Chief Scientist 2011). The 2022 flood events in NSW and Queensland are expected to be some of the most significant disasters economically in the recorded history of Australia (Climate Council 2022). The Insurance Council of Australia has recorded over \$3.3 billion worth of claims to date (Insurance Council of Australia 2022).

The first 2022 flood in Lismore was the largest flood event in that city since records began in 1887. Four people lost their lives, and more than 2,000 premises became uninhabitable. To date, the NSW and Australian Governments have already committed more than \$2.5 billion to help communities impacted by the 2022 floods. As a result of climate change, the atmosphere is warmer and can hold more water, which can increase the intensity of flood events like those experienced in 2022.

Examples of climate change impacts in NSW



Bushfires

In the 2019–20 Black Summer Bushfires 26 lives were lost in the fire front, 2,476 homes were destroyed, \$899 million worth of infrastructure was lost and 5.5 million hectares of land were burnt (NSW Premier & Cabinet 2020). There were 219 deaths from smoke (Borchers Arriagada et al. 2020) and bushfire smoke cost Sydney's economy \$12–50 million per day (Irvine 2019). Billions of animals were killed, injured, or displaced, with more than one billion of them in NSW (AIDR 2020) and it has been called the worst wildlife disaster in modern history (WWF Australia 2020). Further economic impacts were faced by the tourism sector with an estimated revenue loss of \$4.5 billion (Carruthers 2020). The NSW Government has committed over \$3 billion to the bushfire response, recovery and preparedness efforts in NSW.

As the climate continues to change, events like the Black Summer Bushfires are expected to increase in frequency.



Heatwaves

Major heatwaves have caused more deaths in Australia since 1890 than bushfires, cyclones, earthquakes, floods and severe storms combined (Coates 2014). Climate change is driving longer, hotter and more intense heatwaves in NSW. Over the last 3 decades more than a third of heat-related deaths were caused by climate change. In Sydney alone, an extra 1,484 heat-related deaths occurred due to climate change between 1991 and 2018 (Vicedo-Cabrera 2021).

As the climate changes, heatwaves are expected to increase in frequency, intensity and duration.



Drought

Southern NSW has already experienced a 15% long-term decline in rainfall between April and October from 2000–2019 when compared with 1900–99 levels (EPA 2021).

At the beginning of 2020, 100% of NSW was in drought. Since 2017, many regions in NSW have faced the lowest rainfall and driest conditions in 120 years of records. In fact, 2019 was the driest and warmest year on record for NSW and rainfall was 55% below average (Bureau of Meteorology 'Climate Model Summary'). This was less than 10 years after the Millennium Drought eased, which at the time was declared one of the worst droughts since records began. The resulting lower rural production and higher input costs saw average NSW farm profits decline by 224% to a loss of \$142,440 between 2016–17 and 2019–20 (ABARES 'Farm performance'). This decline had flow-on effects to regional and rural communities as farmers scaled back spending, reducing the income of businesses that supply goods and services to the farm sector and the surrounding economy (RBA 2020).

The drought's economic, social and environmental impacts spread well beyond the farm gate, with communities experiencing significant financial and mental health hardships. The drought is estimated to have cost the NSW economy \$5.7 billion of Gross State Product in 2018–19, with further estimated losses of \$6.3 billion in 2019–20.

Climate change is expected to increase the frequency, duration and intensity of droughts.

Further climate change is locked in

The NSW Government is committed to strong action to mitigate climate change and to help deliver a low emissions scenario for the world. The state is a leader on climate change action with major initiatives like the Net Zero Plan Stage 1: 2020–2030, the Electric Vehicle Strategy and the Electricity Infrastructure Roadmap. These initiatives and major action by the private sector and community will enable NSW to reduce emissions by 50% by 2030 compared to 2005 levels, and help achieve net zero emissions by 2050, while growing the economy.



The NSW Government aims to reduce NSW emissions by

50% by 2030

and achieve net zero emissions by 2050

The commitments made by the NSW Government and international commitments to reach net zero are increasing the likelihood of a best-case global warming scenario. However, even if all global emissions stopped today, climate change would continue for decades, driven by past emissions.

According to the IPCC Sixth Assessment Report, even under the lowest greenhouse gas emissions scenario, global surface temperature is expected to rise by up to 1.7°C within the next 20 years and could reach 2°C within 40 years compared to pre-industrial levels (1850–1900). Under higher emissions scenarios, warming could reach as high as 1.9°C within 20 years (IPCC 2021a). Because NSW is warming 1.4 times faster than the global average, and has already experienced warming of 1.4–1.6°C, the state is likely to experience warming greater than 1.7°C in the next 20 years (CSIRO 2021).

Average surface temperature change, Eastern Australia

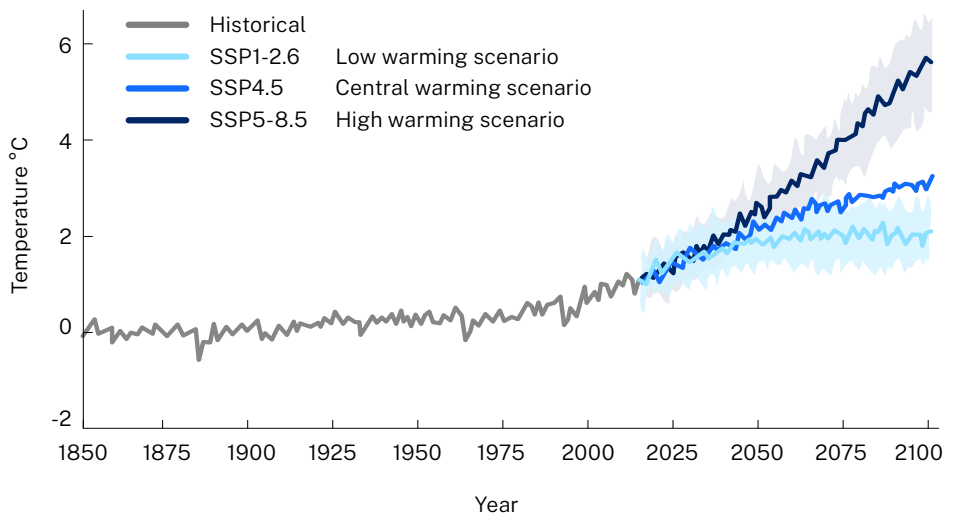


Figure 1 Graph of historical and future projected mean surface air temperature across Eastern Australia from 1850–2100

Data is from Coupled Model Intercomparison Project Phase 6 models within the IPCC Working Group 1 Interactive Climate Atlas using the land only component of the EAU Region. Shaded areas represent the interquartile range of the models and the solid lines the mean of the models (Iturbide et al. 2021; Gutiérrez et al. 2021).

Shared Socioeconomic Pathways (SSPs) are a range of scenarios for climate change that consider different levels of greenhouse gas emissions, population, economics, social factors, and other key concepts. They include high emissions pathways with limited climate change mitigation and low emissions pathways where mitigation is largely successful. Three main SSPs are discussed in this strategy, SSP1-2.6, described as a low warming scenario, SSP4-4.5 described as a central warming scenario, and SSP5-8.5 described as a high warming scenario (IPCC, 2021a).



What further climate change means for NSW

Climate change impacts in NSW will escalate into the future due to past and future emissions. For NSW, this means the state will become hotter and drier over some regions with more extreme weather events.

Under a high emissions scenario (most closely aligned with IPCC scenario SSP5-8.5), some of the climate changes NSW is likely to experience by 2060–79 include:



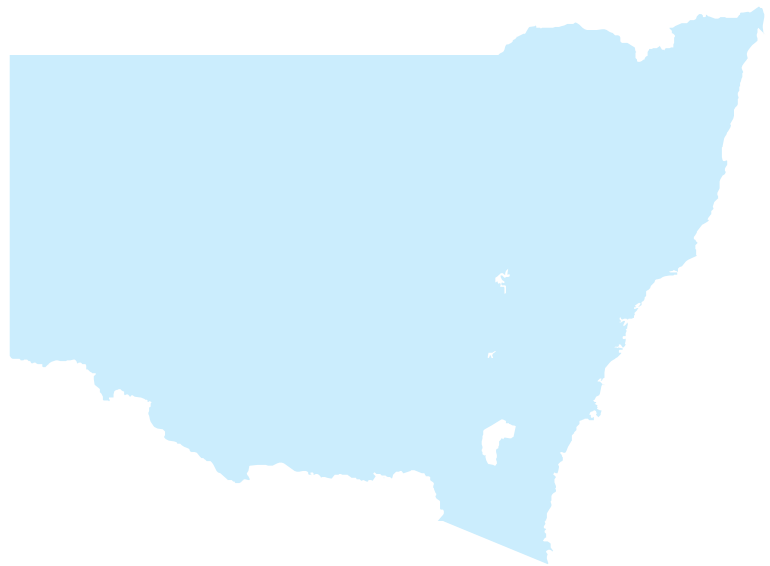
Increased rainfall in summer and autumn



Decreased rainfall in spring and winter



Earlier and longer bushfire seasons with an increased number of high fire danger days



Decline in alpine snowfall



Estimated sea level rise of 21–35 cm



More heatwaves, with an increase in the number of hot days over 35°C by an average of 26 days per year



Climate change risks for NSW

Without major action to adapt, conservative estimates from NSW Treasury modelling for the 2021–22 NSW Intergenerational Report found that even under a lower warming scenario of 2°C where efforts to cut emissions largely succeed, NSW is likely to experience significant climate change risks in the future.

Examples of climate change risks for NSW

Disasters

\$15.8–17.2 billion in total economic costs from disasters triggered by extreme weather events on average every year by 2060–61.



Sea level rise

An estimated 39,000–46,000 NSW properties will be exposed to coastal erosion and inundation by 2060–61 due to sea level rise.



Heatwaves

700,000 – 2.7 million working days will be lost due to heatwaves by 2060–61.



Agricultural production

\$750 million – \$1.5 billion in lost agricultural production every year by 2060–61.



Source: 2021–22 NSW Intergenerational Report

Breakdown of climate change risks from the 2021-22 NSW Intergenerational Report

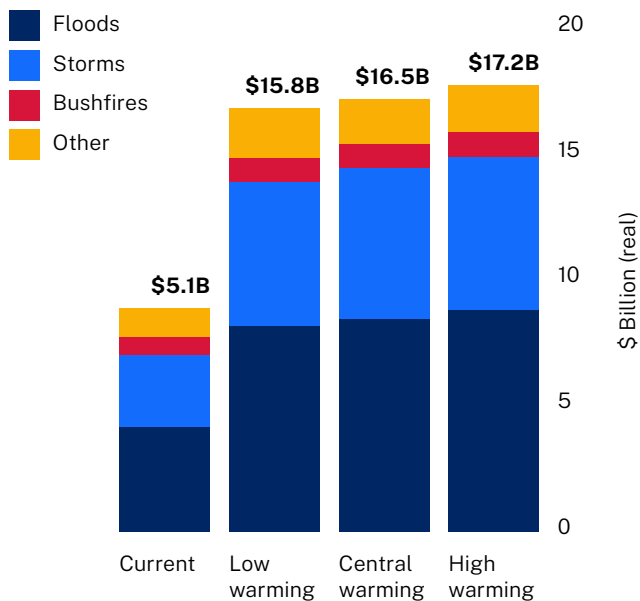


Figure 2 Total economic costs from disasters triggered by extreme weather events on average every year by 2060-61

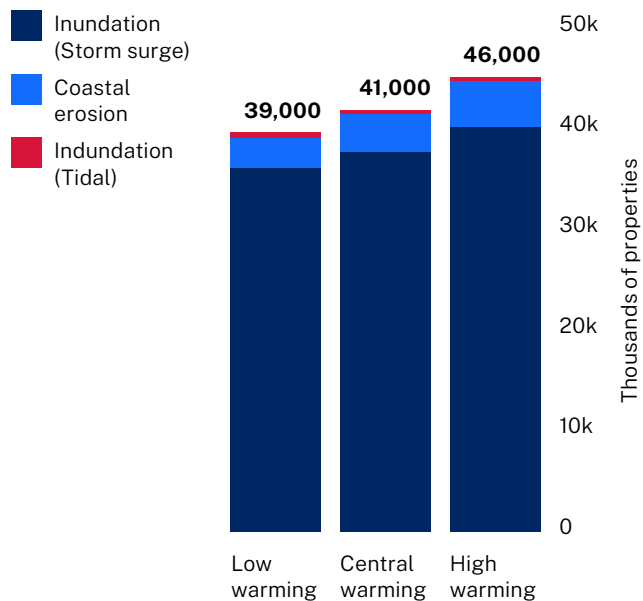


Figure 3 Properties exposed to coastal erosion and inundation by 2060-61 due to sea level rise

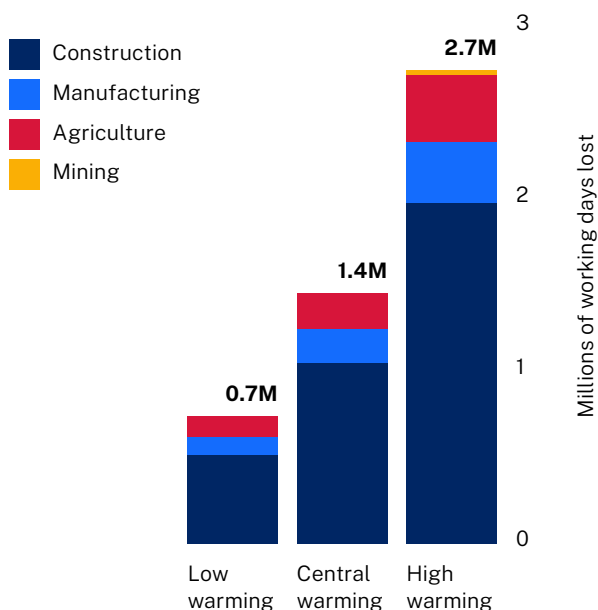


Figure 4 Working days lost per year due to heatwaves by 2060-61

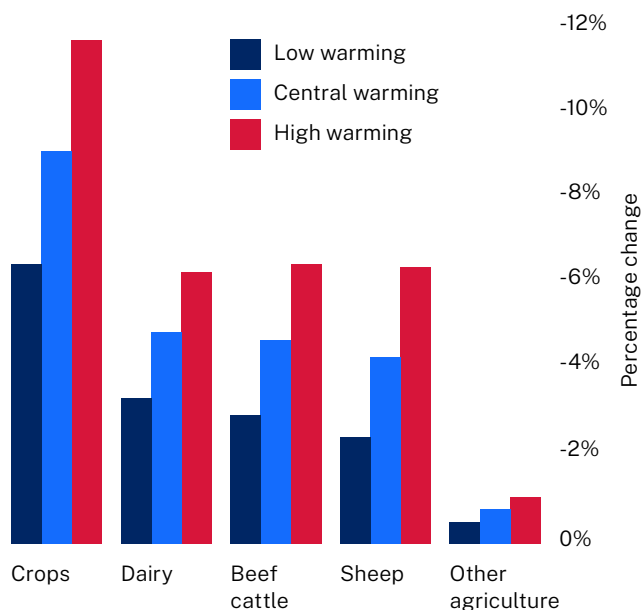


Figure 5 Projected changes in agricultural output due to climate change by 2060-61

National and international context



The Paris Agreement sets a global goal for climate change adaptation

Paris Agreement

In 2015 the Paris Agreement was signed by 196 parties, including Australia. The Agreement is a legally binding international treaty on climate change, with the goal to limit global warming to well below 2°C compared to pre-industrial levels, while pursuing efforts to limit the increase even further to 1.5°C.

The Agreement also sets a global goal for adaptation. Parties to the Agreement are called upon to reduce vulnerability to climate change, enhance their adaptive capacity and strengthen resilience, all while contributing to sustainable development and ensuring an adequate adaptive response in the context of the temperature goals of the Agreement.

The Agreement further encourages governments to develop strong adaptation policy, strategy and plans, monitoring and evaluation, and climate change risk assessments to enable effective action. The Agreement requires that adaptation be given the same level of priority as mitigation.

The countries involved in the United Nations Framework Convention on Climate Change meet each year to review and monitor the implementation of the Convention and its legal instruments, including the Paris Agreement. These meetings are called the Conference of the Parties or COP. The 2021 Glasgow Climate Pact (COP26) stressed that urgent and ambitious action on adaptation this decade is critical to reach the Paris Agreement adaptation goal.

National Climate Resilience and Adaptation Strategy

The Australian Government recently released a new National Climate Resilience and Adaptation Strategy 2021–2025. Under the national strategy, states and territories are responsible for major adaptation initiatives. This includes initiatives on land-use planning, public infrastructure, service delivery for emergencies, health, education, environmental protection and transport, in addition to developing science and information on climate change at local and regional scales. The NSW Government is engaging with the Australian Government on the implementation of the national strategy.

NSW Government progress to date

NSW Climate Change Policy Framework

The NSW Climate Change Policy Framework 2016 outlines the NSW Government's long-term objectives to achieve net zero emissions by 2050 and to ensure NSW will be more resilient to a changing climate. The Government endorsed the Paris Agreement under the framework and stated it would take action consistent with the level of effort required to achieve Australia's commitments under that Agreement. The framework states that part of the NSW Government's role is to implement policies, such as this strategy, to plan for and address climate change risks.

This strategy sets out how the Government plans to achieve the resilience objective under the framework and strengthen the commitment to policy implementation, operational change and advocacy for adaptation action.

NSW has a strong track record on adaptation

The NSW Government has a strong track record on climate change adaptation. This strategy builds on and strengthens the foundation of work already in place.



Examples of NSW Government action on adaptation



Local climate change projections

The NSW Government provides high quality climate data and information for public use through the NSW and Australian Regional Climate Modelling (NARClIM) project. NARClIM is a NSW Government led partnership that provides climate change projections at the local level. The partnership began in 2011 and includes the NSW, ACT, South Australian and Western Australian governments with input from the University of NSW and Murdoch University.

The first NARClIM projections were delivered in 2014 and provided robust regional climate projections for use by NSW stakeholders to plan for a range of future changes in climate.

The latest generation, NARClIM 1.5 was launched in 2021 with future versions planned for release to ensure models can provide the up-to-date information needed for adaptation planning. Projections can be accessed via the NSW Climate Data Portal.



Blueprint for a Resilient South East NSW

The NSW Government is partnering with the Canberra Region Joint Organisation and local councils to deliver the Blueprint for a Resilient South East NSW project. The project is delivering a regional resilience risk assessment and will enable councils and communities in the region to better prepare for climate change.

The project will empower councils to act, help embed climate change in decision-making, provide training to build capability, implement priority projects and build the case for investment in resilience. The project is co-funded by the NSW and Australian governments.



Gondwana World Heritage Climate Change Adaptation Project

The Gondwana Rainforest is a World Heritage listed area in northern NSW with exceptional biological diversity and examples of the record of life on earth and ongoing evolutionary processes. Climate change has been identified as the highest level of threat to the site's species and ecological communities.

The project's objective is to showcase integration of climate change adaptation into on-ground management to support conservation. Actions are based on the best available research and aim to protect refugia and genetically rescue and support the transition of habitats to maximise the protection of biodiversity. The processes from this project can be applied to every World Heritage property in Australia, resulting in world-leading action to protect World Heritage values from climate change.

Examples of NSW Government action on adaptation



Cross-Dependency Initiative

The Cross-Dependency Initiative (XDI) NSW project is an international award-winning project that increases the resilience of critical infrastructure. It is run by the NSW Government in partnership with private enterprise. XDI delivers innovative risk management tools and technology that identifies and quantifies direct risks and the transfer of risks between critical infrastructure.

The project works with public asset owners and operators including utilities, government agencies and local councils. It helps identify risks and helps organisations work together to address shared and cascading risks that drive systems failure during extreme weather events, such as power failures, and share the costs of adaptation.



Bushfire risk management

Through its bushfire management programs the National Parks and Wildlife Service helps protect communities and assets by implementing hazard reduction and responding rapidly to bushfires. There were 2,111 hazard reduction activities completed in 2020–21, including 143 hazard reduction burns and 1,968 mechanical activities.



Worimi Conservation Lands

The cultural values of Worimi Conservation Lands are being damaged and lost due to climate change impacts. In particular, middens, artefacts and burial sites in the dunes have been exposed and damaged by east coast lows, exacerbating the impacts of sand movement due to nearby sand mining.

The Worimi Conservation Lands Board of Management recognises that the risk of further erosion and damage is high. The Board is being supported by the NSW Government to make proactive and informed decisions about how to respond to climate change impacts, both now and into the future.

To date, the work has involved collecting data on the movement of dunes, works to stabilise the dunes, and the development of a climate change adaptation plan. This plan outlines the cultural values of significance to the Worimi people, as well as the climate change risks and the priority actions that will protect both tangible and intangible cultural values.

Examples of NSW Government action on adaptation



Water strategies

The NSW Government has taken action to improve water sharing, management and use across the state. NSW's water resources are under increasing pressure from climate change, a growing population and changing industry and community needs. The NSW Water Strategy takes a strategic and integrated approach to improve the security, reliability, quality and resilience of NSW's water resources over the long term.

The NSW Water Strategy centres water in land use, infrastructure and investment decisions, ensuring forward-thinking and integrated planning for both drought and flood management. At the state-wide level, this strategy proposes more than 40 actions across 7 priority areas, focused on improving the security, reliability, quality and resilience of the state's water resources. It continues to rebuild community confidence in water management in NSW.

It includes commitments to work with Aboriginal communities to increase their access to water and new actions at the landscape and catchment scale to improve river and ecosystem health. Under the NSW Water Strategy 12 regional and 2 metropolitan water strategies are being developed, tailored to the individual needs of each region in NSW. The Government is already making significant investments in regional water infrastructure, and these strategies will provide the blueprints for future investments.



AdaptNSW

Since 2014 the NSW Government has provided NSW communities, businesses, households and government with information and advice on how to adapt to climate change. The AdaptNSW website is a trusted source of information that provides relevant, localised information and empowers people to act.



Climate Risk Ready NSW

The Climate Risk Ready NSW program builds the capability of state and local governments to assess and manage climate change risks to protect government assets, infrastructure and services. The program delivers the Climate Risk Ready NSW Guide and nationally accredited training.

Examples of NSW Government action on adaptation



Flood risk management

Hunter Valley Flood Mitigation Scheme

As one of the largest coastal catchments in NSW, the Hunter Valley has always experienced flooding and this flooding will continue as the climate changes. The Hunter Valley Flood Mitigation Scheme aims to reduce the impact of flooding on communities and ecosystems.

The scheme is valued at \$862 million and involves over 830 individual assets such as levees, floodgates and drains throughout the Hunter Valley's rivers and floodplains. It reduces potential damage to properties by controlling the velocity, direction and depth of floodwaters. Flood mitigation plays a critical role in helping the Hunter Valley communities and ecosystems adapt to climate change.

Hawkesbury-Nepean Flood Risk Management Strategy

The Hawkesbury-Nepean Valley covers around 500 km² and has the highest flood exposure in NSW because of its unique landscape and large existing population.

The Hawkesbury-Nepean Flood Risk Management Strategy is being delivered together with local councils, business and the community to reduce the potential social and economic impacts of flooding, which unfortunately occurred in both 2021 and 2022.

Floodplain Management Program

With floods and storms predicted to become more extreme as the climate changes, the Floodplain Management Program is undertaking important activities to manage flood risk and build community resilience across NSW. The program works to reduce the impacts of flooding and flood liability on communities and reduce private and public losses.

Floodplain Management grants provide technical and financial support to councils and eligible public land managers to make informed decisions about managing flood risk by preparing and implementing management plans. In 2020–21, \$5.4 million in funding was provided to 26 local government projects to deliver integrated floodplain management under the Climate Change Fund.

NSW Coastal and Flood Data Network

Changes in the NSW coastal environment are monitored and assessed by the Manly Hydraulics Laboratory's extensive data collection network. The laboratory maintains and operates a network of 178 flood and 46 estuary automatic water level recorders, 20 ocean tide sites, 75 rainfall recording stations and 7 offshore Waverider buoys.

The data allows changes in the coastal environment to be monitored and assessed and provides an improved understanding and awareness of current and future risks of flooding and coastal hazards. The data is also used by emergency agencies to generate warnings during extreme weather events.

Adapting now creates economic, social and environmental benefits

With early and effective adaptation, the costs and impacts of climate change can be significantly reduced or avoided. Adaptation helps protect the things we value most – it saves lives, homes, livelihoods and ecosystems. It can also bring opportunities and benefits. Adaptation can grow our economy, provide new jobs, improve wellbeing and create new industries.



Every dollar spent on adaptation can create up to ten times the benefits

Global Commission on Adaptation

Benefits of adaptation



Climate-resilient infrastructure

Making infrastructure more climate-resilient adds around 3% to the upfront costs but has benefit–cost ratios of about 4:1. The World Bank found that investing \$1 trillion in making infrastructure more resilient could generate \$4.2 trillion in benefits.



Avoided losses

Investing \$1 in resilience has been shown in some instances to reap savings of \$4–11 in recovery (CSIRO 2020). NSW can expect \$15.8–17.2 billion in total economic costs every year on average by 2060–61 from disasters triggered by extreme weather events. If a conservative amount of 1% of these costs were avoided, this would account for annual avoided costs of between \$158 and \$172 million by 2060–61.



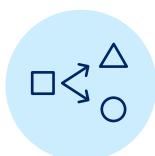
Increased productivity and incomes

Investing \$250–500 per hectare in better dryland farming practices to adapt to climate change can increase cereal yields by 70–140%, bringing net economic benefits of billions of dollars (Global Commission on Adaptation 2019).



Reduced disaster losses

Early warning systems can save lives and assets worth at least 10 times their cost. For example, just 24 hours warning of a coming storm or heatwave can cut ensuing damage by 30% (Global Commission on Adaptation 2019).



Co-benefits with climate change mitigation

Adaptation can also reduce or offset greenhouse gas emissions. Planting trees removes carbon dioxide from the atmosphere. It also builds resilience. For example, trees can protect agricultural land from extreme weather and changed climate conditions, improve air and soil quality, reduce urban heat and the impacts of heatwaves, restore natural systems, improve water infiltration and retention in the landscape, provide climate refugia for ecosystems, and much more.

Objectives and principles

Objectives

The purpose of this strategy is to make NSW more resilient and adapted to the impacts of climate change.

Ambitious and transformative adaptation is critical in the next decade to build resilience, minimise harm from climate change, and maximise opportunity. To enable ambitious action, the strategy has set four key objectives:



Well adapted built environment and infrastructure

Develop and maintain the built environment and infrastructure to prevent, withstand and recover from climate change impacts, while continuing to perform its function and serve the community. This includes developing more resilient infrastructure after disasters.



Well adapted natural environment, biodiversity, ecosystems and natural resources

Actively manage natural systems to be functional and resilient in the face of climate change by enabling adaptation that protects the environment, sustainably manages different uses and maintains ecosystems and biodiversity so they can be enjoyed.



Well adapted economy, businesses, industries and livelihoods

Manage the risks and take advantage of opportunities for our economy, businesses, industries and workers, including the creation of new jobs and industries generated by a climate-resilient future. This includes job opportunities from investment in clean technologies and infrastructure projects.



Well adapted society, government, communities, families and individuals

Society, government, communities, families and individuals have the capacity and resources to adapt to and avoid the worst impacts of climate change and to maintain wellbeing and prosperity.

Principles

NSW Government decisions on climate change adaptation will be guided by the following principles:

Principle 1 - Early and proactive action

Adaptation action should be proactive, far future focused and taken as early as possible to minimise costs and adverse impacts whilst maximising opportunities.

Early action should help position NSW as a leader and first mover, providing an economic advantage and making NSW a preferred place to do business.

Where there are threats of serious or irreversible harm, lack of full certainty will not be used as a reason to postpone action to adapt to climate change in NSW.

Principle 2 - Informed decision-making

Decisions on adaptation in NSW should be planned and based on comprehensive analysis of the best available information. This information includes scientific, local and traditional Aboriginal knowledge systems, and should consider the risks, potential impacts and opportunities of climate change under a range of credible climate change scenarios.

Principle 3 - Integrated decision-making

Decisions on adaptation should integrate competing long, medium and short-term economic, social and environmental considerations on climate change to help ensure all relevant issues are considered.



Priorities

Building climate change resilience will take dedicated focus and significant resources from the NSW Government and all NSW stakeholders over many decades.

This strategy sets out how the Government will lead and strengthen adaptation action for the state as a whole, now and over the long term.

The NSW Government will deliver a wide range of actions that provide the foundational and critical information and services needed to help all NSW stakeholders adapt. The Government has committed \$93.7 million over the next eight years to expand and strengthen the following priority action areas:



Priority 1

Develop robust and trusted metrics and information on climate change risk



Priority 2

Complete climate change risk and opportunity assessments



Priority 3

Develop and deliver adaptation action plans



Priority 4

Embed climate change adaptation in NSW Government decision-making

The Office of Energy and Climate Change in NSW Treasury will be responsible for leading the delivery and review of this strategy on behalf of the NSW Government as a whole. This will include responsibility for overseeing adaptation action including governance, coordination and foundational actions across the Government to better enable all NSW stakeholders to adapt.



Priority 1

Develop robust and trusted metrics and information on climate change risk

The NSW Government will develop a sound evidence base that will provide the right information for strategic adaptation planning and decision-making.

Good decisions are based on the right information. This information will help the Government make prudent investment decisions to ensure resources are spent wisely. It will provide the foundation needed to deliver this strategy and be made publicly available to inform all NSW stakeholders.

Metrics

Unlike mitigation, there is no universal quantitative unit of measurement for adaptation, meaning we cannot set the equivalent of a net zero emissions target by 2050 for resilience. The challenge with resilience and adaptation is that it affects most aspects of life and measuring this is complex and at times qualitative. Notwithstanding these challenges, setting metrics for adaptation is important because it identifies and describes the things we value most and what adaptation and resilience means in a specific context, and breaks this down into concepts we can measure and respond to.

For example, to measure the resilience to climate change of the health and wellbeing of the people of NSW, we could set metrics such as fewer people hospitalised because of heat stress or fewer days of poor air quality due to bushfires. The ongoing economic prosperity of the state is also critically important. To measure this, we could count the number of jobs protected or new jobs created by adaptation. For the built environment we could set metrics like fewer properties and critical infrastructure at significant risk from heatwaves, floods, bushfires, storms and coastal erosion and inundation, or reduced economic losses due to transport disruption from extreme weather events.

Many metrics already set across the NSW Government can also provide key data or be used to measure resilience. For example, NSW Health already measures key health and wellbeing indicators, the Department of Planning and Environment has metrics for water, the built environment and the health of ecosystems, and Transport for NSW already has metrics for disruption to its networks. The NSW Government will establish a framework of metrics that are specific, measurable and timebound to measure progress toward climate change resilience and adaptation for all of NSW. This framework will include a baseline to measure progress against.

All NSW Government agencies will be required to report regularly against these metrics (e.g., annually, or every two or three years as appropriate for the metric) by no later than the end of 2025 to provide whole of government information about the resilience and adaptation of the state.



The NSW Government will:

1. Establish a set of specific, measurable and timebound metrics to measure progress toward climate change resilience and adaptation for all of NSW by the end of 2023.
2. Require all NSW Government agencies to report regularly against the metrics (for example annually, or every 2 or 3 years as appropriate for the metric) by no later than the end of 2025.

Climate change projections

Climate change projections provide essential information to inform adaptation planning. Local level projections model what a specific area's future climate is likely to be, such as how rainfall and temperature are likely to change, giving people the high-quality information they need to plan for the future.

The NSW Government will continue to provide publicly accessible local level climate change projections through NARcliM. The Government will regularly update and improve the quality and resolution of these projections over time. This information will provide a valuable decision-making tool for all stakeholders and provide the core data the Government needs for adaptation planning under this strategy.



The NSW Government will:

3. Publish regularly updated and improved local level climate change projections.

Scenario analysis

A scenario describes a path of development leading to a particular outcome. Scenarios are not a full description of the future. They highlight important elements of a possible future and draw attention to the key factors that will drive change. Scenarios are intended to explore alternatives that may significantly alter the basis of business-as-usual assumptions.

Climate change scenario analysis enables understanding and quantification of risks and uncertainties under different hypothetical futures. It helps in decision-making and can be a key input into development. The NSW Government will engage in climate change scenario analysis for the state to help inform decision-making.



The NSW Government will:

4. Undertake the first climate change scenario analysis for NSW by the end of 2024 and update it periodically to align with the latest evidence.

Research

Climate change brings many uncertainties. The NSW Government will invest in research to better understand the change it's likely to bring. This information will be critical to inform adaptation planning and the delivery of this strategy. The Government will deliver an ongoing research program based on priority climate change risks, opportunities and adaptation options to inform government decisions. The program will include research and modelling to translate climate change scenarios into real-world socio-economic impacts and address priority knowledge gaps across sectors. For example, impacts to health and vulnerable communities.



The NSW Government will:

5. Engage in ongoing research on priority climate change risks, opportunities and adaptation options.
6. Engage in ongoing research and modelling to translate climate change projections into real-world socio-economic impacts and address priority knowledge gaps.

Make useful information accessible

Climate change adaptation information can be complex, therefore making it easily understandable and publicly available is essential. The NSW Government will provide all NSW stakeholders with the best available information to manage their own risks and opportunities where they can. The Government will continue to publish climate change projections and research, and translate climate science into accessible information and resources.

The NSW Government will also continue to be a trusted source of advice and expertise on climate change adaptation by developing practical decision tools, information and advice on the best way to adapt and prepare for climate change.

This information will be made publicly available on the AdaptNSW website and through other channels.



The NSW Government will:

7. Translate climate science into accessible information and resources for people with exposure to climate change risks and all NSW stakeholders.
8. Continue to develop practical information, advice and decision tools on the best way to adapt and prepare for climate change.





Priority 2

Complete climate change risk and opportunity assessments

Climate change risk and opportunity assessments give us the information we need today to make good decisions for tomorrow.

Climate change brings new risks and opportunities across all aspects of the economy, society, environment and ecosystems. As a result of climate change, many aspects of life today will not be the same tomorrow and historical data may no longer help us make good decisions for the future.

To position the state to manage these risks and capture the opportunities associated with climate change, the NSW Government will publish regular climate change risk and opportunity assessments.

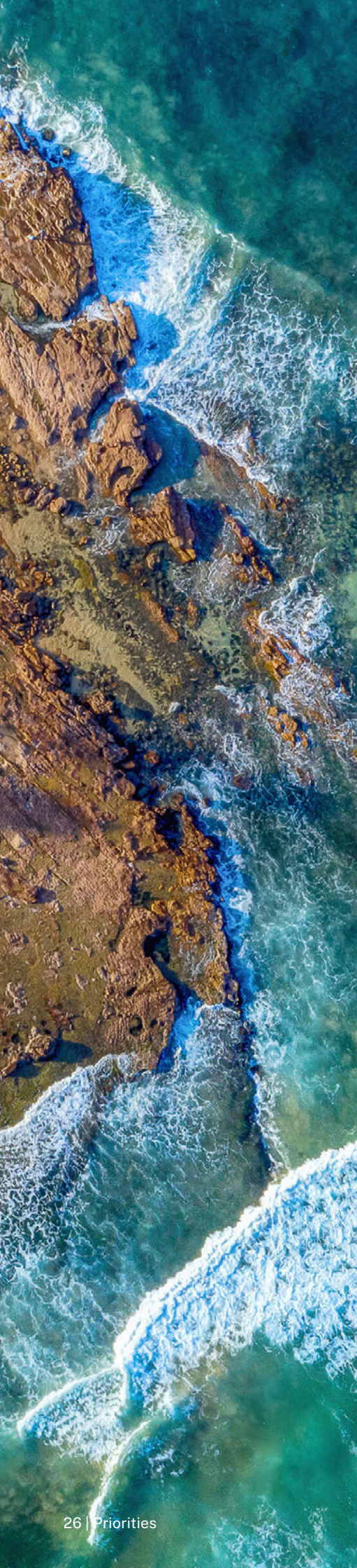
Climate change risk and opportunity assessments give us the information we need today to make good decisions for tomorrow. Assessments use climate change projections to understand what our future climate is likely to be (for example, how rainfall and temperature are likely to change), and then analyse the risks and opportunities these changes create for our economy, society, environment and ecosystems. Assessments identify the highest priority risks and opportunities, so action and resources can be focused to maximise benefits for the community.

The first assessment will be published in 2023. New assessments will be published at least every 5 years after that. As climate change risks escalate, assessments may need to be released more regularly.

NSW Government climate change risk and opportunity assessments will be done in line with the minimum criteria listed below. Assessment methods are evolving rapidly, and new criteria may be added in future in line with leading practice.

The NSW assessments will provide the evidence base for adaptation action plans as part of Priority 3 below.





Risk and opportunity assessment criteria

- 1. User focus** Provide the practical information needed to inform adaptation action plans and communicate the information appropriately to stakeholders.
- 2. Use the best available evidence** Draw on the latest and best available evidence (including scientific research and local and traditional Aboriginal knowledge) about the implications of climate change for NSW.
- 3. Cover the whole of NSW** Analyse risks and opportunities to the NSW economy, society, environment and ecosystems from the current and future effects of climate change. Provide place-based information where possible.
- 4. Leading approach** Use leading practice approaches, including quantitative and qualitative data, local climate change projections, input from key stakeholders, place-based, regional and systems thinking.
- 5. Align with leading practice and standards** Align with International Organization for Standardization guidelines, IPCC work on risk assessments, Taskforce on Climate-related Financial Disclosures and other leading practice standards and guidance on assessments and disclosures.
- 6. Two or more scenarios** Consider risks and opportunities under at least 2 greenhouse gas emissions scenarios that cover from the present until at least 2100. Include a scenario of 2°C of warming or lower and a second scenario using the current most likely global emissions trajectory.
- 7. Analyse risk distribution** Climate change is likely to disproportionately affect those already most vulnerable or sensitive to specific risks. Assessments will analyse the sensitivities and distribution of risks and opportunities across society and ecosystems, with particular emphasis on disadvantaged, vulnerable or sensitive groups and ecosystems.
- 8. Aboriginal priorities** Collaborate with Aboriginal communities to understand their priority risks and opportunities. Through collaboration the assessment will seek to embed the voice and knowledge of Aboriginal people into the assessment process. The assessment will also recognise the significance of connection to Country, living Aboriginal culture and cultural heritage, and the disproportionate impact of climate change on these.

9. Cover both acute events and chronic stressors and hazards	Include acute events and hazards (sometimes called shocks) such as floods, storms and bushfires and chronic stressors (sometimes called slow onset events) or hazards such as changes to temperature patterns, sea level rise, drought, desertification and the expansion of pests and diseases. Chronic stressors can also become acute events, like drought, and coastal erosion and inundation.
10. Cover compounding, cascading and cumulative risks	Analyse inter-dependencies and system-wide risks as well as compounding, cascading and cumulative risks.
11. Identify key risks and opportunities	Identify the most important and significant risks and opportunities for NSW, determined by the potential benefits and nature of the opportunity, severity of the risk, or need for urgent action. This should have a strong focus on transformational adaptation opportunities.
12. Prioritise risks and opportunities	Develop a prioritised list of risks and opportunities for action over the next 5 years, noting that many long-term risks and opportunities require action now or in the immediate future to avoid path-dependency issues. The process will consider how well existing initiatives already cover opportunities and risks.
13. Complement other assessments	The assessment will complement other relevant state-level risk assessments; for example, the United Nations Sendai Framework for Disaster Risk Reduction 2015–2030 emphasises the need to consider climate change as a driver of risk in disaster risk assessments.



The NSW Government will:

- 9. Publish NSW climate change risk and opportunity assessments at least every 5 years, with the first assessment to be published in 2023.



Priority 3

Develop and deliver adaptation action plans

Adaptation action plans will set out concrete actions.

Using the information from the climate change risk and opportunity assessments, the NSW Government will publish climate change adaptation action plans. The plans will focus the Government's time and resources on the most important issues identified in the risk and opportunity assessments.

Adaptation action plans will be integrated whole-of-society, multi-sector policy documents that set out concrete adaptation actions for all areas and levels of government, the economy, society and the environment. They will set out roles and responsibilities, concrete goals, allocate resources and provide a detailed roadmap to put adaptation into practice. The first adaptation action plan will be published in 2023 and a new plan will be published at least every 5 years after that. As climate change risks escalate, plans may need to be published more regularly.

As an example, the NSW Government owns and manages significant infrastructure and provides substantial services that need to be protected from the impacts of climate change, such as roads, stormwater infrastructure, and the health system. Adaptation action plans will provide the framework to do this.

Adaptation action plans will be prepared in line with the minimum criteria listed below and will include both short and long-term actions. Approaches to adaptation are rapidly evolving, and new criteria may be added in line with leading practice.

Adaptation action plan criteria

- 1. Cover the whole of NSW** Include actions that cover the economy, the built environment (including physical assets and infrastructure), the natural environment, ecosystems and all NSW society including government, businesses, communities, families and individuals.
- 2. Set priority actions** Set priority climate change adaptation actions for the next 5 years, including initiatives, policies, programs and activities. This should include transformational adaptation and actions to support adaptation by the most vulnerable and sensitive groups and ecosystems.
- 3. Enable Aboriginal adaptation** Plans will include actions with a specific focus on Aboriginal communities, including actions that are co-designed with the Aboriginal community. This is because these communities are likely to be disproportionately impacted by climate change but also because they can provide unique insights that can enable better adaptation for all NSW. Plans will aim to

promote adaptation that enables Aboriginal social, economic and cultural wellbeing through opportunity, choice, healing, responsibility and empowerment.

- | | |
|---|---|
| 4. Support climate change risk management | Include actions to support NSW Government entity management of physical and other climate change risks to assets, services, and objectives. |
| 5. Clear roles and responsibilities | Set out clear roles and responsibilities for different areas of government and other stakeholders to deliver actions. |
| 6. Address priority risks and opportunities | Show how the NSW Government is addressing the priority risks and opportunities identified in the NSW climate change risk and opportunity assessment. |
| 7. Enable systems adaptation | Plans should include place-based, state-wide, region and system-wide actions and actions that cover shared risks between systems, sectors, regions and stakeholders. |
| 8. Engage with national and international action | May include actions NSW can take at the sub-national, national or international level to drive more ambitious adaptation. |
| 9. Contribute to sustainable development | Adaptation actions should ideally also contribute to the United Nations Sustainable Development Goals, climate change mitigation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, conservation and restoration of biodiversity and ecosystems. |
| 10. Set short, medium and long-term goals, objectives and targets and align with the metrics developed under Priority 1 of this strategy | Set concrete goals, objectives and targets for adaptation. Ensure they are specific, measurable and have clear implementation timeframes so progress can be effectively measured. Plans should both align with the metrics developed under Priority 1 of this strategy and set out other detailed metrics for individual actions as well as monitoring and reporting requirements. Objectives and targets should be short, medium and long-term and show how short-term activities help to achieve medium and long-term objectives that span beyond the 5-year period of the plan. Effective adaptation often has long timeframes where action needs to be taken now for benefits that occur in 30 or more years. |



The NSW Government will:

10. Publish a NSW adaptation action plan at least every 5 years based on the latest climate change risk and opportunity assessment, with the first plan to be published in 2023.



Priority 4

Embed climate change adaptation in NSW Government decision-making

The NSW Government will systematically embed climate change into institutional frameworks and initiatives.

To complement the risk and opportunity assessments and adaptation action plans developed at a state level, the Government will also systematically embed climate change considerations into institutional frameworks and initiatives.

Creating systems and processes that make climate change adaptation part of everyday decision-making and planning is considered one of the leading ways to super-charge adaptation action across society; this is known as mainstreaming.

Embedding climate change adaptation into Government decision-making will help lower the long-term financial impact of climate change on the state, and help improve the prosperity of our economy and the wellbeing of our society and environment.

Update policy, define responsibilities and enhance risk management

Policy is a key tool the NSW Government can use to shape action, both within Government itself and society more broadly. Embedding climate change considerations into policy is one of the most effective ways to integrate it into decision-making now and over the long term. Well defined roles and responsibilities will also help organisations and individuals work together more effectively and efficiently.

Making climate change risk part of standard organisational risk management processes is another effective way to make it part of day-to-day decision-making. Organisations that apply existing risk management frameworks to analyse climate change risks are better equipped to manage those risks. Government agencies can also draw on and develop consistent data and processes to make decisions on climate change adaptation, improving the quality and comparability of action.



The NSW Government will:

11. Update or develop policies, guidance, processes and standards (such as the NSW Government Business Case Guidelines, Guide to Cost-Benefit Analysis, the NSW Gateway Policy and the Asset Management Policy) so that significant NSW Government decisions rigorously consider climate change risks, opportunities and adaptation as part of business-as-usual by the end of 2023.
12. Clearly define responsibilities for NSW public sector senior executive leadership to improve oversight around climate change risks, opportunities and adaptation by the end of 2023.
13. Appoint a climate change risk officer in each NSW Government cluster to embed climate change risk and adaptation across Government actions and decisions by the end of 2023.

14. Require all NSW Government agencies to identify their own climate change risks in alignment with the Climate Risk Ready NSW Guide and climate change projections by the end of 2023.
15. Develop climate change risk thresholds and a prioritisation framework to guide the development of adaptation action plans by the end of 2023 or earlier.

Advocate for climate change adaptation in international decision-making

Embedding climate change considerations in the decisions of international bodies and other sub-national governments is critical to driving the global adaptation agenda forward. Building resilience internationally will help ensure greater global stability and prosperity in the face of climate change. Continued global stability and prosperity provides many benefits for the NSW economy and our community. NSW can also share learnings and learn from adaptation action in other jurisdictions to improve action at home and abroad.



The NSW Government will:

16. Engage with international bodies and groups of sub-national governments to make climate change resilience and adaptation part of all key decisions internationally, move the adaptation agenda forward and maximise opportunities for NSW, including exploring options to share NSW programs and expertise with other jurisdictions and vice versa.



Governance

The NSW Government will monitor, report and evaluate action on climate change adaptation to both measure progress towards a climate change resilient NSW, and to ensure we are continuously improving.



Monitoring

Processes to measure progress on adaptation are critical so we can know what has been achieved, if action is working, and if the state is becoming more resilient. Monitoring will also help identify emerging risks and opportunities enabling the NSW Government to be more agile in this rapidly changing space.

The Office of Energy and Climate Change in NSW Treasury will be responsible for monitoring the actions under this strategy and adaptation action plans. The Office will track progress and will coordinate and develop governance for monitoring and reporting by other agencies.



Reporting

The NSW Government will publish whole of government climate change disclosures consistent with the Taskforce on Climate-related Financial Disclosures recommendations and other leading international and national standards and guidance as they evolve.

NSW Treasury, including the Office of Energy and Climate Change will develop the disclosure framework and guidance and prepare the disclosure on behalf of the NSW Government as a whole. Each disclosure will be peer reviewed by an appropriately qualified person, such as an auditor. The first whole of government disclosure will be published in 2023.

The NSW Government will also publish data and projections on climate change risks, including the financial impacts of those risks, in the NSW Treasury Intergenerational Report released every 5 years.



Evaluation

At least every 5 years, a panel comprised of representatives from Infrastructure NSW, the Office of the NSW Chief Scientist and Engineer, the NSW Chief Economist and other representatives with suitable expertise will publish an evaluation report on the effectiveness of the actions set out in this strategy and adaptation action plans.

The first evaluation report will be published in 2028, with future reports published at least every 5 years after that. This process will assess how effective the strategy is at achieving the resilience objective in the NSW Climate Change Policy Framework and how well NSW is adapting to climate change.

Strategy actions

The NSW Government will:

Priority 1

Develop robust and trusted metrics and information on climate change risk

1. Establish a set of specific, measurable and timebound metrics to measure progress toward climate change resilience and adaptation for all of NSW by the end of 2023.
2. Require all NSW Government agencies to report regularly against the metrics (for example annually, or every 2 or 3 years as appropriate for the metric) by no later than the end of 2025.
3. Publish regularly updated and improved local level climate change projections.
4. Undertake the first climate change scenario analysis for NSW by the end of 2024 and update it periodically to align with the latest evidence.
5. Engage in ongoing research on priority climate change risks, opportunities and adaptation options.
6. Engage in ongoing research and modelling to translate climate change projections into real-world socio-economic impacts and address priority knowledge gaps.
7. Translate climate science into accessible information and resources for people with exposure to climate change risks and all NSW stakeholders.
8. Continue to develop practical information, advice and decision tools on the best way to adapt and prepare for climate change.

Priority 2

Complete climate change risk and opportunity assessments

9. Publish NSW climate change risk and opportunity assessments at least every 5 years, with the first assessment to be published in 2023.

Priority 3

Develop and deliver adaptation action plans

10. Publish a NSW adaptation action plan at least every 5 years based on the latest climate change risk and opportunity assessment, with the first plan to be published in 2023.

Priority 4

Embed climate change adaptation in NSW Government decision making

11. Update or develop policies, guidance, processes and standards (such as the NSW Government Business Case Guidelines, Guide to Cost-Benefit Analysis, the NSW Gateway Policy and the Asset Management Policy) so that significant NSW Government decisions rigorously consider climate change risks, opportunities and adaptation as part of business-as-usual by the end of 2023.
12. Clearly define responsibilities for NSW public sector senior executive leadership to improve oversight around climate change risks, opportunities, and adaptation by the end of 2023.
13. Appoint a climate change risk officer in each NSW Government cluster to embed climate change risk and adaptation across Government actions and decisions by the end of 2023.
14. Require all NSW Government agencies to identify their own climate change risks in alignment with the Climate Risk Ready NSW Guide and climate change projections by the end of 2023.
15. Develop climate change risk thresholds and a prioritisation framework to guide the development of adaptation action plans by the end of 2023 or earlier.
16. Engage with international bodies and groups of sub-national governments to make climate change resilience and adaptation part of all key decisions internationally, move the adaptation agenda forward and maximise opportunities for NSW, including exploring options to share NSW programs and expertise with other jurisdictions and vice versa.

References

- AIDR (Australian Institute for Disaster Resilience) (2020) Major Incidents Report 2019–20: An overview of major incidents that have involved the fire and emergency services sector from July 2019 to June 2020, Department of Home Affairs, Australian Government.
- Borchers Arriagada N, Palmer AJ, Bowman DMJS, Morgan GG, Jalaludin BB and Johnston FH (2020) 'Unprecedented smoke-related health burden associated with the 2019–20 bushfires in eastern Australia', *Medical Journal of Australia*, 213(6):282–283, doi: 10.5694/mja2.50545.
- Carruthers F (2020) 'Tourism loses \$4.5b to bushfires as overseas visitors cancel', *Australian Financial Review*, accessed May 2022.
- Climate Council (2022) A supercharged climate: rain bombs, flash flooding and destruction, Climate Council of Australia, Sydney.
- Coates L, Haynes K, O'Brien J, McAneney J and de Oliveira FD (2014) 'Exploring 167 years of vulnerability: an examination of extreme heat events in Australia 1844–2010', *Environmental Science & Policy*, 42:33–44.
- CSIRO (Commonwealth Scientific and Industrial Research Organisation) (2015) Climate Change in Australia: Projections for Australia's NRM Regions, Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology.
- CSIRO (2020) Climate and disaster resilience technical report, Commonwealth Scientific and Industrial Research Organisation.
- CSIRO (2021) Australian warming, Commonwealth Scientific and Industrial Research Organisation.
- EPA (Environment Protection Authority) (2021) NSW State of the Environment 2021, NSW Environment Protection Authority.
- Global Commission on Adaptation (2020) Adapt Now: A global call for leadership on climate resilience, Global Commission on Adaptation.
- Gutiérrez JM, Jones RG, Narisma GT, Alves LM, Amjad M, Gorodetskaya IV, Grose M, Klutse NAB, Krakovska S, Li J, Martínez-Castro D, Mearns LO, Mernild SH, Ngo-Duc T, van den Hurk B and Yoon J-H (2021) 'Atlas', in *Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, [V Masson-Delmotte, P Zhai, A Pirani, SL Connors, C Péan, S Berger, N Caud, Y Chen, L Goldfarb, MI Gomis, M Huang, K Leitzell, E Lonnoy, JBR Matthews, TK Maycock, T Waterfield, O Yelekçi, R Yu and B Zhou (eds.)], Cambridge University Press, In Press, Interactive Atlas available from <http://interactive-atlas.ipcc.ch/>
- Insurance Council of Australia (2022) Climate Change Impact Series: Flooding and Future Risks (PDF 493KB), Insurance Council of Australia.
- IPCC (Intergovernmental Panel on Climate Change) (2018) Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, United Nations Intergovernmental Panel on Climate Change.
- IPCC (2021a) Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, [V Masson-Delmotte, P Zhai, A Pirani, SL Connors, C Péan, S Berger, N Caud, Y Chen, L Goldfarb, MI Gomis, M Huang, K Leitzell, E Lonnoy, JBR Matthews, TK Maycock, T Waterfield, O Yelekçi, R Yu and B Zhou (eds.)], Cambridge University Press, Cambridge, UK and New York, USA.
- IPCC (2021b) The concept of risk in the IPCC Sixth Assessment Report: a summary of cross Working Group discussions, United Nations Intergovernmental Panel on Climate Change.
- IPCC (2022a) Climate Change 2022: Impacts, Adaptation and Vulnerability, Summary for Policymakers, United Nations Intergovernmental Panel on Climate Change.
- IPCC (2022b) Climate Change 2022: Mitigation of Climate Change, Summary for Policymakers, United Nations Intergovernmental Panel on Climate Change.
- Irvine J (12 December 2019) 'The economic cost of bushfires on Sydney revealed: up to \$50 million a day and rising', *Sydney Morning Herald*.
- Iturbide M, Fernández J, Gutiérrez JM, Bedia J, Gimenez M, Diez-Sierra J, Manzanos R, Casanueva A, Baño-Medina J, Milovac J, Herrera S, Cofiño AS, San Martín D, García-Díez M, Hauser M, Huard D and Yelekçi Ö (2021) 'Repository supporting the implementation of FAIR principles in the IPCC-WG1 Atlas', Zenodo, DOI: 10.5281/zenodo.3691645.
- NSW Premier & Cabinet (2020) Final Report of the NSW Bushfire Inquiry, NSW Government.
- Queensland Chief Scientist (2011) Understanding Floods: Questions & Answers, Queensland Government.
- RBA (Reserve Bank of Australia) (2020) Statement on Monetary Policy: February 2020, Reserve Bank of Australia, Sydney.
- UNODRR (United Nations Office for Disaster Risk Reduction) (2020) The Human Cost of Disasters 2000-2019 Centre for Research on the Epidemiology of Disasters United Nations Office for Disaster Risk Reduction.
- Vicedo-Cabrera AM et al. (2021) 'The burden of heat-related mortality attributable to recent human-induced climate change', *Nature climate change*, 11(6):492–500.
- WWF Australia (2020) Australia's 2019-2020 bushfires: the wildlife toll, Interim Report, World Wide Fund for Nature – Australia

More information

- [2021–22 NSW Intergenerational Report, NSW Treasury](#)
- [AdaptNSW](#)
- [Australian Warming, Climate Change in Australia](#)
- [Climate Model Summary, Bureau of Meteorology](#)
- [Climate Risk Ready NSW Guide](#)
- [Farm performance: broadacre and dairy farms, ABARES](#)
- [Floodplain Management Program](#)
- [Hawkesbury-Nepean Flood Risk Management Strategy](#)
- [Hunter Valley Flood Mitigation Scheme](#)
- [IPCC Sixth Assessment Report](#)
- [National Climate Resilience and Adaptation Strategy 2021–2025](#)
- [Net Zero Plan Stage 1: 2020–2030](#)
- [NSW Climate Change Policy Framework](#)
- [NSW Climate Data Portal](#)
- [NSW Electricity Infrastructure Roadmap](#)
- [NSW Government’s Electric Vehicle Strategy](#)
- [NSW State of the Environment report](#)
- [Sendai Framework for Disaster Risk Reduction 2015–2030](#)
- [The Glasgow Climate Pact – Key Outcomes from COP26](#)
- [The Paris Agreement](#)
- [United Nations Framework Convention on Climate Change](#)
- [United Nations Sustainable Development Goals](#)

Image credits: Cover: Murrumbidgee River and rural Gundagai (Destination NSW). Page 3: Mungo National Park, Willandra Lakes World Heritage Region (John Spencer/DPE). Page 6: Flood sign underwater in the Lismore CBD (David F. Getty Images). Page 7: Fireman (John Spencer/DPE). Aerial Photography of Sydney skyline cityscape (Andrew Merry). Darling River Run, Menindee (Destination NSW). Page 9: Sea Cliff Bridge, Clifton (Destination NSW). Page 10: Bar 83, Sydney (Destination NSW). Page 12: Place des Nations, Geneva, Switzerland (Jonathan Ansel Moy de Vitry). Page 13: Bankwest Stadium, Parramatta (Destination NSW). Page 14: Mooney Mooney (Kelly Nowak/DPE). Country NSW, Mudgee (Destination NSW). Palm forest walking track, Border Ranges National Park (Branden Bodman/DPE). Page 15: Flooding on East Hills Line (NSW

Transport). Fireman (John Spencer/DPE). Stockton Beach, Stockton (Destination NSW). Page 16: A public road crosses Talbingo Dam wall above Talbingo town, off Snowy Mountains Highway, on the edge of Kosciuszko National Park (Elinor Sheargold/DPE). Work in progress, coworking (John Schnobrich, Unsplash). Tathra Wharf during the March 2018 bushfire (David Rogers Photography). Page 17: Hunter Valley flood mitigation scheme (John Spencer/DPE). Page 20: Newcastle Memorial Work, The Hill (Destination NSW). Page 24: Farming, Barraba (Destination NSW). Page 25: Sydney cityscape at dusk including high rises, office buildings, streets (Lisa Madden/DPE). Page 26: Bulli Rockpool, Bulli (Destination NSW). Page 28: Glenn Innes (Destination NSW). Page 31: The Entrance, Central Coast (Destination NSW).

Published by the NSW Government

climatechange.environment.nsw.gov.au

NSW Climate Change Adaptation Strategy

First published: June 2022

ISBN/ISSN: 978-1-922840-31-8

Copyright and disclaimer

© State of New South Wales 2022. Information contained in this publication is based on knowledge and understanding at the time of writing, June 2022, and is subject to change.