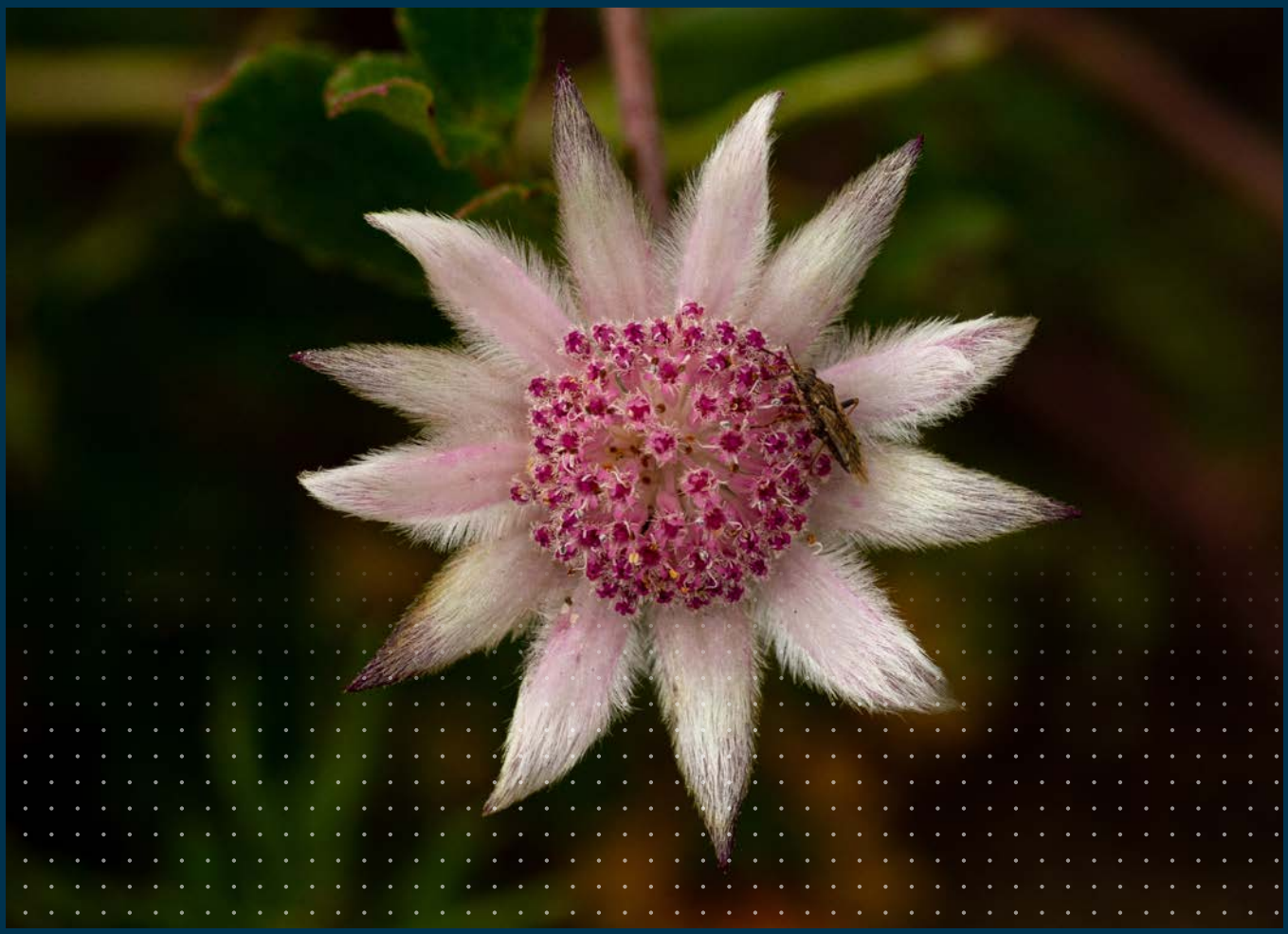
NSW Environment Protection Authority

NSW State of the Environment 2021

Tabled Report



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Acknowledgement of Country

Aboriginal people have a spiritual and cultural connection and an inherent right to protect the land, waters, sky and natural resources of New South Wales. This connection goes deep and has been since the dreaming. The entire landscape, including traditional lands, fresh water and seas, has spiritual and cultural significance to Aboriginal people. If the cultural and spiritual values of Aboriginal people are sustained by providing protection, respect, quantity and quality, then many other components of Aboriginal life will be healthy. By this understanding there is no separation of country, culture, waters and wellbeing. The health of the natural environment, fresh waters, land animals, marine animals and people are intimately connected.

In compiling this report the NSW Environment Protection Authority (EPA) acknowledges this and that Aboriginal people as the first protectors have continuously cared for Country and the natural environment of NSW for thousands of generations. The EPA acknowledges the custodians and honours the ancestors, the Elders both past and present and extend that respect to other Aboriginal people in NSW.

Dharawal Country, Royal National Park, NSW

EPA Statement of Commitment

We, the NSW Environment Protection Authority, acknowledge Aboriginal peoples as the enduring Custodians of the land, sea, waters and sky of New South Wales.

We recognise the entire NSW landscape, including the lands, waters, plant and animal species and seas, has spiritual and cultural significance to all Aboriginal people of NSW. By this understanding there is no separation of nature, wellbeing, and Culture. The health of the natural environment, land animals, marine animals and the health of people and Culture are intimately connected.

Upon the release of the NSW 2021 SoE Report and in the spirit of reconciliation, the EPA is committed to:

- Work in respectful partnership with Aboriginal peoples
- Actively learn from and listen to Aboriginal voices, Culture and Knowledge
- Respect Aboriginal people's knowledge and science as an equal to western science.
- Weave Aboriginal Knowledges and Science with conventional science into the EPA's decision making.
- Act boldly and bravely to play our part to mend and heal Country together
- Ensure Aboriginal Knowledge, Science and Indigenous Cultural and Intellectual Property (ICIP) is protected, and Aboriginal people have Free, Prior Informed Consent
- Address both the tangible and intangible cultural elements of environmental protection
- Deliver on results that have direct benefits for Aboriginal communities
- Embed consistent, meaningful, and trustworthy engagement with Aboriginal communities
- Develop Aboriginal cultural competency across the agency
- Increase Aboriginal employment across the agency to exceed public sector Aboriginal employment targets and to identify specific occupational gaps
- Monitor the impact of the commitment to Aboriginal peoples, Country, culture and spirit.

Gumbainggir Country, Clarence floodplain coastal backswamp (wetland) northern NSW. Photo Stuart Murphy.

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Foreword

I am pleased to present the EPA's eleventh *NSW State of the Environment*. This report describes the status and trends in the quality of the NSW natural environment and implications for environmental and human health.

The condition of our natural environment is a major determinant of our quality of life – the air we breathe, the water we drink, the soil so essential for our land and agriculture, the raw materials for industry and economic growth and the natural beauty that sustains public amenity and tourism. Reporting on the state of our environment helps us take stock of environmental conditions in our state, identify emerging issues and act effectively for the benefit of future generations and the environment itself.

This report is published every three years and provides a valuable time-series of data on our natural environment. The accompanying interactive online portal includes more frequent updates as a resource for the general community and to support policy-makers in determining outcomes for the environment.

I am grateful this year for the generous involvement of the Aboriginal Peoples Knowledge Group in preparing this report. In 2021, the EPA invited the views, values and knowledge of Aboriginal people to enhance our understanding of the health of the NSW environment. The Aboriginal Peoples Knowledge Group has, in a short time, made an invaluable contribution to this report and will continue to guide further engagement for wider representation from Aboriginal people in this kind of reporting. As the Knowledge Group has acknowledged so powerfully:

'Everything is connected. How we use and care for the land/Country impacts its health. Healthy land/Country means not only healthy plants, animals and ecosystems but also healthy people.'

So, what does the report tell us about our environment?

Over the past three years our environment has too frequently been in the news as a series of natural events and disasters has played out – severe droughts and water shortages for many remote communities, several major fish kills in the Darling River system, the worst bushfires ever recorded in NSW, followed by widespread flooding.

This demonstrates how sensitive and vulnerable the environment is to disturbance and harm, often caused by humans, and how important it is to protect it so our own and future generations can continue to enjoy its many benefits.

But it is not all bad news and *NSW State of the Environment 2021* identifies that many aspects of the environment are in good condition.

Air quality continues to be generally good, with low concentrations of lead, carbon monoxide and sulfur dioxide, although particle pollution from smoke and dust soared in 2019 due to the continuing drought and extensive bushfires. Ozone and particle pollution levels require ongoing attention in some situations.

The **industry and household waste** disposed of to landfill is decreasing while recycling of garden and food waste is on the increase. The NSW Government is combating illegal dumping and supporting emergency clean-ups of hazardous waste such as illegally dumped asbestos.

There are also many opportunities for innovative solutions that benefit both the environment and the economy. An example of this is the *Return and Earn* **container deposit scheme**, which was established in December 2017. Previously, drink container rubbish made up almost half of the total litter volume in NSW. By September 2021, over 8.1 billion containers had been returned, resulting in a 52% reduction in drink container litter.

Electricity generation has seen a strong increase in the share of renewable energy sources in the NSW electricity supply from around 16% in 2017 to 19% in 2020. In the three years to June 2020, total NSW and ACT electricity generation remained stable with a slight increase of 0.5% as the population continued to grow, while electricity consumption per capita declined by about 6%.

Impacts from **population** growth and our use of natural resources can have a profound effect on our environment. Some of the principal challenges identified in previous *NSW State of the Environment* reports remain.

Climate change continues to pose a significant threat to both the environment and population of NSW. Its effects are already being felt and are anticipated to become more severe over the coming decades. International collaboration will be required to make the deep reductions in greenhouse gas emissions necessary to counteract these effects. NSW is doing its part by supporting a number of programs and initiatives under *Net Zero Plan Stage 1: 2020–2030*, which aims to strengthen the prosperity and quality of life of our people, while helping to achieve the objective of delivering a 50% cut in emissions by 2030 compared to 2005 levels.

The number of **threatened species** in NSW continues to rise. More than 1,000 native plant and animal species and 112 ecological communities are currently listed as threatened under state legislation. The main threats to these species are habitat loss due to permanent clearing and degradation of native vegetation and the spread of invasive pests and weeds.

Preparation of this report has relied on extensive contributions from within the EPA as well as from many other NSW Government agencies. Data and information have been validated by the contributing organisations and independent experts, through an extensive process of review. An important inclusion this year is the views, values and knowledge of Aboriginal people to enhance understanding of the health of the NSW environment.

My sincere thanks to everyone who contributed to this report.

Tracy Mackey
Chief Executive Officer
NSW Environment Protection Authority

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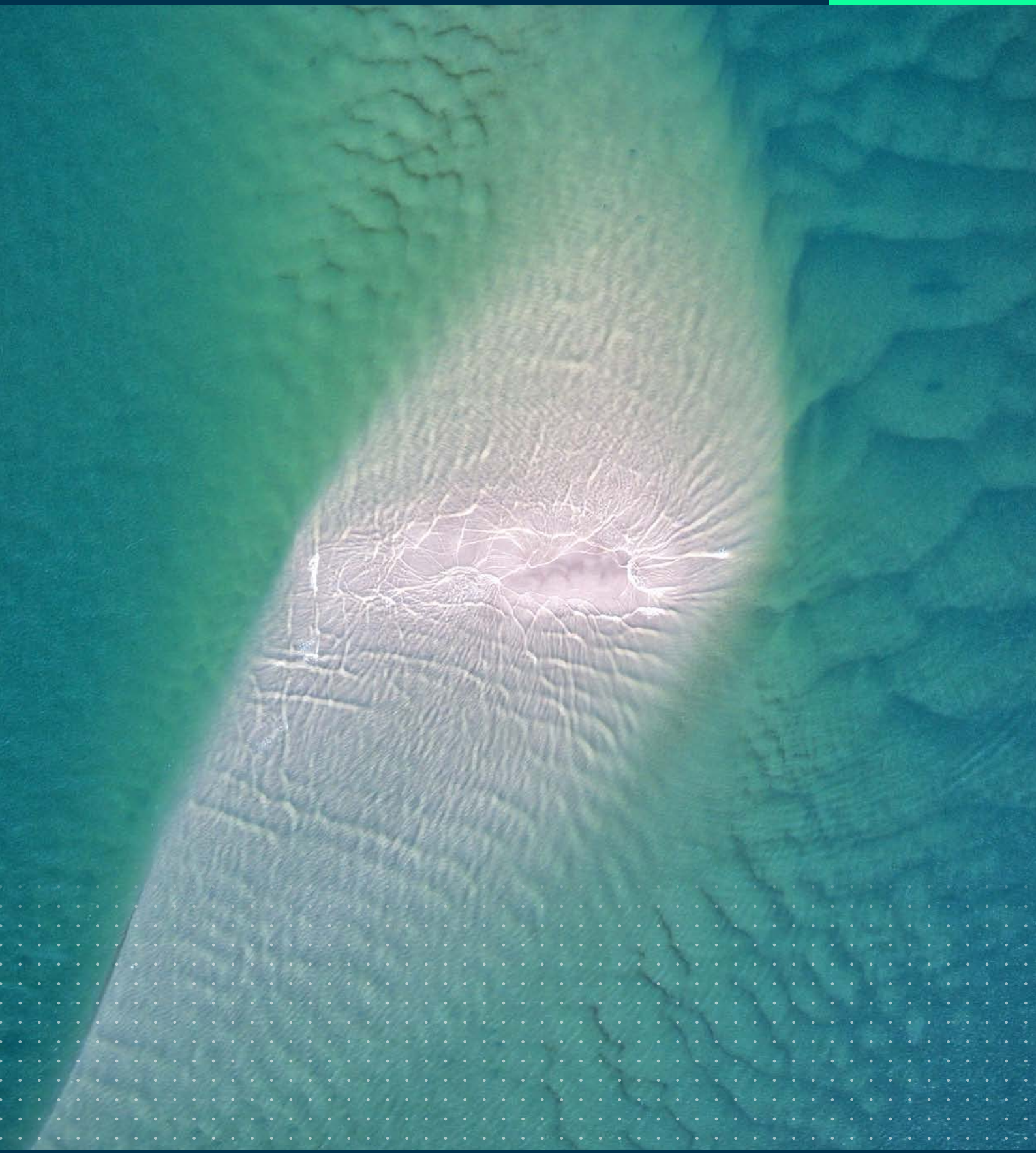
About the Report



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About this report

NSW State of the Environment 2021 (SoE 2021) has been prepared by the EPA to provide a snapshot in time of the status of the main environmental issues facing the state. The SoE is updated every three years and brings together information and data from across all NSW Government agencies with responsibility for managing the state's environmental assets.

This information is assembled and compiled within an SoE online reporting system. A new version of the SoE system has been created following completion of the three-yearly data update in December 2021. This SoE 2021 report was extracted from the system for tabling in the NSW Parliament as a more concise report without the interactive functionality, online linkages and supplementary resources available in the 2021 online version.

How to use this report

Structure and linkages

NSW State of the Environment 2021 is structured around six broad themes and 22 separate topics within those themes. The six themes are all related and the SoE online system allows for seamless transition from content in one topic to another. Each topic has a structure consistent with the Status and Trends – Pressures – Responses model for SoE reporting.

Indicator summaries

SoE 2021 assesses the current status and trends of each of 77 environmental indicators, along with the reliability of the information used to provide an indicator rating. Any new information or data is generally assessed over the reporting period between the previous and current SoE report, taking into account previous data whenever possible to help understand the level of background variation that may be present.

Key to the indicator summaries

Indicator status

'Indicator status' refers to the environmental condition of the indicator.

Indicator rating	Interpretation
	Green: Good – the data shows a positive or healthy environmental condition.
	Blue: Moderate – the data shows that the environmental condition is neither good nor poor, or results may be mixed.
	Red: Poor – the data indicates poor environmental condition or condition under significant stress.
	Grey: Unknown – insufficient data or information is available to make an assessment.

Indicator trend

'Indicator trend' describes the direction of significant change in environmental condition, where this can be differentiated from natural background variation. The trend is usually judged over the three years of the reporting period, but with a greater focus on the latest and most current data.

However, longer term data is also considered, where available, as it helps to gauge the level of background variation that occurs naturally and interpret the significance of any change. The trend reported, if maintained, may have an impact on the overall status of the indicator in the future.

Indicator trend	Interpretation
Getting better	The trend in environmental condition for the indicator is clearly improving (environmental impacts are decreasing). However, while a trend may be positive in direction, it may still be many years before the change is enough to warrant a revision to the status.
Stable	No significant change in condition is evident, usually allowing for some level of fluctuation due to the background variability that occurs in most naturally occurring systems.
Getting worse	The trend in environmental condition for the indicator is clearly deteriorating (environmental impacts are increasing).

Indicator reliability

'Indicator reliability' describes the level of confidence in the data or information used to make these assessments. It considers the statewide extent of data coverage, the accuracy and 'fitness for use' of the data, and the reliability of the information and its interpretation in assessing the status and trend for the indicator. This is represented by the symbols below.

Indicator reliability	Interpretation
✓✓✓	**Three ticks:** Good – the data or information is sufficient to interpret the outcome with confidence.
✓✓	**Two ticks:** Reasonable – the data coverage may not be complete or the supporting information drawn on is not ideally fit for purpose (often it is collected for some other purpose) but is still adequate for use in this context and the interpretations are sound.
✓	**One tick:** Limited – the data coverage is patchy and uneven in quality or there may be some inconsistencies in the supporting information, so caution is needed in considering the ratings and interpretations.

Credits

Preparation of *NSW State of the Environment 2021* has relied on contributions, appraisal and validation from many sources.

EPA Aboriginal Peoples Knowledge Group

In 2021, the EPA invited the views, values and knowledge of Aboriginal people to enhance its understanding of the health of the NSW environment.

The SoE Aboriginal Peoples Knowledge Group was established to improve representation of Aboriginal people during preparation of the 2021 report. This included, among other things, providing introductions to the six environmental themes, sharing cultural stories, reviewing the Fire topic and setting a process to deliver future enhancements to the website.

This has been an important step to better recognise outcomes and impacts to Aboriginal people and cultures. The group will continue to guide further engagement for wider representation from Aboriginal people across NSW in State of the Environment reporting.

For this report the Aboriginal Peoples Knowledge Group comprised members of:

- EPA Aboriginal Initiatives
- EPA Governance Risk and Planning
- Department of Planning, Industry and Environment.
- NSW Aboriginal Land Council.*

And two independent members:

- Wally Stewart, Walbunja man from the south coast of NSW
- Associate Professor Bradley Moggridge, Kamilaroi Water Scientist.

*Established under the *Aboriginal Land Rights Act 1983* (NSW), the NSW Aboriginal Land Council is the peak representative body for Aboriginal people in NSW.

'We talk about Country as Aboriginal people. We talk about Country as a being. The thing for us is you hear people like to say "This is my country" and it's not like it's "I take, it's no one else's". It's "This is the Country I'm connected to. This is the being I'm connected to".'
– Andrew Beach (Wonnarua): Acting Unit Head Regulatory Operations

'Our Country is our soul, is our mother and if that's gone, we're gone too.'
– Denise O'Donnell (Malyangapa, Ngiyampaa & Barkindji): EPA Liaison

Future Opportunities raised by the Group

Throughout the report, the Aboriginal Peoples Knowledge Group has identified future opportunities for management authorities to learn more and apply how Aboriginal cultures and practices improve the care, protection and management of the environment.

The Group has also identified the following as being important:

- That Aboriginal knowledges and cultures are valued and promoted alongside western sciences.
- Inclusion of Aboriginal people in decision making and programs that aim to sustain healthy native vegetation, animals and Country.
- That more scientific, biodiversity and conservation (environmental management) committees include membership of Aboriginal people, and that this outcome be measured through a future additional SoE indicator.

Agency contributors

Preparation of *NSW State of the Environment 2021* has relied on contributions, appraisal and validation from many NSW Government agencies and from within the EPA.

The EPA is grateful for the assistance of NSW agencies who contributed the majority of content for other topics, particularly:

- Department of Planning, Industry and Environment
- Department of Regional NSW
- Forestry Corporation of NSW
- Hunter Water Corporation
- NSW Rural Fire Service
- Sydney Water Corporation
- Transport for NSW.

Review assistance was also provided by the Department of Premier and Cabinet and NSW Ministry of Health.

Independent expert reviewers

Independent expert review enhances the value and transparency of the report by ensuring that the most up-to-date and appropriate information is included; analysis and interpretation of the material is appropriate; and content adequately covers new and emerging issues.

The EPA acknowledges the contribution of the following experts who reviewed content and data relevant to their expertise:

- Associate Professor Howard Bridgman, University of Newcastle
- Associate Professor Mathew Crowther, University of Sydney
- Dr Scott Dwyer, Institute for Sustainable Futures
- Dr Damien Giurco, Institute for Sustainable Futures
- Dr Ben Gooden, CSIRO
- Dr Richard Greene, Australian National University
- Dr Mike McLaughlin, University of Adelaide
- Professor Andrew Pitman, University of NSW
- Associate Professor Owen Price, Director of the Centre for Environmental Risk Management of Bushfire Risk, University of Wollongong
- Professor David Stern, Australian National University
- Mr Rob Sturgiss, Australian Department of Environment and Energy
- Professor Martin Thoms, University of New England
- Mr Ian Varley, Water Resources and Environmental Management
- Professor Stuart White, Institute for Sustainable Futures
- Bhiamie Williamson, Euahlayi man and Associate Lecturer Centre for Aboriginal Economic Policy Research, Australian National University
- Associate Professor Jane Williamson, Macquarie University
- Kerryn Wilmot, Institute for Sustainable Futures

Photo credits

The EPA is on a journey to inclusiveness of Aboriginal people and cultures and notes the names of traditional Country may be contestable and should not be regarded as fact and has been used to demonstrate EPAs commitment.

- **Front Cover:** Tim Johnson, Pink flannel flower, Murramarang National Park, Yuin Country
- **About the Report:** Roger Laird, Harrington sandbar, Harrington, Biripi Country
- **Key Findings:** Pauline Choppin, Plant with water drops, Warrumbungles, Gamilaroi, Wiradjuri and Weilwan Country
- **Drivers:** istock image, Pitt Street shops, Sydney, Gadigal Country
- **Human Settlement:** istock image, Suburb from above, Sydney, Gadigal Country
- **Climate and Air:** Kevin Dodds, Misty town and hills, Tumut valley, Walgalu/Wolgalu, Wiradjuri, and Ngungawal Country
- **Land:** Claudia Abbott, Green hills, Megalong Valley, Dharug and Gundungurra Country
- **Biodiversity:** Jennifer O'Meara, Green and gold bell frog, Sydney Olympic Park, Wangal Country
- **Water and Marine:** Simon Walsh. Marshes, Boulder Beach, Nyangbul Bundjalung Country
- **Appendix:** Sarah Winter, Waterfall, Great Otway National Park, Gulidjan and Gadubanud people

Key Findings

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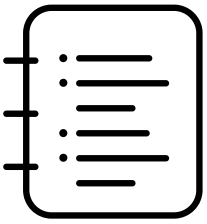

Key Findings

Key Findings in State of the Environment 2021

The 2021 report looks at 22 environmental topics across six broad themes covering *Drivers*, *Human Settlement*, *Climate and Air*, *Land*, *Biodiversity* and *Water and Marine*. The report shows population growth and human activity have influenced air and water quality, ecosystems and threatened species.

Key findings in this SoE report include:

- Air quality is generally good, drinking water quality has been maintained at a high quality and the recreational water quality of our beaches continues to be good.
- The overall rate of greenhouse gas emissions has fallen 17% since 2005.
- The proportion of electricity generated from renewable resources has grown steadily from about 16% in 2017 to 19% in 2020. Growth in renewables (solar and wind power) has more than doubled over the past five years to 2020.
- The NSW economy is now predominantly services based and is therefore less reliant on the consumption of natural resources. There is clear evidence that carbon emissions have been decoupling from economic growth over an extended period of time and that growth in the economy is not being achieved at the expense of the environment.
- The NSW Government's *Waste Less, Recycle More* program has continued to be effective in managing waste, with littering down and new recycling facilities opening for problem wastes.
- About 9.6% of NSW is conserved in the public reserve system. The rate of new reservations has increased markedly, with around 305,000 ha being added to reserves since 2018. Joint management agreements are in place with Aboriginal traditional owners across about 30% of the parks estate.

Ongoing Challenges

Many of the challenges reported in previous SoE reports remain in the 2021 report findings. These include:

- The growing population of NSW continues to exert pressure on the environment, although there has been a temporary respite due to reduced activity and human caused disturbance during the COVID-19 pandemic. Innovative ways to use our natural resources more sustainably and to protect fragile ecosystems must continue to be found.
- The effects of climate change are already evident, but these will become broader and intensify in the future.
- The extreme weather conditions, drought and floods of the recent reporting period (2017–2021) put pressure on water resources and infrastructure in regional areas, cities and towns.
- The number of species listed as threatened in NSW continues to rise. These species are at the greatest risk from threats including vegetation clearing, the spread of invasive species and the mounting impacts of climate change.
- NSW is still heavily dependent on non-renewable sources of energy such as coal for power generation. Transport has become established as the largest (and fastest growing) sector for energy use.
- The condition of most native vegetation continues to deteriorate. Since the Black Summer fires of 2019, 62% of vegetation in the fire zone is under pressure from too much burning.
- The state's major inland river systems continue to be affected by water extraction, altered river flows, loss of connectivity and catchment changes such as altered land use and vegetation clearing. These affect water availability, river health and ecosystem integrity.
- Our love of coastal living and recreation continues to put pressure on the condition of coastal estuaries and lakes.

Key Responses

The NSW Government undertook a number of significant environmental reforms during the reporting period. The responses to major environmental issues are described under each topic (go to theme page and select topic). Some key responses include:

- The ***Net Zero Plan Stage 1: 2020–2030*** was released in March 2020, which provides the foundation for NSW Government action on climate change over the next decade. Emissions in 2030 are projected to fall be 47–52% lower than 2005 levels under the current policy settings. Policies under the net zero plan are also being delivered as part of the NSW Electricity Infrastructure Roadmap, the Electric Vehicle Strategy and the NSW Waste and Sustainable Materials Strategy 2041.
- The NSW Water Strategy was launched in September 2021. This strategy proposes more than 40 actions across seven priority areas, focused on improving the security, reliability, quality and resilience of the state's water resources. A key action of the strategy is investing over $500 million over the next eight years to help local water utilities reduce risks in urban water systems through the Safe and Secure Water Program.
- $175 million has been allocated to the S***aving our Species*** (SoS) program for the 10 years to 2026. The number of plants and animals and communities being managed under the SoS program is steadily rising, with 465 projects in 2018–19 covering roughly 40% of all listed entities (species, populations or communities).
- $240 million has been allocated over five years to support a greater commitment to long-term conservation of biodiversity on private land.
- The NSW Bushfire Inquiry was instigated following the Black Summer fires. All 76 recommendations were accepted by the NSW Government and around $460 million in funding allocated to their implementation, including for new bushfire risk management plans, increased hazard reduction works, enhanced rapid response capacity, improved bushfire modelling and upgraded fire trails.

Drivers

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Drivers

The key drivers of human induced change to the environment are the economy and a growing population.

Introduction to Drivers

The first theme of the report describes the key drivers of human-induced change in the environment: population growth and economic trends. While these drivers lead to a cumulative build-up of threats and pressures on the environment, their effects are diffuse and manifested through a multitude of pathways, making it difficult to directly attribute changes in the environment to their effects.

The population of NSW generally continues to grow, despite a slowdown (and possible temporary reversal) due to the COVID-19 pandemic. Trends in population growth, settlement patterns and residential densities are described in the Population topic.

Achieving sustainable economic growth requires an understanding of the relationship between the economy and the environment. Trends in economic growth and the interaction between the economy and resource consumption, waste production and environmental disturbance are discussed in the Economic activity and the environment topic, along with new economic instruments and accounting systems that will enhance environmental management and decision-making.

In this report:

- The population of NSW is expected to reach 10.57 million people by 2041 with most growth in Greater Sydney. Population growth is the main driver of environmental issues.
- Since 1990, the NSW economy has grown by 2.4% a year and has shifted over time from a resource-intensive industry base to being 70% services-based.
- Between 2010 and 2019, carbon emissions fell by 13% while the economy grew by 26%, indicating a decoupling of carbon emissions from economic growth.

Aboriginal Perspectives

As the NSW environment faces increasing pressures due to economic trends and a growing population, decision-makers need to work with Aboriginal people, whose knowledge, cultures and practices can help shape a more sustainable environment.

As one of the largest landowners in NSW, Aboriginal people and organisations are well placed to provide input on future social and development planning tools and concepts for regional growth areas that maximise positive environmental and social outcomes and protect open spaces, as well as reducing negative environmental impacts from intensive development in major cities.

Many Aboriginal services have a regional focus for delivery and planning. Careful development of future regional growth areas can help reduce impacts in major centres with Aboriginal communities leading development and growth in these areas.

Population

Population growth is a key driver of changes to the environment caused by humans.

NSW's population is expected to reach

10.57 million

people by 2041

Greater Sydney's population was

5.02 million

people as at June 2020

People per sq km in NSW

7.4%

increase between 2015 and 2020

The NSW population grew by

550,000

people from 2015 to 2020

The NSW population has continued to increase at an annual average growth rate of 1.4% between 2015 and 2020.

Why population growth is a driver of environmental change

Population growth can be a significant driver of environmental impacts. In NSW, a rising population accompanied by growing urbanisation has led to greater demand for housing, land, energy, water, consumer products and transport services, and can increase energy, water and resource use, and the generation of waste and emissions.

Status and Trends

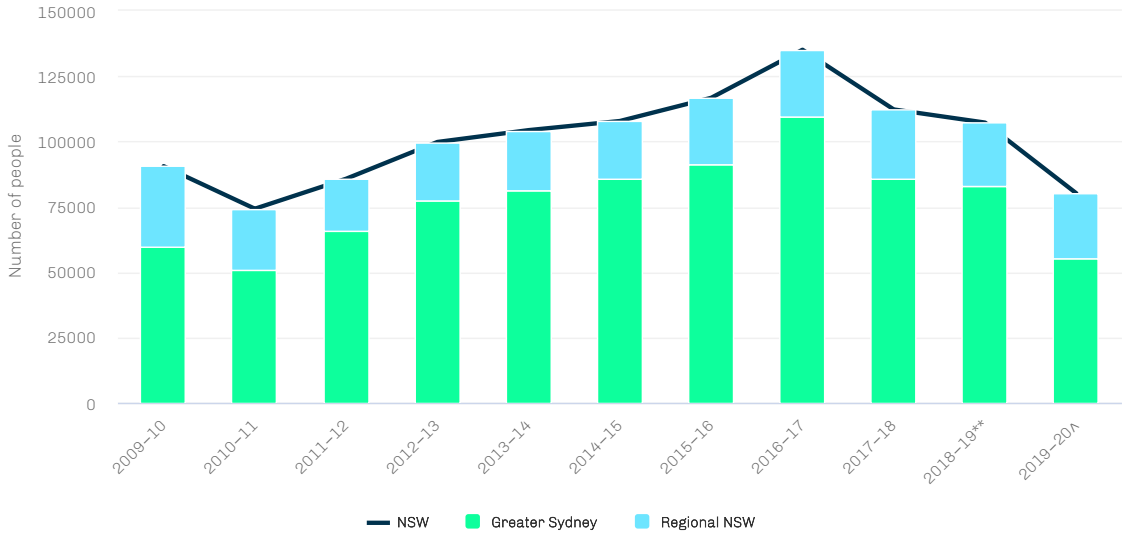
By June 2020, 8.17 million people were living in NSW, 61% of whom resided in Greater Sydney. Over the five-year period from June 2015 to June 2020, the state's population grew by more than 550,000 people. However, the rate of growth has started to slow.

Spotlight figure 1 shows population growth rising at a steady rate between 2010 and 2016, with a peak in 2016–17 (coinciding with a peak in the number of overseas students studying in NSW) and growth at a slower rate between 2017 and 2020.

Population density in NSW has also risen. In June 2020, there were an average of 10.2 people per square kilometre – a 7.4% rise since 2015. Across Greater Sydney, the average density reached almost 480 people per square kilometre – 41 more than in 2015.

By 2041, the NSW population is expected to grow to 10.57 million with most of the increase in Greater Sydney. The challenge will be to manage projected population growth alongside environment protection and conservation, and maintain liveability.

Spotlight figure 1: Population growth in NSW, Greater Sydney* and regional NSW 2009–20



Notes:
* Greater Sydney extends from Hawkesbury River in the north to Royal National Park in the south and includes the Blue Mountains, Wollondilly and Hawkesbury local government areas in the west. The historic results have been updated to reflect the definition of Greater Sydney as not including the Central Coast.
** 2019 figures are revised ABS estimates and subject to change.
^ 2020 figures are preliminary ABS estimates and subject to change.

Source:
ABS 2020a; calculations by DPIE

Pressures

Over the past 40 years, natural population increases have been fairly stable while overseas migration has been a significant contributor to growth. However, during the closure of international borders due to the COVID-19 pandemic, overseas migration was temporarily not a major driver of population growth. The 2021 NSW Budget forecast negative population growth for the state of –0.1% in 2021–22, before a gradual rise to 1.2% in 2024–25.

Response

The NSW Government has developed long-term plans for Greater Sydney and regional NSW. The plans aim to provide for sustainable and resilient development with a balanced approach to the use of land and water resources, while enhancing liveability and protecting the natural environment.

Other strategies for reducing environmental impacts of urbanisation and a growing population include the Waste and Sustainable Materials Strategy, the Sydney Green Grid framework for enhancing quality of open space, Future Transport 2056, NSW Government's Net Zero Plan and the NSW Water Strategy.

Related topics: Energy Consumption | Transport | Urban Water Supply | Waste and Recycling

Economic Activity and the Environment

The health of the NSW economy is strongly linked to the condition of the environment and natural resources, although the economy is becoming less resource-intensive.

Carbon emissions

Carbon emissions fell by **13%** while NSW GSP grew by **26%** between 2010 and 2019

Service-based economy

~ 70%

of the NSW economy is service-based

A steady reduction in resource dependency and lower carbon emissions from energy production are two areas where economic growth is not being achieved at the expense of the environment.

Why economic activity and the environment are important

Over the past 30 years, the NSW economy has been shifting from a resource-intensive industry base to a service-based economy that has reduced environmental impacts.

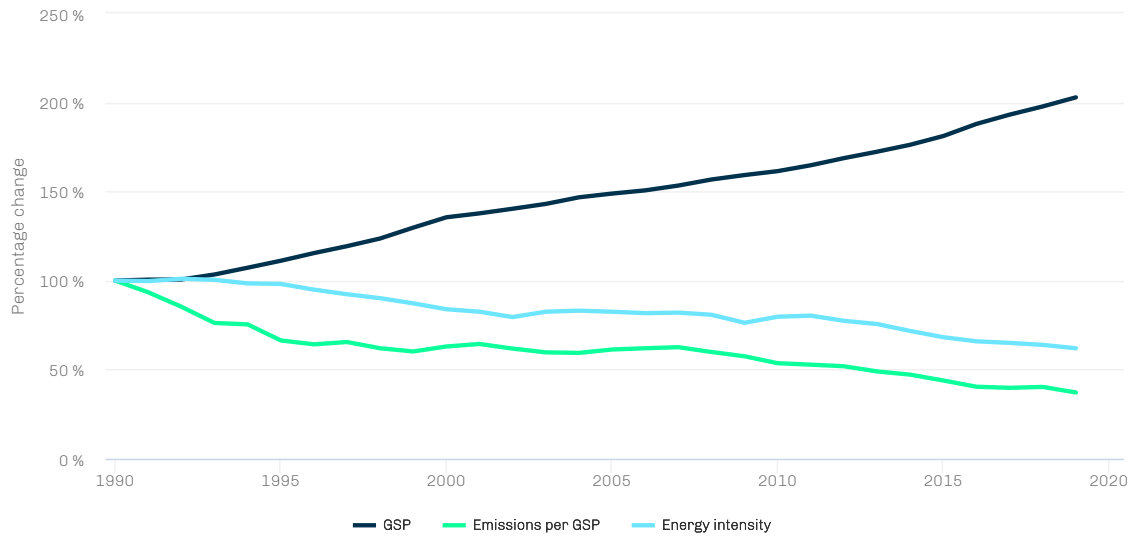
Environmental-economic accounts, which supplement conventional economic accounts, can enhance decision-making by enabling environmental factors to be considered in decisions that have traditionally been based on economic factors alone.

Status and Trends

Since 1990, the NSW economy has grown by almost 2.4% per annum. Gross State Product (GSP) has increased in real terms by about $23,400 per capita over the same period. Carbon emissions fell by 13% from 156,594 kilo tonnes (kt) to 136,579 kilo tonnes (kt), while the NSW GSP grew by 26% between 2010 and 2019. Around 70% of the NSW economy is service-based, becoming less resource-intensive.

The decrease in emissions in the 1990's was largely due to having avoided primary forest clearing, with the land sector going from a significant source of emissions in 1990 to a net sink of carbon that decade. Emissions from stationary energy and transport and re-clearing of land for agriculture continued to increase until about a decade ago. Emission reduction from electricity generation, mining fugitives, waste and net sequestration by the land sector contributed to emission reductions over the past decade, although transport emissions continue to increase.

Spotlight figure 2: Relative change in NSW economic, emission and energy intensity 1990–2019



Source:
ABS 2020a (cat. no. 5220.0), Science, energy and Resources, National Greenhouse Accounts 2019 and Australian Energy Statistics, Table F

The **Spotlight figure 2** shows how economic performance (measured as GSP), carbon emissions intensity and energy intensity (both measured in tonnes per dollar of GSP) have changed relative to 1990 levels. Relative to economic activity, overall carbon emission and energy intensity has steadily declined since 1990, indicative of a decoupling between emissions and economic growth.

The trends over the past decade indicate reductions in the carbon emissions intensity of the NSW economy. These reductions are based on the emissions intensity of stationary energy decreasing due to improved power generation efficiencies, an increase in the share of renewable energy, greater energy efficiency and fuel switching.

Pressures

The impacts of processing and use of resources, the production of goods and services, transport and waste generation, including greenhouse gas emissions, are central to how economic activity generates environmental pressures. Decoupling environmental pressures from economic growth is critical to creating a sustainable future.

Responses

The NSW Government uses various economic tools to manage its environmental resources, including cost-benefit analysis, market-based instruments and program evaluations.

Economic instruments, such as levies or taxes, subsidies, tradeable permits and performance-based regulatory charges, use market-based responses rather than traditional regulatory approaches to offer a more flexible way to meet environmental quality objectives. A major initiative that relies on a market-based scheme is the container deposit scheme Return and Earn.

Related topics: Population | Energy Consumption | Waste and Recycling

Human Settlement

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Human Settlement

Human settlement is our most heavily modified and intensively used environment and presents specific challenges in the use of resources and services and the management of pollution and waste.

Introduction to Human Settlement

The Human Settlements theme addresses issues that arise in the urban environment in which most of the people of NSW live, including energy use, transport patterns, urban water use, management of waste and recycling and contaminated sites.

The growth in population and the economy described in the Drivers theme leads to the consumption of energy, water and land resources and the generation of waste. The production and use of energy has been identified as the largest source of greenhouse gas emissions in NSW, with electricity generation and transport being responsible for most of these emissions. Energy production and use is described in the Energy Consumption topic, while trends in the use of public and private transport are discussed in Transport.

Communities, industry and agriculture all require access to reliable sources of water. Drinking water quality and patterns of potable water use are described in the Urban Water Supply topic. Trends in waste generation, recycling and litter prevention are covered in Waste and Recycling, while management of legacy pollution of land and groundwater is outlined in the Contaminated Sites topic.

In this report:

- Energy consumption per capita in the NSW and the ACT decreased by 3.2% from 2017 to 2019 while the share of renewable energy sources in the NSW electricity supply reached 19% in 2020, a rise of 3% since 2017.
- In contrast, energy use for transport continues to rise at a steady rate, together with transport-related emissions.
- Litter has dropped by 43% over the past six years while the percentage of waste diverted for recycling has increased slightly.
- Sustained efforts have seen the number of notified and regulated contaminated sites, and the number of sites remediated grow.
- Water use per person per day in NSW has been stable since 2009, but pressure from population growth and weather events continues.

Aboriginal Perspectives

Country is everywhere, including within human and urban environments. It is living and breathing underneath all the buildings and connected to Aboriginal people through stories and culture. Aboriginal people still hold a strong responsibility to care for these places. For people to be healthy, the urban environments we live in need to be healthy too. From the beginning, Country has sustained Aboriginal peoples and Aboriginal peoples have sustained Country. The whole landscape, including all animals, plants and soils, were cared for and used sustainably according to stories and culture.

The arrival of Europeans brought many changes for Aboriginal people, the landscape and ways of life. Aboriginal people were excluded from planning decisions and most now live in heavily modified and intensively used environments that face many challenges.

As these places face increasing pressures, there is a need to work with Aboriginal people and recognise cities and urban environments as Country too. Aboriginal people's knowledge, cultures and practices can help shape healthy urban and human environments across NSW. The responsibility to care for Country and nourish our human settlements is on all of us.

Energy Consumption

As NSW moves from fossil fuels to renewable energy sources, the aim is to connect communities to reliable and affordable energy while reaching net zero carbon emissions by 2050.

Energy consumption decreased by

↓ 2%

in NSW and the ACT between 2010 and 2019

Renewable energy sources shared

19%

of total energy generation in NSW and the ACT in 2019–20

Transport remains the biggest energy user, representing

47%

of total energy use in NSW and the ACT in 2018–19

Energy consumption per capita in NSW and the ACT decreased by

↓ 3.2%

between 2017 and 2019

Energy consumption decreased by 2% from 1,169 to 1,142 petajoules (PJ) between 2010 and 2019 and per capita consumption decreased by 3.2% between 2017–19.

Of the 19% of electricity supplied by renewable sources, solar and wind combined provided 14% and hydro 3%. The transport sector remained the biggest energy user at 47% of the total energy use in NSW and the ACT.

Why energy consumption is important

The percentage of renewable energy in the NSW electricity supply is increasing. Between 2015 and 2020 the amount of wind and solar energy in NSW electricity generation more than doubled, partly due to generation from rooftop solar panels and large-scale solar and wind farms. NSW is one of the leading states in adding renewable energy to the electricity market.

Four out of the five coal-fired power stations supplying around three-quarters of the state's electricity are scheduled to close in the next 15 years. We are moving towards a two-way energy system where more consumers are installing their own rooftop solar systems and exporting energy back to the grid. Communities are looking to new local renewable energy technologies and models, such as trading energy and sharing solar energy with their neighbours.

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Total NSW non-renewable energy consumption	**POOR**	Stable	✓✓✓
Transport sector use of non-renewable energy	**POOR**	Stable	✓✓✓
Renewable electricity generation in NSW	**MODERATE**	Getting better	✓✓✓
Per capita residential energy consumption	**MODERATE**	Getting better	✓✓✓

Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

In 2019–20, 81% of electricity in NSW came from non-renewable sources such as oil, coal and gas. This was a 7% decline since the 2018 State of the Environment report.

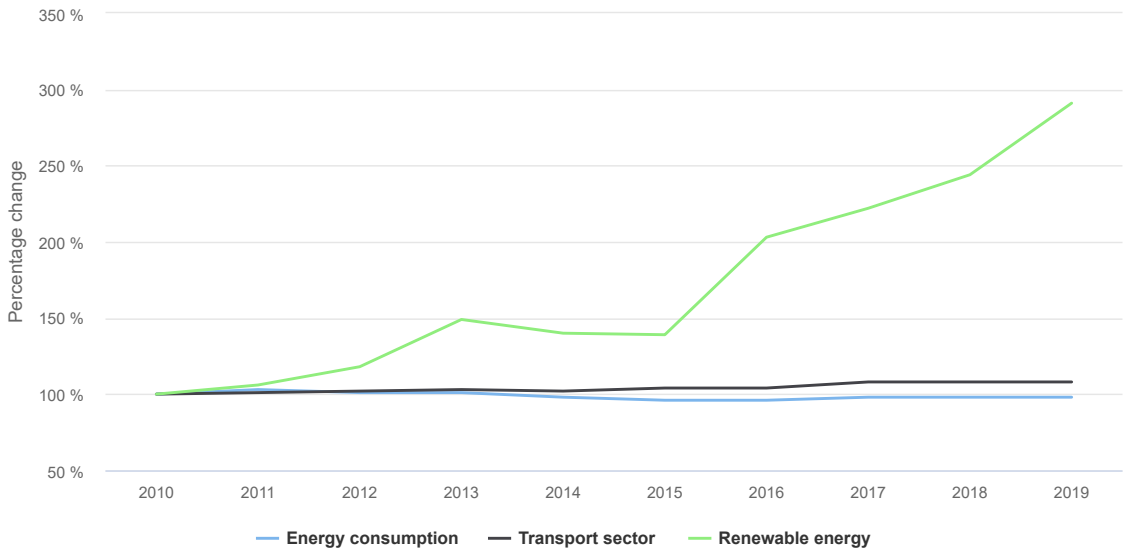
From June 2017 to June 2020, total NSW and ACT electricity generation remained stable with a slight increase of 0.5% as the population continued to grow, while electricity consumption per capita declined by about 6%. The Gross State Product (GSP), which experienced above trend growth for the four years to 2018–19, contracted by 0.7% in 2019–20, likely due to impacts of COVID-19. However, the economy has since rebounded, growing by 2.4% from June 2020 to June 2021. Since then, the state has experienced a faster than expected rebound in economic activity and continues to see a strong recovery from the pandemic-driven collapse in the middle of 2020.

In 2018–19, the transport sector used almost half (47%) of the total energy used in NSW and the ACT – up from 43% in 2008–09.

The industrial sector used 33% of energy, with the residential and commercial sectors accounting for 11% and 9% respectively.

Electric vehicles (EV) – which both use and store energy – will become increasingly common. Currently, the sale of EVs is low (about 0.8% of new vehicle sales) but is projected to increase rapidly, with two million EVs expected on Australian roads by the mid-2030s.

Spotlight figure 3: Measures of energy consumption, transport sector energy use and renewable energy source



Source:
Derived from Department of the Environment and Energy, Australian Energy Statistics, Table O, June 2021, Table F, October 2020

The **Spotlight figure 3** shows the change between 2010–19 in energy consumption, energy use by the transport sector and the contribution of renewable energy sources to total energy demand. Total energy consumption generally decreased between 2010–19 with slight fluctuation, while the transport sector share of energy use slightly increased by 4%.

The contribution of renewable energy sources to the state's total electricity generation increased substantially between 2015–19.

Pressures

The electricity grid was designed to operate as a one-way power delivery system through big energy generators, such as coal-fired power stations, delivering electricity via poles and wires to homes and businesses.

While electricity demand from the grid is expected to decline with increasing adoption of energy efficient appliances and machinery and rooftop solar and battery systems, it is expected to increase with the predicted growth in electric vehicle charging and related infrastructure.

However, the increase in rooftop solar photovoltaics (PV) sending power back into the grid and other distributed energy resources (DER), such as battery storage, electric vehicles and chargers and smart meters, means these behind the meter systems need a power system that can evolve and allow DER to be integrated. Demand for DER is predicted to grow; by 2050, it may contribute up to 45% of the nation's electricity generation capacity.

The current absence of an overarching national policy to guide the closure and replacement of coal-fired plants means states and territories must manage changes needed to properly coordinate energy generation, transmission, storage and investment.

Without national coordination, renewable energy generation and storage projects may not come online within planned timeframes, which could delay bringing clean energy into the grid.

Responses

The NSW Government continues to implement policies to encourage energy efficiency and use of renewable energy, such as the *Net Zero Plan Stage 1: 2020-2030* released in March 2020, and the Energy Security Safeguard that supports energy efficiency and reduction in demand at peak times. A range of clean energy initiatives is being delivered, such as the Emerging Energy Program to encourage investment in new generation technology and the Solar for Low Income Households program.

On 9 November 2020, the NSW Government released the Electricity Infrastructure Roadmap – a plan to transition the NSW electricity sector into one that is cheaper, cleaner and more reliable. The Roadmap is enabled by the *Electricity Infrastructure Investment Act 2020* and builds on the foundations of the 2019 Electricity Strategy and 2018 Transmission Infrastructure Strategy.

The roadmap will:

- deliver five Renewable Energy Zones (REZs) in Central-West Orana, New England, South West, Hunter-Central Coast and Illawarra regions
- attract up to $32 billion of private investment in regional energy infrastructure by 2030
- support the private sector to bring 12 gigawatts of renewable energy and 2 gigawatts of storage, such as pumped hydrogen, online
- help NSW deliver on its ambitions to reach net zero emissions by 2050
- reduce NSW electricity emissions by 90 million tonnes by 2030.

The NSW Government released the Electric Vehicle (EV) Strategy in June 2021, to help increase EV sales to more than 50% of new car sales by 2030–31 and help NSW achieve net zero emissions by 2050. EVs also present opportunities to increase the proportion of renewable energy used in the transport sector.

The NSW Government's Hydrogen Strategy, released on 13 October 2021, will provide up to $3 billion in incentives to develop the NSW green hydrogen industry, including:

- investing $70 million in hydrogen hubs in the Illawarra and Hunter regions
- providing exemptions from electricity network and government scheme charges
- expanding the scope of the Energy Security Safeguard to include hydrogen
- rolling out hydrogen refuelling stations.

Related topics: Economic Activity and the Environment | Population | Greenhouse Gas Emissions | Climate Change

Transport

The demand for transport has increased as the population grows. There has been a modal shift as people rethink their travel needs during the 2020–21 COVID-19 lockdown periods.

Average distance travelled per vehicle

12,000 km

in 2019–20

COVID-19 saw public transport patronage in Greater Sydney drop by

41.6%

in 2020–21, compared to 2018–19 levels

Transport sector greenhouse gas emissions increased by

16%

since 2005

Electric vehicles made up

0.1%

of light vehicles on NSW roads as at March 2021

The demand for transport has increased as the population grows. Total vehicle kilometres travelled for light duty vehicles, primarily passenger vehicles, peaked in 2018–19 and dropped due to COVID-19 travel restrictions. The transport sector (road, rail, ship and air) is one of the major contributors to greenhouse gas emissions and air pollution in NSW. Electric Vehicle (EV) sales are expected to increase as a result of the NSW Electric Vehicle Strategy which aims to make the state the easiest place to buy and use an EV in Australia. Electrifying the NSW fleet is integral in reaching net zero emissions by 2050.

Why transport is important

Transport plays a key role in the movement of people and goods. Transport assists participation in social life and fulfils an essential economic function. However, the construction and operation of transport infrastructure may have negative environmental impacts, including:

- reliance on non-renewable resources for fuel
- greenhouse gas emissions
- noise and air pollution
- land clearing.

Private modes of transport, such as cars, generally have greater impacts on the environment than trains, buses, ferries and light rail. This is because they are less efficient at moving large numbers of people and mostly rely on polluting energy sources. Walking and cycling are the most energy efficient transport modes. Current major public transport delivery programs will reduce fuel consumption and congestion and lead to lower environmental impacts caused by private cars.

Freight transport by rail can have a lower environmental impact than moving freight by road because it is more efficient at carrying larger volumes of goods. Environment protection licences held by rail freight operators and rail infrastructure owners help manage environmental impacts such as noise.

NSW indicators

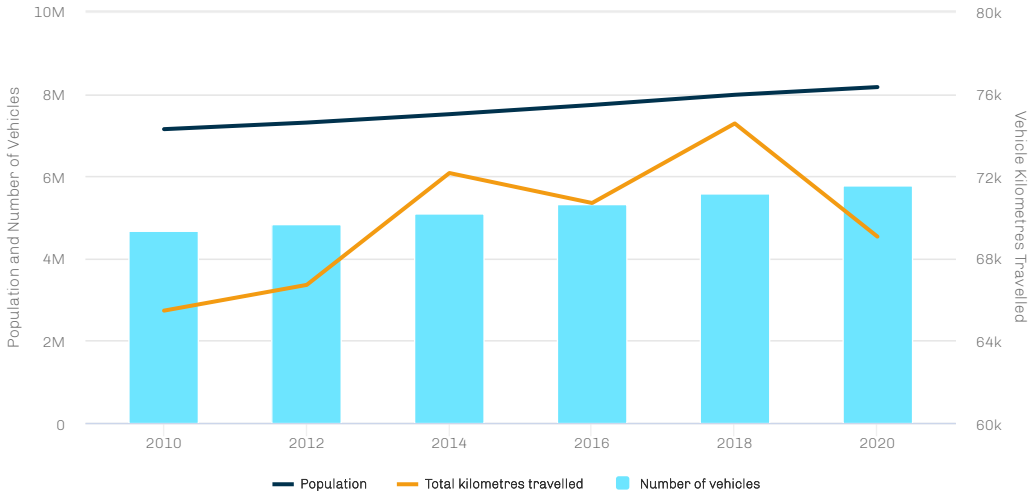
Indicator and status		Environmental trend	Information reliability
Vehicle kilometres travelled (total)	POOR	Stable	✓✓✓
Vehicle kilometres travelled (per person)	MODERATE	Stable	✓✓✓
Public transport use overall trips	GOOD	Getting better	✓✓✓
Percentage of electric vehicles of the NSW car fleet	POOR	Getting better	✓✓✓

Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

The total distance travelled by motor vehicles in NSW increased by 13% in the eight-year period between 2009–10 and 2017–18 and then dipped 10% during 2019–20 because of statewide COVID-19 restrictions on travel (ABS 2020b). Heavy truck vehicle kilometres travelled (VKT) increased 8% between 2017–18 and 2019–20 while passenger vehicle VKT decreased by 16%. In this time, NSW's population grew by 12.5% (ABS 2021a). (see **Spotlight figure 4**).

Spotlight figure 4: NSW total number of registered vehicles, population and vehicle kilometres travelled 2009–10 to 2019–20



Notes:
Terms and symbols used above are defined in How to use the report.

Source:
ABS 2008, 2010, 2020b

In 2019–20, around 6.2 million Greater Sydney residents made 18.6 million trips by all modes of transport on an average weekday – around three trips per person per day. Private motor vehicles remained the dominant mode of transport in NSW, accounting for 68% of all trips on an average weekday by Sydney residents and over 80% of trips by Hunter and Illawarra residents (TfNSW 2021a).

Transport emissions are currently the second largest component of NSW greenhouse gas emissions. Since 1990, transport emissions have increased from 19Mt to 28 Mt (DISER 2021a), with 2019 emissions 48% higher than 1990 levels (Adapt NSW 2021). This is an average increase in transport emissions of 1.65% per year. This reflects activity increases across transport modes due to population and economic growth. Petrol and diesel-fuelled vehicles are the main sources of oxides of nitrogen (NOx) emissions in Greater Sydney and the second largest source of population exposure to fine particles (Broome et al 2020). Other potential environmental impacts include noise pollution and fragmentation of ecosystems.

Pressures

The NSW population is expected to grow to 10.57 million by 2041, which without government action will lead to more vehicles on the roads and more demand for public transport. In spite of the projected increase in VKT, the strong reduction in vehicle emission rates due to tightening national vehicle emission standards has resulted in significant reductions in total fleet emissions to date, and these reductions are projected to continue over the next 10–20 years (EPA 2018). However, due to the contribution of non-exhaust particle emissions from road brake and tyre wear, total particle emissions will begin to increase from around 2026. Together with increasing population and population density, total population exposure to transport fine particle emissions is likely to increase without the rapid uptake of zero-emission vehicles and improvement in transport efficiency.

Urban sprawl leads to greater reliance on private vehicles. Construction of new roads can have significant impacts on wildlife and can lead to a direct loss of mature trees and canopy, which in turn exacerbates the urban heat island effect (Landcom 2020). Tyres and brake linings, petrol and oil deposits are a major source of heavy metals which can be washed into the stormwater systems during rain, eventually polluting waterways.

Ballast water, sewage, and wastes from international shipping vessels have environmental impacts on our coastal ecosystems.

Responses

A range of transport infrastructure service and technology initiatives are being delivered under *Future Transport 2056* which aims to encourage travel by public and active transport (such as walking and cycling), rather than by private car, which can help reduce traffic congestion and greenhouse gas emissions. These initiatives aim to increase the proportion of electric vehicles in the state. The NSW Electric Vehicle Strategy is the State government's plan to accelerate the NSW vehicle fleet of the future. The State government's Future Energy Strategy commits to securing energy needs from sustainable sources, supporting the transition of the transport sector to net zero emissions by 2050. For example, the electrified rail network was moved to renewable energy in mid-2021 and planning is also under way for the transition of the full NSW bus fleet of over 8,000 buses to zero emissions buses.

The environmental impacts of transport can be lessened by reducing the distance people need to travel to workplaces and essential facilities. *Future Transport 2056: Greater Sydney services and Infrastructure Plan* (TfNSW 2018) sets out a vision for achieving this by shifting from one central business district to a metropolis of three cities: The Eastern Harbour City, the Central River City and the Western Parkland City. The aim is for people to more conveniently access jobs and services by travel to one of these cities within 30 minutes from home.

Strategies to manage environmental impacts of road and related infrastructure are part of project planning, design, construction, operation and maintenance. Strategies include minimising the use of non-renewable resources, managing erosion and sediment during construction works, protecting biodiversity via planning approvals and conditions, implementing additional wildlife protection features, such as fauna fencing and fauna crossings (Biosis 2016) and reducing energy use and greenhouse gas emissions through LED traffic lights.

Related topics: Climate Change| Energy Consumption | Greenhouse Gas Emissions | Population

Urban Water Supply

A high-quality and secure water supply is essential to sustain communities and support economic growth.

Summary

Drinking water quality

100%

compliance with water quality guidelines for the last three years

Water use per person per day (Greater Sydney)

276 litres

stable overall since 2009

Annual water consumption

43% reduction

in regional NSW since 2005–06 through water efficiency measures

Water supply

~50

NSW town and city water supplies at risk of failure in 2019–20 due to drought

Climate change and more intense droughts are increasing risks to the water security of NSW cities and towns. Increasing the proportion of rainfall independent water supply and implementing programs to improve water efficiency and reduce system leakage are key strategies for improving the resilience of water systems and water security.

Why urban water supply systems are important

A sustainable supply of water to urban areas is fundamental to the health, wellbeing and economic growth of communities, and to maintaining the health of aquatic systems.

While households in NSW generally use 16% or less of all water consumed in the state (ABS 2020), the implications of failing to provide a secure supply of water to communities are significant.

Water supplies to urban areas are under constant pressure from growing populations and variable weather conditions, including droughts and flooding, which are being exacerbated by climate change. Urban water supply systems must be managed to ensure different and changing water needs for households, businesses, communities and the environment can be met now and in the future.

NSW indicators			
Indicator and status		Environmental trend	Information reliability
Proportion of the metropolitan and regional water supply meeting national guidelines	GOOD	Getting better	✓✓✓
Total and per person water consumption for metropolitan and regional centres	MODERATE	Getting better	✓✓✓
Water recycling - major utilities	MODERATE	Stable	✓✓✓
Water recycling - local water utilities	MODERATE	Getting better	✓✓✓

Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

For the last 10 years (2010–11 to 2019–20), the average volume of residential water supplied per connected property has been relatively stable for Sydney Water ranging between 189 kilolitres per property (kL/prop) and 215 kL/prop, and Hunter Water ranging between 156p and 181 kL/prop. For regional water utilities, the volume supplied has shown a greater variability over the same period, ranging between 167 and 238 kL/prop).

Overall demand for water decreased substantially during the Millennium Drought (from 2002–2009) in Greater Sydney. Subsequently, demand has slowly increased in line with the city's population growth, except for the period between mid-2019 to the end of 2020 when water restrictions were in place to manage water supplies during the drought period. Overall demand stayed relatively constant in the Lower Hunter and regional centres due to decreased consumption per person.

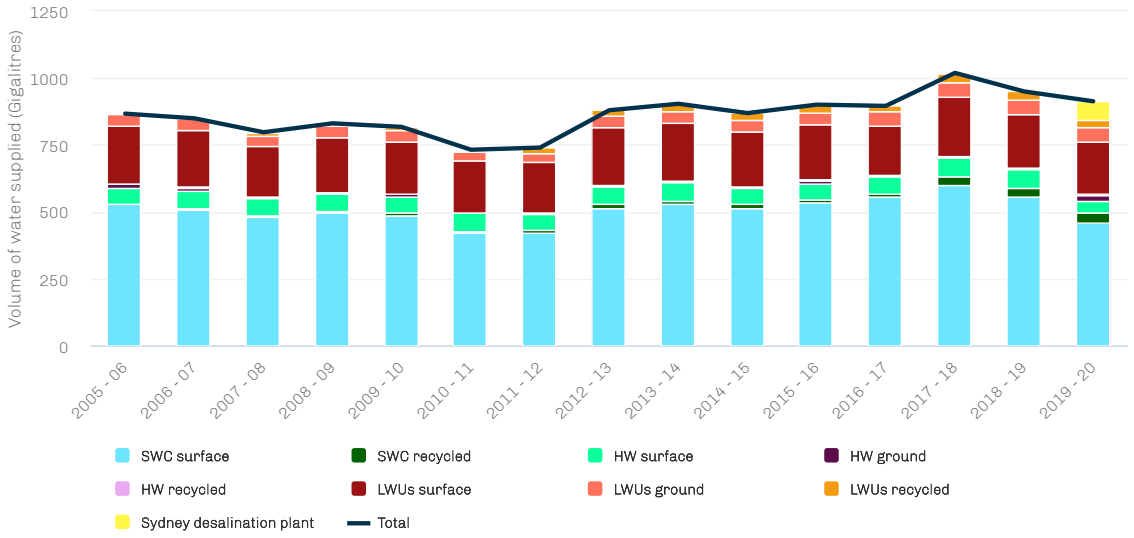
The 2017–20 drought saw water supplies across cities and towns under significant stress. The situation prompted the State and local governments to rethink their approaches to water security and to escalate their investment in water infrastructure.

At the beginning of 2020, 100% of NSW was in drought, resulting in a drop in the average volume of residential water supplied per connected property compared to the previous year. There was a -5.5% drop for Sydney Water, -11% for Hunter Water and -14.5% for the median of all the local water utilities in regional NSW. Sydney's residential water use was 12% lower in 2019–20 than in 2017–18 following the introduction of voluntary and enforced drought response measures between February 2019 and December 2020.

Spotlight figure 6 tracks the volumes of water taken from different sources since 2005–06, including:

- supply reservoirs
- in-stream sources
- groundwater aquifers
- recycled water schemes
- the Sydney desalination plant.

Spotlight figure 6: Urban water supplied, by source



Notes:
Includes Sydney Water Corporation (SWC), Hunter Water (HW) and all local water utilities (LWUs) in regional NSW, and the Sydney desalination plant.

Source:
DPIE 2021a | BOM 2018 | BOM 2020

Pressures

Australia is the driest inhabited continent in the world and has a highly variable climate. It faces difficulties with changing rainfall patterns and drought as a result of natural climate variability and climate change. NSW is already experiencing trends of higher average temperatures and reduced cool season rainfall. There are indications from climate models that drought conditions may become more frequent and severe.

The recent drought has highlighted the vulnerability of metropolitan and regional water supplies across NSW. Between July 2017 and February 2020, Greater Sydney's water storages were impacted by one of the worst droughts on record. Sydney's water storages declined rapidly over two and a half years, reducing dam levels to around 40% of capacity. Some inland storage levels fell to as low as 10%. This rate of decline in water storages had not been experienced in the historical record and was not anticipated in the 2017 Metropolitan Water Plan which was prepared to secure water for Greater Sydney. It demonstrated that storages can deplete rapidly in a severe drought and highlighted the risks associated with relying mainly on dam levels to trigger key decisions and drought response measures.

Poor water quality affects its suitability for human use, increases the cost of treatment for supply and may affect the health of aquatic ecosystems. Stormwater runoff, wastewater discharge and development in catchment areas are a significant risk to water quality and can alter habitats for species and ecological communities that depend on healthy water. Bushfires in catchments also pose a risk to water quality and impact on water supplies. Dry periods followed by extreme wet weather and high flows bring additional hazards to catchments.

Responses

The NSW Government has developed a 20-year *NSW Water Strategy* as part of a suite of long-term strategies being developed to maintain the resilience of the state's water services and resources over the coming decades. This statewide, high-level strategy works with 12 regional water strategies and two metropolitan water strategies, the Greater Sydney Water Strategy and the Lower Hunter Water Security Plan.

These strategies are setting the direction for and informing the best mix of water-related policy, planning and infrastructure investment decisions over the next 20 to 40 years. They aim to balance different and changing water needs and make sure that households, businesses, towns and cities, communities and the environment have access to the right amount of water for the right purpose at the right times.

Related topics: Population | Water Resources | River Health | Groundwater | Climate Change

Waste and Recycling

As NSW transitions to a circular economy, we need to transform the way we use and manage our resources to make them as productive as possible and reduce the environmental and human health impacts of waste.

Per person waste generation

↑ 9%

increase since 2015–16 to 2.65 tonnes per year

Total waste generation

↑ 17%

increase since 2015–16 to 21.9 million tonnes per year

Recycling

64%

of waste diverted for recycling in 2019–20

Litter volume

↓ 43%

decrease against the 2013–14 benchmark

Since 2015–16, the total amount of waste recycled and disposed of has increased. The amount recycled has increased at a higher rate than waste disposed of. Construction and demolition (C&D) waste accounts for the most waste disposed and recycled. Between 2013–14 and 2019–20, the volume of litter in NSW decreased by 43%.

Why waste and recycling is important

Waste and littering can have widespread and damaging effects on the environment and human health. As consumption grows, so does the amount of waste that needs to be effectively managed. Waste can vary in scale and type, from littered cigarette butts and single-use plastics to discarded food and garden organics, illegal dumping of unwanted household items, construction and demolition waste and hazardous waste materials, including asbestos and chemical contaminants.

Recycling and reuse of discarded items and materials is an effective way of managing some of this waste (if waste streams are non-hazardous) and also contributes to a circular economy. Community awareness of recycling options has steadily increased over the last few years as more and more waste is successfully diverted from landfill.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Total waste generation	MODERATE	Getting worse	✓✓✓
Per person waste generation	MODERATE	Getting worse	✓✓✓
Total and per person solid waste disposal	GOOD	Getting worse	✓✓✓
Total and per person solid waste recycled	GOOD	Getting better	✓✓✓
Litter items per 1,000 m^2	GOOD	Getting better	✓✓✓

Notes:
Terms and symbols used above are defined in About this report.

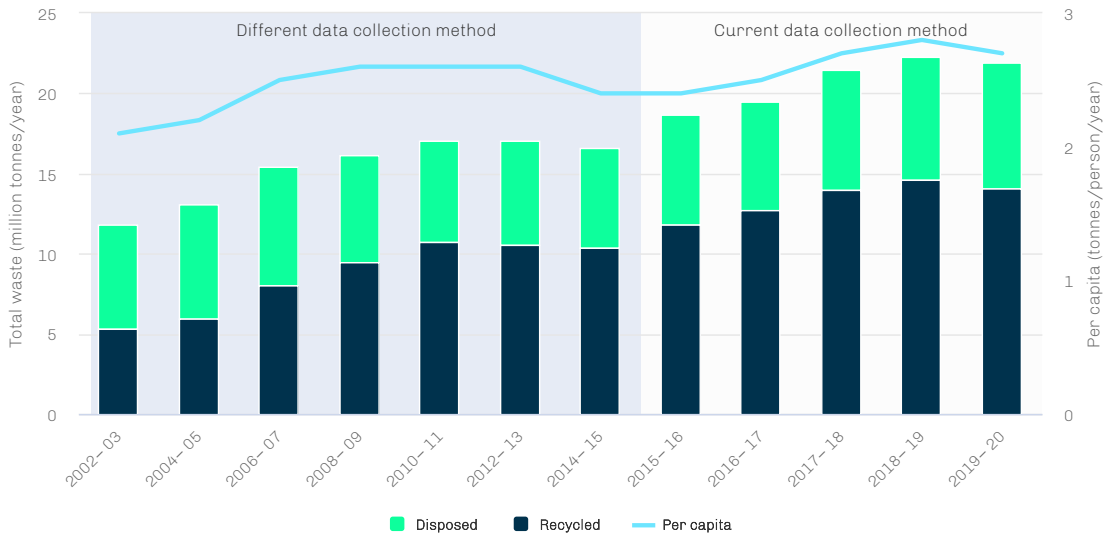
In 2019–20, the proportion of waste diverted for recycling was 64%, an increase of one percent over five years. The construction and demolition (C&D) waste stream accounted for the largest proportion of both waste generated and waste recycled in 2019–20: 12.5 million tonnes of C&D waste were generated, of which 9.6 million tonnes were recycled. The volume of C&D waste has fallen by 9.5% since 2018–19.

The volume of litter in NSW decreased by 43% in six years and the number of littered items decreased by 19%. The largest category of littered items in volume were drink bottles and cans at 35% of the total in 2020. However, since the start of *Return and Earn* scheme in 2017, the volume of litter from these eligible containers has decreased by 52%.

In 2019–20, household waste was the most common type of illegally dumped material at 62% of all incidents recorded in EPA's Report Illegal Dumping online system. Since 2016–17, the total number of recorded illegal dumping incidents increased by 15% from 16,802 to 19,355 reports. However, the number of incidents involving illegal dumping of asbestos has been decreasing since 2016–17.

An estimated 2 million tonnes of hazardous waste was generated in NSW in 2019–20. Asbestos and contaminated soils accounted for 72% of this. Approximately 3% of hazardous waste was exported interstate from NSW in 2019–20. This included zinc compounds moved to SA for recovery, oil to Queensland for recycling, and a range of other waste types to mainly Queensland and Victoria for destruction, disposal, recovery, recycling and reuse. Reasons for interstate export included economics, waste infrastructure gaps and proximity to suitable waste facilities outside NSW.

Spotlight figure 7: Total waste disposed and recycled and waste generated per capita – 2002–03 to 2018–19



Source:
EPA Waste and Resource Reporting Portal (WARRP) data 2021

Spotlight figure 7 shows that between 2016 and 2020, total waste disposed of in NSW steadily increased, while the total tonnes recycled grew at a much higher rate. The total waste disposed of increased from 6.9 million tonnes in 2015–16 to 7.8 million tonnes in 2019–20. In the same period, the total waste recycled increased from 11.8 million tonnes to 14.1 million tonnes. Since 2015, the overall recycling rate remained relatively unchanged.

The volume of litter in NSW decreased by 43% in the six years to 2019–20, while the number of littered items also fell by 19%. Drink bottles and cans remained the largest category of littered items by volume at 35% of the total in 2020. However, the trend has been down since the start of the *Return and Earn* container deposit scheme in 2017. As at September 2021, over 6.1 billion containers had been returned through the scheme's network and over 2 billion returned from kerbside recycling, resulting in a 52% reduction in drink container litter.

In 2019–20, household waste was the most common type of illegally dumped material at 62% of all incidents reported to the EPA's Illegal Dumping Online system. Since 2016–17, the total number of recorded illegal dumping incidents increased by 15% to 19,355 reports. However, the number of incidents involving illegal dumping of asbestos has decreased since 2016–17.

An estimated 2 million tonnes of hazardous waste were generated in NSW in 2019–20. Asbestos and contaminated soils accounted for 72% of this. Approximately 3% of hazardous waste was exported interstate from NSW in 2019–20. Reasons for interstate export included cost efficiency, waste infrastructure gaps and proximity to suitable waste facilities outside NSW.

Pressures

Over the next 20 years, the volume of waste generated in NSW annually is expected to grow from 21 million tonnes in 2021 to nearly 34 million tonnes by 2041. This is due to the continued increase in population and economic growth. Managing high volumes of waste each year is challenging and over time will require more efficient and suitable infrastructure boosted by advances in technology. Facilities for the storage, treatment and disposal of hazardous waste, landfill and liquid waste are approaching capacity.

NSW has also joined an agreement to ban the export of unprocessed plastic, paper, glass and tyres in a bid to move towards a circular economy, increasing the need for adequate infrastructure and processing on shore.

Responses

The NSW Government is committed to the state becoming a circular economy and fulfilling the targets and actions set by the *National Waste Policy*.

The *NSW Waste and Sustainable Materials Strategy 2041* sets out a 20-year vision for reducing waste and changing how the NSW economy produces, consumes and recycles products and materials. The vision and actions in the *NSW Plastics Action Plan* are a key component of this and address each step of the plastics life cycle.

After achieving the Premier's Priority Target to reduce litter by 40% by 2020, a new state target to cut litter items by 60% by 2030 has been announced. NSW will also be using new, more robust measurement tools for tracking terrestrial and marine litter. Anti-littering campaigns such as *Don't be a Tosser!* and new programs for reducing cigarette butt and marine litter will focus on changing public attitudes and behaviour. The *Return and Earn* container deposit scheme has resulted in over 556,000 tonnes of materials being recycled since 2017 and a 52% reduction in drink container.

In alignment with *Net Zero Plan Stage 1: 2020–2030*, the NSW Government has set a goal of net zero emissions from organic waste to landfill by 2030. This includes targets for all NSW food-generating businesses to have a source-separated service for organic waste by 2025 and all households by 2030.

Related topics: Population | Economic Activity and the Environment

Contaminated Sites

Contaminated land can threaten human health, the environment and the Aboriginal cultural values of the land, limit land use and increase development costs. It is typically found on sites of past industrial or agricultural use or where chemicals are stored, such as at service stations.

Remediated sites

30

EPA-regulated significantly contaminated sites were remediated from 2018–20

Notified contaminated sites

139

contaminated sites were notified to the EPA from 2018–20

Petroleum or service station sites

53%

of sites the EPA declared as significantly contaminated from 2018–20 are petroleum industry or service station sites

Regulated sites

36

The EPA declared 36 new sites as significantly contaminated from 2018–20

Between 2018–20, the number of notified and regulated contaminated sites steadily increased. This was matched by an increase in the number of remediated sites. The petroleum industry and service stations represented the largest number of sites declared significantly contaminated by the EPA.

Why managing contaminated land is important

Industrial, agricultural and other commercial activities can result in the discharge of substances to land which contaminate it by accumulating in soil, sediments, groundwater, surface water or air. Some of these substances can remain in the environment for a long time, have an adverse impact on human health or the environment and degrade the productive use of land or water.

Contaminated land must be managed to ensure there are no unacceptable risks to human health or the environment from the contamination and to ensure that land is suitable for its current or approved use.

The SoE Aboriginal Peoples Knowledge Group has noted that legacy land contamination can be an issue on Crown land transferred to Aboriginal people under the *Aboriginal Land Rights Act 1983*. This is a concern among Aboriginal communities and land holders.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Number of regulated contaminated sites*	MODERATE	Getting better	✓✓✓
Number of regulated contaminated sites remediated**	MODERATE	Getting better	✓✓✓

Notes:
Terms and symbols used above are defined in About this report.

*An increase in the number of contaminated sites being regulated is a positive indicator because it means there has been an increase in regulatory oversight of contamination.

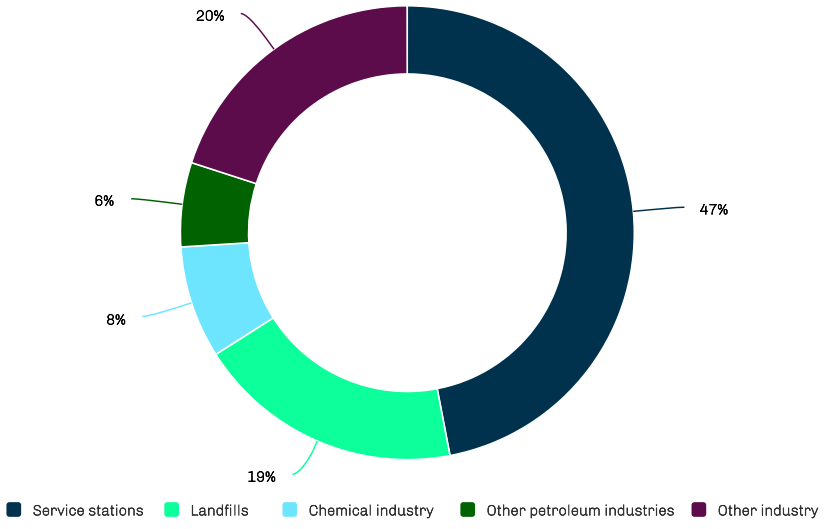
**An increase in the number of regulated contaminated sites remediated is a positive indicator because a remediated site is no longer significantly contaminated, that is, the number of significantly contaminated sites has decreased.

Status and Trends

As at December 2020, 1,805 contaminated sites had been notified to the EPA, of which 388 required regulation. Of these regulated sites, 185 have been remediated.

Between January 2018 and December 2020, 139 new sites were notified to the EPA, of which 36 were significantly contaminated. Service stations and other petroleum industries accounted for 53% of the new sites (see **Spotlight figure 9**).

Spotlight figure 9: Number of newly regulated sites between January 2018 and December 2020 under the Contaminated Land Management Act by contamination type



Source:
EPA data 2021

Pressures

Sites in the major coastal cities, particularly Sydney, are remediated more quickly than in rural areas as there is more demand for land in cities for residential and commercial development. However, the extent of contamination beneath the surface of the land is often difficult to identify and manage, so characterising the risks and costs of remediation can be challenging and time consuming.

Responses

The EPA manages land declared as 'significantly contaminated' under the *Contaminated Land Management Act 1997*. Land that is not declared as 'significantly contaminated' is regulated by planning authorities, including local councils, who generally deal with the contamination under their planning and development processes.

To respond to the contamination challenges from service stations and petroleum industries, the NSW Government introduced the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation in 2008, which required operators of UPSS to install tanks and pipes for underground fuel systems in accordance with industry best practice, and to monitor those systems for leaks.

When the UPSS Regulation was first made, the EPA was declared to be the Appropriate Regulatory Authority (ARA) for all UPSS-related matters. On 1 September 2019 local councils resumed responsibility for regulating most UPSS sites in their local areas, which are mostly service stations. The EPA continues to publish technical and guideline documents to support management and clean-up of these sites.

In March 2021, the use of PFAS firefighting foam was banned in most situations to reduce its impact on the environment. However, it can still be used when responding to catastrophic fires by relevant authorities and exempt entities. The Protection of the Environment Operations (General) Amendment (PFAS Firefighting Foam) Regulation 2021, was published in March 2021 and is the first step in the NSW Government's commitment to gradually replace PFAS-containing firefighting foams with appropriate alternatives.

The EPA is leading an investigation program to assess the legacy of PFAS use across NSW, focusing on sites where large quantities of PFAS were used in the past. As at June 2021, the EPA had conducted 914 investigations.

DPIE Crown Lands endeavours to identify and appropriately deal with contamination issues on land prior to determination of any Aboriginal land claim or transfer of ownership under the *Aboriginal Land Rights Act 1983*. Given the size and nature of the Crown estate, it is not always possible to resolve all issues prior to transfer, especially with illegal dumping which can occur at unknown locations. Since 2016 DPIE Crown Lands has adopted a Contaminated Land Management Strategy to help reduce occurrence of this issue and, where necessary, remediate contaminated sites to an extent consistent with their existing purpose or use. The onus to remediate or clean up transferred Crown Land (under the Aboriginal Land Rights Act) does not transfer with the land, foremost remaining with the person responsible for the contamination where land is determined to be significantly contaminated under the Contaminated Land Management Act.

Climate and Air

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Climate and Air

The emissions that we release into the atmosphere affect the quality of the air we breathe and may build up in the atmosphere contributing to climate change.

Introduction to Climate and Air

The topics in this theme describe air quality in NSW and the effects of carbon emissions on our climate, as well as how climate change already affects many aspects of our environment.

Energy generation, industrial and manufacturing processes and transport give rise to emissions of air pollutants and greenhouse gases. Ensuring that air quality remains safe and healthy is essential to provide a clean living environment and maintain the wellbeing of the NSW population. While air quality is generally good in NSW, the levels of the major pollutants and the issues that can arise in some situations are discussed in the Air Quality topic.

The build-up of greenhouse gases in the atmosphere since the start of the industrial age is causing our climate to change with potentially serious consequences. The overall levels and trends in greenhouse gas emissions in NSW are described in the Greenhouse Gas Emissions topic. The changes in current temperature and weather patterns in NSW and future projections of change are discussed in Climate Change, as well as the impacts of these changes on the environment more generally.

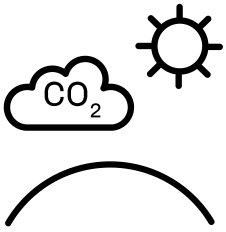
In this report:

- The effects of climate change, especially increases in temperature, are already being felt and will become more intense in the future.
- NSW greenhouse gas emissions in 2018–19 were 136.6 million tonnes of carbon dioxide equivalent (CO_2-e), which is 17% lower than in 2005.
- By 2030, emissions are projected to be 47–52% lower than 2005 levels with current policies implemented.
- NSW air quality is generally good, although particle pollution soared in 2019 due to the continuing drought and unprecedented and extensive bushfires.

Aboriginal Perspectives

Over tens of thousands of years, Aboriginal people and cultures have been able to live effectively with changing climates. Intergenerational knowledge handed down through vibrant cultures has meant Aboriginal peoples have intimate and detailed knowledges of their respective Country and climates. This knowledge has also resulted in effective understanding and management of place, including seasonal calendars which relate to specific lands and waters that guide Aboriginal people on climate matters.

Aboriginal communities and peoples are, and continue to grow as, major landowners, developers and caretakers across NSW. Decision-makers need to recognise and work with these opportunities to further develop outcomes that Aboriginal peoples are presenting in their land management practices, including those that contribute to a reduced carbon footprint.



Greenhouse Gas Emissions

Although generating and using energy from non-renewable sources in NSW continues to produce greenhouse gas emissions, their levels are decreasing. With current policies implemented, emissions by 2030 are projected to be 47–52% lower than 2005 levels.

Greenhouse gas emissions in NSW were

136.6 million tonnes

of CO_2-e in 2019, representing 26% of Australia's total emissions

After peaking in 2007, greenhouse gas emissions in 2019 in NSW were

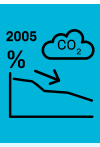
⬇ 17%

lower than in 2005

Greenhouse gas emissions in NSW are projected to be

78.9–87.6 million tonnes

of CO_2-e in 2030



Greenhouse gas emissions in 2030 are projected to be

⬇ 47–52%

lower than in 2005

In 2018–19, NSW recorded net greenhouse gas emissions of 136.6 million tonnes carbon dioxide equivalent (CO_2-e). Emissions peaked in 2007 and were 17% lower in 2019 than in 2005. Emissions have declined across most economic sectors, with the exception of transport, which has undergone almost uninterrupted growth in emissions.

By 2030, with current NSW Government policies implemented, greenhouse gas emissions are projected to fall to 78.9–87.6 million tonnes CO_2-e, a 47–52% reduction from 2005 levels. Electricity generation emissions are forecast to reduce significantly as a result of an increased share of renewable energy as the state's coal-fired power stations are retired.

Why managing greenhouse gas emissions is important

Burning and extracting fossil fuels and certain chemical processes release greenhouse gases which build up in the atmosphere causing extra heat to be trapped by the atmosphere and resulting in global warming. Human activities are estimated to account for global warming of between 0.8°C and 1.3°C above pre-industrial levels. Unless deep reductions in greenhouse gas emissions occur, global warming will exceed 1.5–2°C during the 21st century (IPCC 2021).

Managing the amount of greenhouse gas emissions released and sequestered will be vital to the ongoing health of our state's ecosystems and viability of key economic sectors.

The impacts of increased greenhouse gas concentrations and climate change to NSW are explored in the Climate Change topic.

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Atmospheric concentrations of greenhouse gases	**POOR**	Getting worse	✓✓✓
Annual NSW greenhouse gas emissions	**POOR**	Getting better	✓✓✓
Annual NSW per capita greenhouse gas emissions	**POOR**	Getting better	✓✓✓

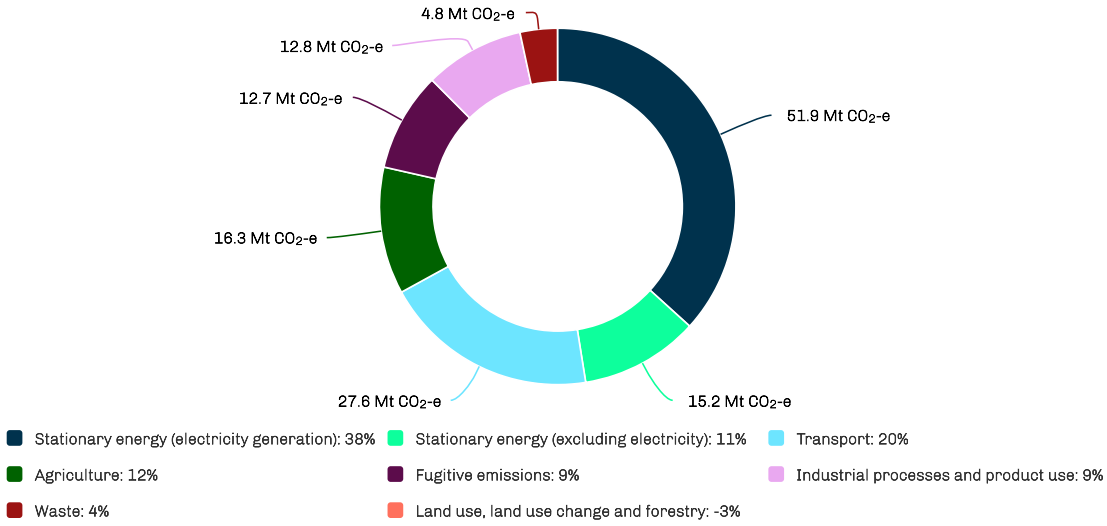
Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

In 2018–19, per capita NSW greenhouse gas emissions, including land use, land-use change and forestry, were 16.9 tonnes CO_2-e. While this is below the national average of 20.9 tonnes per capita, both are much higher than the global per capita average of 6.6 tonnes last recorded in 2014.

Stationary energy, primarily from electricity generation, is the largest source of greenhouse gas emissions in NSW at 38%, followed by emissions from transport (20%), agriculture (12%), industrial processes and product use (9%) and fugitive emissions from coal and gas (9%) (**Spotlight figure 5**). The land use, land-use change and forestry sector is currently a carbon 'sink' as it stores more carbon than it emits and thus reduces the state's emissions by 3%.

Spotlight figure 5: NSW greenhouse gas emissions by UNFCCC key categories, 2018–2019



Notes:
The sum of percentages shown above will be greater than 100% as values are rounded and it does not show removals from the land use, land-use change and forestry sectors, which equate to approximately 3% of emissions (4.7Mt CO_2-e).

Source:
Australian Department of Industry, Science, Energy and Resources (DISER 2021f)

By 2030, emissions from electricity generation are expected to fall substantially as initiatives to increase renewable energy take effect. These initiatives are projected to reduce NSW greenhouse gas emissions by 23–31%. Transport is projected to become the largest source (33–36%) of NSW emissions by that time, with emission reductions from the uptake of light duty electric vehicles and the electrification of buses offset by increasing emissions from aviation and trucks. Emissions from agriculture will represent 18–20%, fugitive emissions from fuels 12–14% and industrial processes and product 9–10% of NSW emissions. Net carbon sequestration by the land sector is projected to increase, reducing NSW emissions by 8–9%.

Pressures

Economic activity and population growth are key drivers of greenhouse gas emissions. Most emissions are from energy use, transport, land clearing and agriculture.

Responses

The *Net Zero Plan Stage 1: 2020–2030* (DPIE 2020a) sets out the NSW Government's long-term objective to achieve net zero emissions by 2050. Base case trends in NSW emissions, and initiatives under the plan's first stage are projected to achieve a 47–52% reduction in emissions by 2030, compared with 2005 levels as reported in the *Net Zero Plan Stage 1: 2020–2030 Implementation Update* (DPIE 2021f).

Related topics: Energy Consumption | Climate Change | Net Zero Plan Stage 1 2020–2030

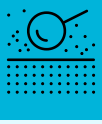
Air Quality

Good air quality is essential for providing a clean environment and maintaining the health of the NSW population.

Particle concentrations in regional areas exceeded national standards up to

151 days a year

between 2018 and 2020



Ground level ozone in Sydney exceeded national standards up to

28 days a year

between 2018 and 2020 in Sydney

NSW air quality was generally good in 2018 and most of 2020. However, particle pollution soared in 2019 due to the continuing drought and unprecedented extensive bushfires. Concentrations of carbon monoxide, nitrogen dioxide, lead and sulfur dioxide generally complied with national air quality standards, but levels of particles and ozone pollution continued to be of concern.

Why managing air pollution is important

Air pollution is the release of particles and gases into the air that can adversely affect human health and the environment. Short-term exposure to elevated air pollutants worsens respiratory and cardiovascular problems and increases the risk of acute symptoms, hospitalisation and even death. Longer-term exposure can lead to chronic respiratory and cardiovascular disease and mortality and permanently affect lung development in children.

The impacts of air pollution can vary according to its source, location and the weather conditions. Pollution may spread over large areas and affect many people or it may be concentrated on communities at a smaller, more local scale. High levels of air pollution can cause severe health conditions, but even low levels of pollution that meet air quality standards can potentially harm those exposed over the long term. Vulnerable people, including the elderly, children and those with chronic health conditions, are generally the most affected.

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Concentrations of ozone	**MODERATE**	Stable	✓✓✓
Concentrations of particles (PM_{10}*)	**MODERATE**	Stable	✓✓✓
Concentrations of particles ($PM_{2.5}$**)	**MODERATE**	Stable	✓✓✓
Concentrations of carbon monoxide	**GOOD**	Stable	✓✓✓
Concentrations of nitrogen dioxide	**GOOD**	Stable	✓✓✓
Concentrations of sulfur dioxide	**GOOD**	Stable	✓✓✓
Concentrations of lead	**GOOD**	Stable	✓✓

Notes:
Terms and symbols used above are defined in About this report.

* PM_{10} refers to particles which are 10 micrometres (10µm) or less in diameter.

** $PM_{2.5}$ refers to particles which are 2.5 micrometres (2.5µm) or less across.

Status and Trends

Smaller particles in the air are invisible to the naked eye and can be inhaled deep into the lungs. Two sizes of airborne particles are monitored: PM_{10} with particles 10 micrometres or less in diameter and even tinier $PM_{2.5}$ particles which are 2.5 micrometres or less across. Growing evidence about the adverse health impacts of these particles prompted a tightening of national air quality standards to better address this issue.

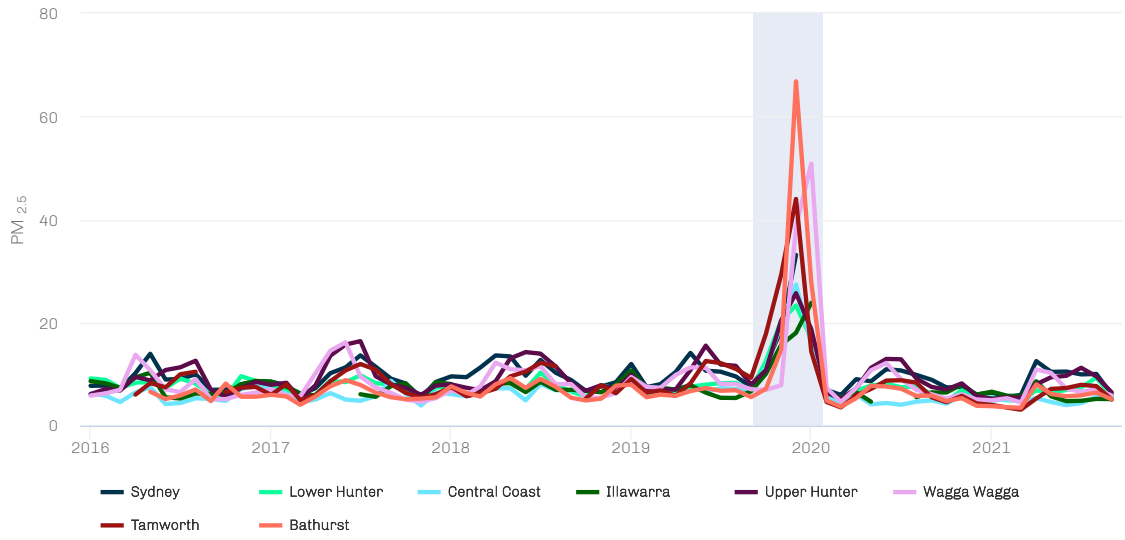
Particle pollution generally meets national air quality standards in Sydney, except when natural events such as bushfires or dust storms occur and during hazard reduction burns. Between 2018 and 2020, PM_{10} and $PM_{2.5}$ concentrations exceeded the national air quality standards on up to 58 days a year in Sydney and up to 151 days a year in regional areas

of NSW. These maximum readings were largely due to dust storms and the 2019–20 'Black Summer' bushfires and were the highest in NSW since 1996.

Concentrations of ground-level ozone, a key component of photochemical smog, exceeded national air quality standards in Sydney on six or fewer days in 2018 and 2020 – similar to most years since 2010 – but climbed to a record 28 days in 2019. Nitrogen oxides and volatile organic compounds are the main precursors of ozone and they generally originate in emissions from industrial facilities, power stations and motor vehicle exhausts. The elevated ozone levels in 2019 reflected that year's warm dry weather and emissions from extensive bushfires.

The levels of other pollutants of potential concern, such as nitrogen dioxide and sulfur dioxide, are typically 25–75% lower than the national air quality standards across NSW.

Spotlight figure 8: Monthly average $PM_{2.5}$(fine particulate matter) levels over 5 years from select monitoring stations



Notes:
Plot band highlights the 2019–2020 bushfires. Monitoring stations with 5 years of data and representative of the region's air quality have been selected.

Source:
DPIE calculation from NEMP Air Quality monitoring stations.

Monthly average $PM_{2.5}$ (fine particulate matter) readings in **Spotlight figure 8** show that while on average NSW has good air quality, there are measurable impacts on air quality from:

- bushfires, notably the unprecedented Black Summer bushfires in late 2019 through to early 2020
- seasonal variability with higher concentrations in winter, from the use of wood heaters, agricultural burning, as well as the natural impact of less air movement during cooler months due to temperature inversions
- drought conditions in 2017 to 2020, where vegetation coverage was lower, and topsoil was more easily picked up by
- wind impact of longer term weather factors, such as improvements from mid-2020 onwards due to wetter conditions caused by La Nina.

Pressures

Everyday activities can affect air quality in NSW. The transport we use, how we heat our homes and the industries producing our goods and services – all generate a range of air pollutants that can threaten our health.

Exposure to hazardous levels of air pollution can be expected during extreme events, such as the increasing number of bushfires and dust storms. Climate change is likely to result in changes to more and different air pollution episodes, which could be characterised by high pollutant levels lasting up to several days extending over wider areas. Air quality in our cities is also under pressure from population and economic growth.

Responses

The NSW air quality monitoring network is the largest in Australia with more than 90 long-term stations, well in excess of the number recommended by the *National Environment Protection (Ambient Air Quality) Measure*.

The NSW Government regulates industry emissions to air and also monitors and delivers coal mine dust management compliance campaigns. These are to ensure open cut coal mines in the upper Hunter minimise particle emissions. Other campaigns include regulating the sale of wood heaters, supporting local councils in managing wood smoke from domestic wood heaters through periodic Wood Smoke Reduction Programs and providing community education materials.

The NSW Government also implements strategies such as the Summer Petrol Volatility Program and the Vapour Recovery Program to reduce petrol emissions from service stations. The national air quality standards for ozone were revised in 2021 to reflect health evidence and Australia's climate.

Air quality is also a key component of other government strategies. These include the Net Zero Plan, NSW Electricity Strategy, NSW Electric Vehicle Strategy, NSW Hydrogen Strategy, Greater Sydney Regional Plan - A Metropolis of Three Cities , NSW Freight and Ports Plan, Future Transport 2056 and NSW Electricity Infrastructure Roadmap. These strategies all include goals and actions to improve air quality. The government, through DPIE and the EPA, also conducts air quality research and modelling and advocates at the national level for improved air quality standards.

Related topics: Climate Change | Energy Consumption | Greenhouse Gas Emissions | Transport

Climate Change

The effects of climate change on the people and the environment of NSW are expected to become greater as warming continues.

Sea level rise

↑ 3.4mm

rise in sea level per year at Port Kembla tidal gauge since 1991, equating to a total increase in mean sea level of around 10 cm

Long-term rainfall trends

~15% decline

in April to October rainfall over southern NSW during the last 20 years (2000–19) relative to 1900–99, despite strong natural variability

Increase in temperature

↑ ~1.1°C

increase in mean NSW temperature from 1961–90 to 2011–20

Significant climate related risks to human and natural systems risk increase at

1.5°C

average global warming and above

The climate of NSW is changing due to global warming. The effects of climate change on the people and environment of NSW are expected to become more pronounced as the climate continues to change over this century.

Why climate change is important

Emissions of CO_2 and other greenhouse gases from human activity including power generation, industry, transport, land-use and land cover change, and agriculture, accumulate in the atmosphere, trapping heat and leading to global warming.

Without substantial, concerted action, climate change poses a major threat to humanity and most living systems on Earth. While impacts are being observed now, they will become more pronounced over time. Extreme events such as extreme heat, dangerous fire weather and heatwaves are projected to increase in duration, magnitude and frequency with impacts on communities and infrastructure.

In 2016, 194 nations (98%) signed the Paris Climate Agreement, which focuses on limiting global warming to well below 2°C and aims to limit warming to 1.5°C. Each country has pledged to make national contributions to reducing greenhouse gas emissions. However, concentrations are continuing to increase at rates that will increase temperatures beyond the

Paris Agreement targets. Cuts in emissions well beyond those pledged under the agreement will be necessary to meet the target. Even with global warming of 1.5°C, climate-related risks for human and natural systems will be higher than they are today (IPCC 2021). The extent of the impacts of climate change will ultimately be determined by the concerted actions taken by nations globally to reduce greenhouse gas emissions.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Annual mean temperature (present)	MODERATE	Getting worse	✓✓✓
Sea level rise (present)	MODERATE	Getting worse	✓✓✓
Rate of temperature warming	POOR	Stable	✓✓✓
Annual mean temperature (2070): projected outcomes	POOR	Getting worse	✓✓
Sea level rise (2070): projected outcomes	POOR	Getting worse	✓✓

Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

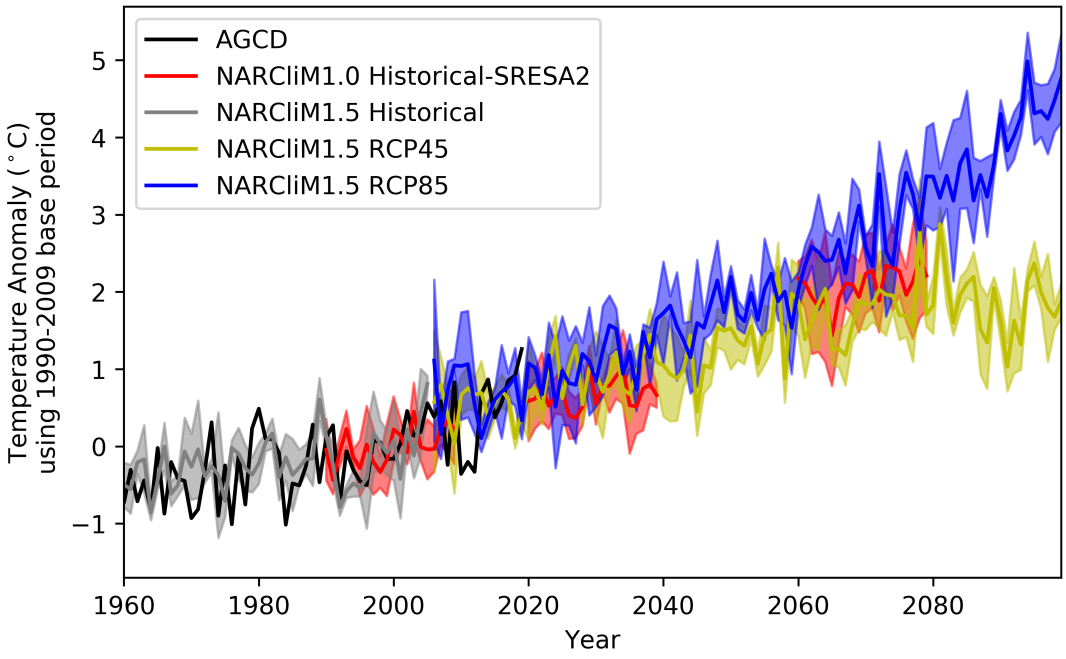
Globally, warming has increased by approximately 1.1°C since industrialisation (1850–1900). Based on current trajectories, global temperature will likely increase by approximately 1.5°C by around 2030. Exceeding this target will result in more serious and frequent heat extremes and bushfires, and fewer cold extremes.

In NSW, the mean temperature for 2011–2020 was about 1.1°C higher than late last century (1961–90), with 2018 and 2019 being the warmest years on record. Mean temperatures during 2020 in NSW were generally above average, with the exception of the state's south-west. Black Summer fires peaked in December 2019–January 2020, causing widespread destruction and prolonged poor air quality in Sydney and Canberra.

Other observed changes include increased seasonal variability in rainfall and increases in some extreme weather events such as heatwaves.

The changes to climate are expected to become more severe over time. Regional climate projections over NSW suggest that by 2070 mean temperature will have risen by a further 2.1°C relative to a 1990–2009 baseline period, with much larger increases in extreme temperatures (**Spotlight figure 21**).

Spotlight figure 21: Observed and projected changes in annual mean temperatures for NSW and the ACT



Notes:

Projected changes in annual mean temperatures use data from two generations of NARCliM regional climate simulations, NARCliM1.0 and NARCliM1.5. Together, these simulations are designed to complement each other and provide a range of plausible climate futures.

AGCD data is from http://www.bom.gov.au/climate/austmaps/about-agcd-maps.shtml0

Source:

DPIE NSW and ACT Regional Climate modelling (NARCliM) project. Adapted from Nishant et al. 2021, Figure 12.

Since the late 20th century, sea surface temperatures (SST) in the western Tasman Sea have increased by 0.2–0.5°C per decade. For the Sydney area, SST have increased by 0.2°C per decade since 1945.

The rate of sea level rise has nearly doubled. From an average rate of 1.7 mm per year during most of the 20th century, sea levels at the Port Kembla Baseline Sea Level Monitoring Station now indicate an average 3.4 mm increase per year since 1991. Globally, sea levels are expected to rise by a half to one metre by the end of the 21st century.

Pressures

The future effects of climate change will be extensive, including more extreme weather events, increasing coastal erosion and inundation and greater impacts on infrastructure, human health and wellbeing. The survival of many species and ecosystems, water availability, and the productivity of some agricultural systems will be affected.

Responses

Effective action to counteract the effects of climate change depends on concerted action globally. The extent of climate change impacts will be determined by mitigation and adaptation actions and the time taken to reduce greenhouse gas emissions.

The NSW Climate Change Policy Framework released in 2016 sets targets for NSW to achieve net zero emissions by 2050, become more resilient to a changing climate and adapt to climate change.

The AdaptNSW website provides guidance on implementing adaptation actions. Integrated Regional Vulnerability Assessments have been completed across NSW to identify regional areas where adaptation actions are needed.

The NSW and ACT Regional Climate Modelling project (NARCliM) (Evans et al. 2014, Nishant et al. 2021) provides high resolution projections of plausible future climate changes regionally for NSW and south-eastern Australia and has informed many of the projections in this chapter. NARCliM regional climate projections are available at the NSW Climate Data Portal.

Related topics: Economic Activity and the Environment | Energy Consumption | Greenhouse Gas Emissions | Transport

Land

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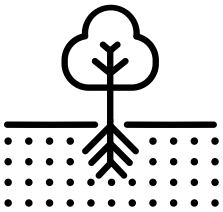


Land

How our land is used and managed is the main determinant of its condition and the health of native species and ecosystems.

Introduction to Land

The topics in this theme describe the condition of our land and its ability to provide ecosystem services and suitable habitat for native species and ecosystems.

The natural environment is subject to disturbance from human uses of the land and associated land management practices. Managing the land sustainably and maintaining the quality of habitat for natural ecosystems and wildlife enhances their prospects for survival in the longer term. Fire is an integral part of the natural environment and essential to the growth and reproduction of many natural systems and Country, but altered fire regimes are a threat to the sustainability of ecosystems and species.

Healthy soils provide essential ecosystem services and the primary productivity that supports natural ecosystems and the economic prosperity of the state. The health of soils in NSW and recent changes in condition are described in the Soil Condition topic. Changes in the extent and condition of native vegetation and the quality of habitat it provides, as well as recent trends in clearing rates, are discussed in Native vegetation. The preservation of ecosystem,s and habitats is covered in the Protected Areas and Conservation topic. The impacts of fire and altered patterns of burning on the health of ecosystems and species, especially too much fire, are discussed in the Fire topic.

In this report:

- While native vegetation covers 69% of NSW, the ecological carrying capacity of this vegetation is estimated at just 31% of natural levels in the aftermath of the 2019–20 Black Summer fires.
- Since 2018, more than 300,000 hectares have been added to the public reserve system, which now covers around 9.6% of land in NSW.
- In contrast, permanent clearing of native woody vegetation in NSW has increased about three-fold since 2015 and stands at an average of 35,000 ha cleared each year. Permanent clearing of non-woody vegetation, such as native shrubs and ground covers, occurs at an even higher rate.
- Soil resources in NSW are generally in a moderate condition. Ongoing declines are mainly due to acidification caused by intensified land use, with the added recent hazard of wind erosion levels which has increased four-fold over the past three years due to prevailing weather conditions.
- The Black Summer fire season was the most severe ever recorded in NSW with about 5.5 million hectares burnt. It is estimated more than a billion animals were killed, burnt or displaced in NSW. Where fire history is available, an estimated 62% of vegetation is now under pressure from too much fire.

Aboriginal Perspectives

Everything is connected. How we use and care for the land/Country impacts on its health. Healthy land/Country means not only healthy plants, animals and ecosystems but also healthy people.

Country is more than a place. It is our soul and our identity. We speak about Country like we are speaking about a person, taking care of our lives in every aspect – spiritually, physically, emotionally, socially and culturally.

In 2021, NAIDOC invited the nation to 'heal Country!' – a call for stronger measures to recognise, protect and maintain all aspects of Aboriginal and Torres Strait Islander cultures and heritage. To understand the state of our environment is to understand what the environment means to Aboriginal people. Caring for Country is not just an ambition, it is Aboriginal Lore. From the beginning, Aboriginal people have protected Country. This has included the use of cultural burning, also known as fire-stick farming, which has helped to shape the biodiversity, ecology and character of our Country.

For generations, Aboriginal peoples have been calling for stronger action and to be a part of protecting all Country. To do this better and to learn requires understanding, recognition, respect and promotion of Aboriginal people's rights to culture and Country and working with Aboriginal peoples as partners in the development and implementation of policies and programs.

Aboriginal peoples have been caring for the land and Country from the beginning and they embrace the opportunity to teach the wider community about Aboriginal culture and land management practices. The combination of Aboriginal cultures and western sciences into all types of land management will enhance environmental outcomes.

The NSW *Our Place on Country Aboriginal Outcomes Strategy 2020–23* outlines ways to respectfully embed Aboriginal cultural knowledge and empower Aboriginal voices in decision-making. The strategy encourages working together to advocate for and celebrate the living history of Aboriginal communities that have existed within our state for thousands of generations.

In the spirit of NAIDOC in 2021, and in recognition of our people, we say heal Country, heal our nation.

Soil Condition

Healthy soil resources support natural biomes, provide essential ecosystem services and productivity that enable the agricultural industry to prosper.

Wind erosion

There was more than **400%** average increase in dust hours between 2017 and 2020 compared to the previous 10-year average

Loss of soil organic carbon

3.1%

of natural carbon stocks have been lost across NSW since 2006

Between 2017 and 2020, wind erosion was a major issue with significantly elevated dust levels and loss of topsoil arising from recent drought conditions across western and central NSW.

The main ongoing issues contributing to deterioration in soil condition and productivity across NSW are increasing acidification and the continuing decline of soil organic carbon in agricultural soils due to the intensification of land use.

Why soil condition is important

Soils make a significant contribution to the ecological integrity of the environment and economic prosperity of NSW. Healthy soils deliver essential ecosystem services, including:

- nutrient transformation and cycling
- water infiltration and filtering
- climate regulation through carbon storage and cycling
- providing habitat for biota
- supporting natural ecosystems
- enabling farming for food and resources.

Soil is a non-renewable resource, as its formation is an extremely slow process beyond human timeframes (Bui et al. 2010; Stockmann et al. 2014). Therefore, to maintain productivity and ecosystem services, soils must be managed sustainably to prevent them becoming degraded.

NSW indicators

Indicator and status	Environmental trend	Information reliability
Soil pH (acidification) **MODERATE**	Getting worse	✓✓

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Organic carbon	**MODERATE**	Getting worse	✓✓
Wind erosion	**POOR**	Getting worse	✓✓
Hillslope erosion	**MODERATE**	Stable	✓✓
Salinisation	**MODERATE**	Stable	✓✓
Acid sulfate soils	**MODERATE**	Getting better	✓✓

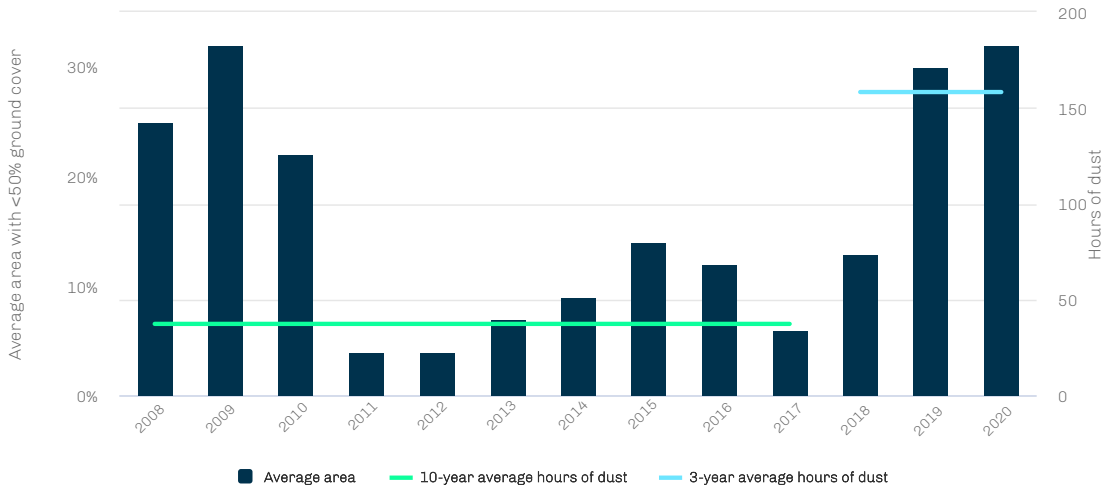
Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

The increasing intensity of land use, climate variability and extreme weather events, are the greatest risk factors in maintaining soil condition and the provision of ecosystem services.

Conservation farming practices introduced over recent decades, including the maintenance of groundcover vegetation and reduced tillage, are helping to mitigate erosion and declines in some soil condition parameters in the face of ongoing and increasing pressures.

Spotlight figure 10: Average dust hours and area with less than 50% total vegetation cover recorded at NSW DustWatch stations



Notes:
Years shown are financial years and so cover the 12 months ending 30 June of that year.

Source:
DustWatch data 2020

the Spotlight figure 10 shows dust hours recorded were 4.2 times the average levels of the previous 10 years and wind erosion worsened across NSW with negative impacts on soil loss and air quality.

The average area of less than 50% groundcover has increased from the previous 10-year average of 14% to 25% over the past three years, attributable to extreme climate conditions.

Pressures

While land management practices have generally improved, the pressure on soil condition continues due to the increasing intensity of land use across NSW. There is, therefore, a greater need to ensure that soils and land are managed sustainably and within their inherent physical capacity to handle a specific level of disturbance or use.

While soil may be managed sustainably with little risk of degradation in normal weather, the unpredictability and variability of severe weather events can rapidly reduce its capacity to absorb disturbance, leading to loss of soil condition and degradation.

Due to a changing climate, these conditions are likely to occur more frequently, leading to a greater focus on how to retain and manage groundcover.

Responses

Legislation and policies to regulate soil conservation and the clearing of native vegetation include the:

- *Soil Conservation Act 1938*
- *Local Land Services Act 2013*
- *Biodiversity Conservation Act 2016*

These laws aim to achieve a balance between land use and biodiversity conservation in NSW.

Policies for sustainable soil management in NSW include:

- *State Environmental Planning Policy (Rural Lands) 2008*
- the *Policy for Sustainable Agriculture in NSW* (NSW Agriculture 1998)

NSW is a signatory to the *National Soil Strategy* which provides a national framework for coordinated action on soil by governments, industry and stakeholders.

Eleven regional natural resource management bodies, under Local Land Services (LLS), are working with local farmers, landholders and communities, including Landcare groups, to develop strategies and programs to improve natural resource management and sustainable land use across NSW.

Farmers and landholders are also independently adopting improved land management practices, due to a greater awareness of, and commitment to, sustaining their operations and protecting environmental values.

Related topics: Climate Change | Native Vegetation

Native Vegetation

Maintaining native vegetation in good condition is critical to the survival of the species and ecosystems that depend on it.

Summary

Permanent clearing of woody vegetation

35,000 ha each year

on average from 2017 to 2019, compared to 13,000 ha on average each year from 2009 to 2015

Intact native vegetation cover in NSW

69%

comprising 50% woody vegetation and 19% non-woody native vegetation

Ecological condition of overall vegetation habitat

42%

2% decrease following the bush fires in 2020

Ecological carrying capacity of overall vegetation habitat

31%

2% decrease following the bush fires in 2020

Following the Black Summer bushfires it is estimated 31% of the ecological carrying capacity of native vegetation in NSW remains, compared to pre-European settlement. The rate of loss of vegetation in NSW due to clearing has steadily increased since 2015.

Why native vegetation matters

Native vegetation provides essential habitat for plant and animal species, and is an integral component of healthy, functioning ecosystems. For tens of thousands of years, First Nations peoples have been stewards of the natural landscape which helped to shape the biodiversity and character of our Country.

Clearing of native vegetation, and the destruction of habitat that is associated with it, has been identified as the single greatest threat to biodiversity in NSW (Coutts-Smith & Downey 2006).

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Permanent clearing rate for woody native vegetation	**MODERATE**	Getting worse	✓✓✓
Extent of native vegetation	**MODERATE**	Getting worse	✓✓✓
Condition of native vegetation	**MODERATE**	Getting worse	✓✓
Ecological carrying capacity	**MODERATE**	Getting worse	✓✓
Levels of pressure on the condition of native vegetation	**MODERATE**	Stable	✓

Notes:
Terms and symbols used above are defined in About this report

Status and Trends

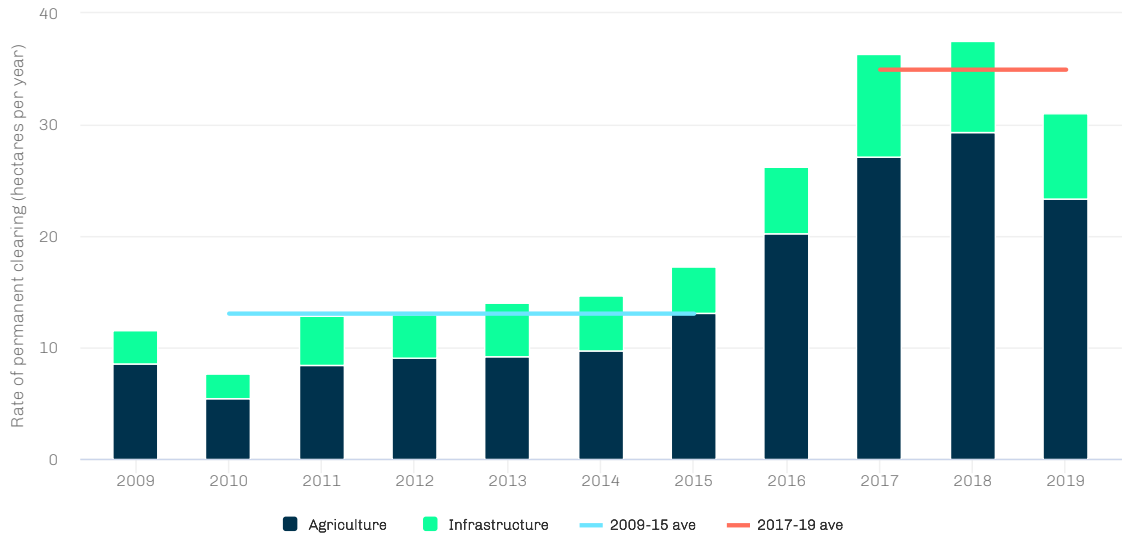
The state has 49.8% woody native vegetation cover and 19% non-woody vegetation cover in which the structure has not been substantially altered. Woody vegetation includes heathlands, forests, woodlands and shrublands higher than two metres. Non-woody vegetation includes grasses, small shrubs, herbs and groundcover. While structurally intact, vegetation condition across both woody and non-woody extents is declining largely due to the effects of different land uses and land management practices.

Habitats in National Parks and Wildlife (NPWS) reserves across the State remain relatively intact, with 63% of their original ecological carrying capacity remaining. Habitats in all other land tenures retain only 30% of their original ecological carrying capacity, but areas of native vegetation are also being protected through private land conservation.

The pattern of habitat loss and degradation varies between bioregions and across tenures. Habitat in the Australian Alps, South East Corner and NSW North Coast bioregions has remained the most intact relative to other bioregions with 53% to 62% of their original ecological carrying capacity remaining. Land has been used more intensively in the NSW South Western Slopes, Brigalow Belt South and Riverina bioregions, resulting in less remaining and more fragmented habitat relative to other bioregions, and therefore, less remaining ecological carrying capacity overall (15% to 25%).

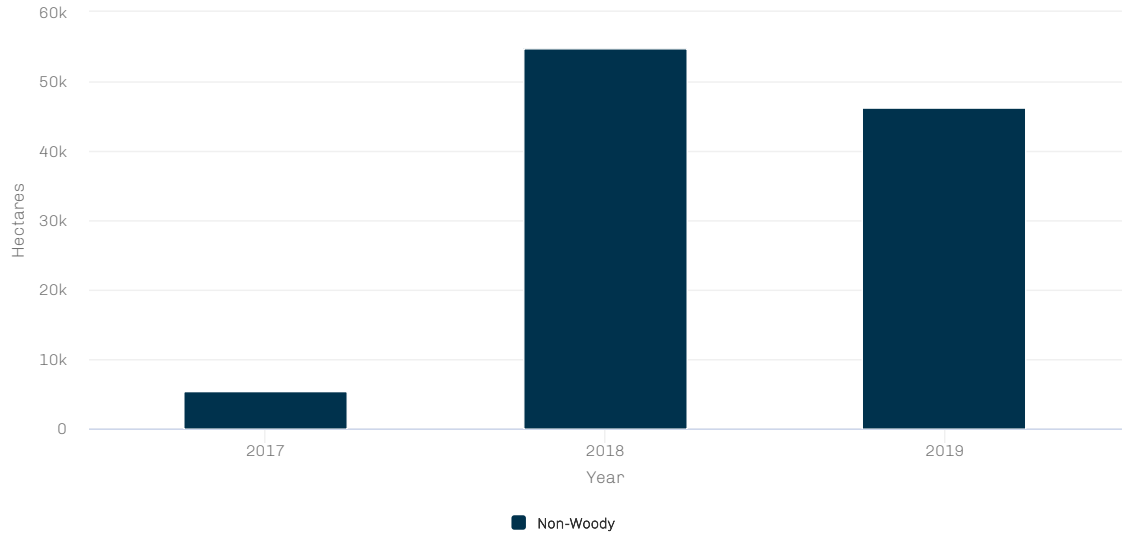
The Black Summer bushfires of the spring and summer 2019–20 altered large areas of habitat for species and ecosystems in NSW. Following the fires in 2020, overall ecological condition and ecological carrying capacity for NSW both decreased by 2%, to 42% and 31% respectively. Within the immediate fire ground, ecological condition decreased from 72% in 2013 to 44%, a 39% reduction, while ecological carrying capacity decreased from 62% to 38%, a 24% reduction. The longer term impacts are still being assessed and the recovery process will continue for many years.

Spotlight figure 13a: Permanent clearing of woody vegetation each year in NSW 2009–2019



Notes:
Rate of permanently removal of woody vegetation from DPIE analysis of satellite imagery to classify landcover types. Satellite imagery used for this analysis was captured by SPOT and Sentinel 2 remote sensing.

Spotlight figure 13.b: Non-woody vegetation clearing on regulated land



Notes:
Regulated land is where authorisation may be required from Local Land Services for native vegetation clearing. This category makes up around 54% of land in NSW. The non-woody vegetation removal figures above depict only clearing that occurs on Category 2 regulated land. Additional clearing of non-woody vegetation, on excluded or category 1 exempt land, has not been included. Landholders also have a range of allowable clearing activities available to them for use without approval from Local Land Services.

Pressures

Land clearing is listed as a key threatening process under the *Biodiversity Conservation Act 2016*. The rate of permanent clearing of woody vegetation in NSW has been steadily increasing since 2015, with a slight decrease in 2019, the most recent reporting year. Precautions built into NSW legislation include limits on allowable land clearing, offset requirements, and government investment in private land conservation (see next section).

The average rate of permanent clearing over seven years from 2009 to 2015 was 13,028 hectares per year (Spotlight figure 13.1a). In area, 26,200 hectares of woody vegetation was permanently cleared in 2016, the year before the new regulatory framework (*Biodiversity Conservation Act 2016*) came into effect in August 2017. The subsequent rate of permanent clearing from 2017 to 2019 was 34,933 hectares per year on average. Some of this included agricultural clearing approved under the previous native vegetation framework.

In 2019, 46,300 hectares of non-woody vegetation were cleared on regulated land, and 54,760 hectares in 2018 (Spotlight figure 13.1b).

Land use changes and intensifying land use place significant pressure on the condition of remnant native vegetation. Other pressures on condition, which are likely to remain for the foreseeable future, include long-term effects of fragmentation, increasing threats from invasive species and worsening elements of climate change including impacts of fires. Native forest harvesting results in temporary vegetation change, but is not classified as land clearing because there is an acknowledgment that all harvested areas must be regrown.

Responses

Programs of restoration and revegetation are occurring at local and regional levels to enhance the extent and condition of native vegetation. However, there is a net loss of vegetation because these programs are not restoring native vegetation at the rate of permanent clearing.

In 2017, the NSW Government introduced the land management and biodiversity conservation framework, which included the new *Biodiversity Conservation Act 2016* and amendments to the *Local Land Services Act 2013*. A new biodiversity offsets framework was also introduced. The Biodiversity Offsets Scheme establishes a framework to avoid, minimise and offset the impacts on biodiversity from development or clearing. The NSW Biodiversity Values Map identifies land with high biodiversity value that is particularly sensitive to impacts from development and clearing.

The Biodiversity Offsets Scheme and the Biodiversity Conservation Trust's private land conservation program have been introduced to encourage landholders to protect and conserve biodiversity and vegetation habitat on private land. The *Biodiversity Conservation Act 2016* also enables the Minister for the Environment to declare Areas of Outstanding Biodiversity Value. These are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally.

The pressures that affect vegetation condition are likely to continue in the foreseeable future and the Government will conduct a statutory five-year review of the land management and biodiversity conservation framework commencing in 2022. The Government's ongoing monitoring of land clearing rates, the Biodiversity Indicator Program and the five-year review are opportunities to monitor the impacts and risks of land clearing on biodiversity.

Related topics: River Health | Wetlands | Coastal, Estuarine and Marine Ecosystems

Protected Areas and Conservation

Protected areas of land and water in original or nearly original natural condition are the foundation of nature conservation in NSW.

Private land conservation

4%

of privately-owned land in NSW was managed for conservation in 2020–21

Terrestrial reserve system comprehensiveness

39%

of bioregions met targets for adequate representation of each regional ecosystem in public reserves in 2020–21

Terrestrial reserve system representativeness

47%

of bio-subregions met targets for the adequate representation of each regional ecosystem in public reserves in 2020–21

Public conservation reserves

9.6%

of NSW was formally protected in terrestrial public reserves in 2020–21

The NSW terrestrial reserve system covers about 7.59 million hectares or approximately 9.6% of the state. Around 6.4% of the NSW marine estate is protected within sanctuary zones of marine protected areas.

Why protected areas and conservation are important

The state's terrestrial reserve system has a substantial network of protected areas, such as national parks and flora reserves, that:

- conserve representative areas of habitats and ecosystems, plant and animal species and significant geological features and landforms
- protect significant Aboriginal and European cultural heritage
- provide opportunities for recreation and education.

A network of marine-protected areas span the NSW marine estate which conserve marine biodiversity and maintain ecosystem integrity and function. They also:

- enable resources to be used in an ecologically sustainable manner
- enable parks and reserves to be used for scientific research and education
- provide opportunities for public appreciation and enjoyment
- support Aboriginal cultural uses.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Area of terrestrial reserve system	MODERATE	Getting better	✓✓✓
Growth in off-reserve protection	MODERATE	Getting better	✓✓
Protected areas jointly managed or owned by Aboriginal people	MODERATE	Getting better	✓✓✓
Proportion of marine waters protected in marine parks and reserves	MODERATE	Stable	✓✓✓

Notes:
Terms and symbols used above are explained in About this report.

Status and Trends

Since the NSW State of the Environment 2018 , there were 84 additions to NPWS parks and reserves , by June 2021, totalling 304,629 hectares. The comprehensiveness and representativeness of formal protected areas in NSW is improving with significant additions of underrepresented areas, but some bioregions and vegetation classes are below target levels, particularly in the central and western regions.

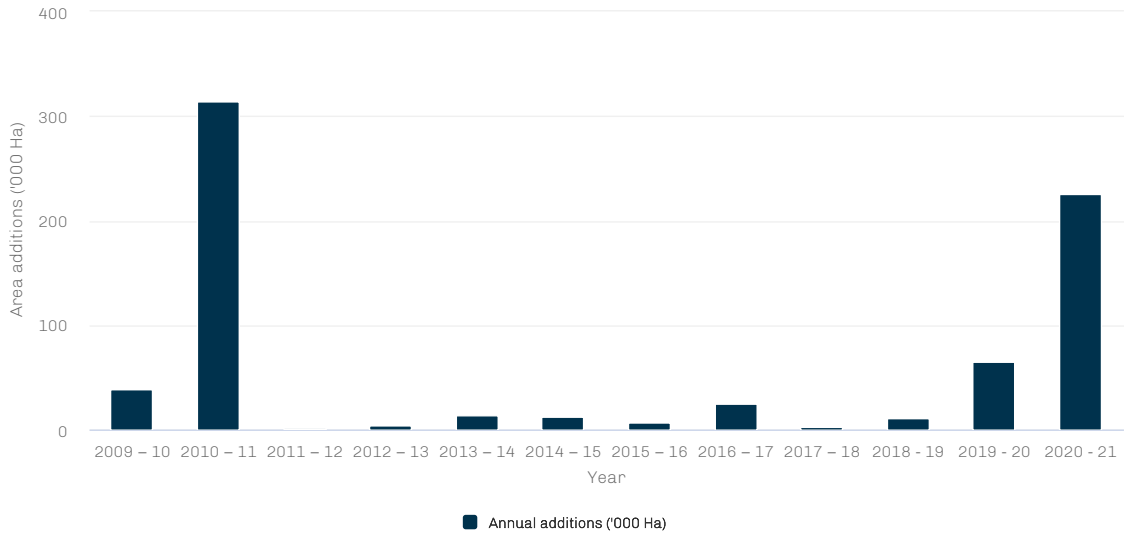
At 30 June 2021, terrestrial reserves covered about 7.59 million hectares, approximately 9.6% of NSW. Although this is below the rate of some other Australian states and territories such as Tasmania (42%), South Australia (30%), Northern Territory (24%), Western Australian (23%), and Victoria (18%), NSW also has a substantial State forest network managed by the Forestry Corporation which is subject to comprehensive regulatory prescriptions, exclusion arrangements and forestry practices based on ecologically sustainable forest management principles.These measures make a significant contribution to the overall protection of the environmental values of native forests in NSW. Almost 70,000 hectares of State forest are protected in formal reserves while 872,000 hectares are excluded from harvesting.

Conservation on private land and Crown land supplements the protected areas, provides vegetation corridors linking larger public reserves and protects some natural ecosystems that are under-represented or not present in public reserves.

Public land jointly managed or owned by Aboriginal people has increased through whole-of-government Indigenous Land Use Agreements. By June 2021, the National Parks and Wildlife Service (NPWS) had 33 joint management agreements with Aboriginal traditional owners, covering approximately 2.28 million hectares.

The network of marine protected areas includes marine parks (around 345,000 hectares), aquatic reserves (around 2,000 hectares) and national park and nature reserve areas below the high tide level (around 20,000 hectares). Over the past three years there has been a focus on improving the management of existing marine parks and aquatic reserves.

Spotlight figure 14: Annual additions in area (in thousands of hectares) of national parks and reserves in NSW since 2009



Notes:
The data in this figure only refers to areas in NSW national parks and reserves and does not include other protected areas or conservation on private land which also significantly contribute to protecting environmental values.

Source: NPWS data

Spotlight figure 14 shows annual additions in thousands of hectares to national parks and reserves since 2009. In 2020–21, 226,000 hectares of land had already been added to protected areas by January 2021.

Pressures

Pest animals and weeds are some of the greatest threats to threatened species and ecological communities in reserves and other protected areas, and also have impacts on Aboriginal Country and cultural sites. Other pressures include illegal activities on reserves (such as waste dumping) and land-use changes, including clearing of natural vegetation on private land near reserve boundaries which can make it difficult to maintain habitat connectivity between protected areas. Climate change impacts on plants and animals that have a restricted range or diminished capacity to adapt to significant temperature changes, and increases the likelihood and frequency of damaging bushfires.

Pressures on marine protected areas include modifications to estuary entrances, the clearing of riparian and adjacent habitat including wetland drainage (in estuaries), diffuse source runoff from agriculture and urban areas to estuaries, climate change including increased impacts on coastal reserves from storms and sea level rise, modified freshwater flows in estuaries and boating and foreshore development. These pressures, as well as others, have been indentified as priority threats to the NSW marine estate by the Marine Estate Management Authority (MEMA 2017).

Responses

Every year, NPWS acquires land for national parks by purchasing private land and through public land transfers, donations and bequests. In August 2019, the Minister for Energy and Environment committed to expanding the NSW reserve system by 200,000 hectares in two years. When this target was achieved in October 2020, the Minister committed to an additional 200,000 hectares, raising the overall target to 400,000 hectares by 2022.

Since 2018, an additional 30,901 hectares of State forest have been dedicated as flora reserves, also contributing to the formal reserve system.

Legislation, policies and programs protect the land and water in the NSW's public reserve system. For example, the *Marine Estate Management Act 2014* provides for strategic and integrated management of the entire NSW marine estate, and the marine parks and aquatic reserves within the marine estate. Reforms to Aboriginal cultural heritage and

initiatives such as Our Place on Country Strategy provide legal and policy frameworks to improve management, conservation and participation of Aboriginal people in protecting Aboriginal cultural heritage in NSW and providing access to Country.

Threatened species are protected in public reserves through the *Saving our Species* program and partnerships with private and not-for-profit environment groups. For example, work is under way on turning 555 hectares of Shanes Park in the Blacktown Local Government Area into a predator-free area. Up to 30 locally extinct or threatened mammals, birds, reptiles and amphibians – including the eastern quoll and brush-tailed phascogale – will be reintroduced, making it one of the biggest urban wildlife restoration projects in the world.

Related topics: Invasive Species | Wetlands | Native Fauna | Threatened Species | Climate Change

Fire

Fire is an integral part of our environment. It is essential for the growth and reproduction of many natural systems and the health of Country but altered fire regimes are a threat to ecosystem health.

The 2019–20 Black Summer fires burnt

5.5 million hectares

of area across NSW

The 2019–20 Black Summer fires burnt or displaced

3 billion

vertebrate animals across south-east Australia

The 2019–20 Black Summer fires affected

62%

of NSW vegetation communities which are under pressure from too much burning

Fire generated thunderstorms

50%

increase in the total number of events recorded (since 1978) during the 2019–20 Black Summer fire season

The 2019–20 Black Summer fire season was the most severe ever recorded in NSW, and as the climate warms and dries such fire patterns are likely to become more frequent. Many vegetation communities are now under pressure from too much burning.

Why managing fire is important

Fire is a natural part of the Australian landscape and much of the flora of NSW depends on fire to assist in its reproduction and growth. Altered fire regimes as a result of European settlement – too much or too little fire or fire of too high an intensity – have had a major detrimental impact on the integrity, structure and sustainability of most ecosystems and many threatened species.

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Proportion of mapped vegetation communities exceeding (minimum or maximum) vegetation fire interval thresholds	**POOR**	Getting worse	✓✓

Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

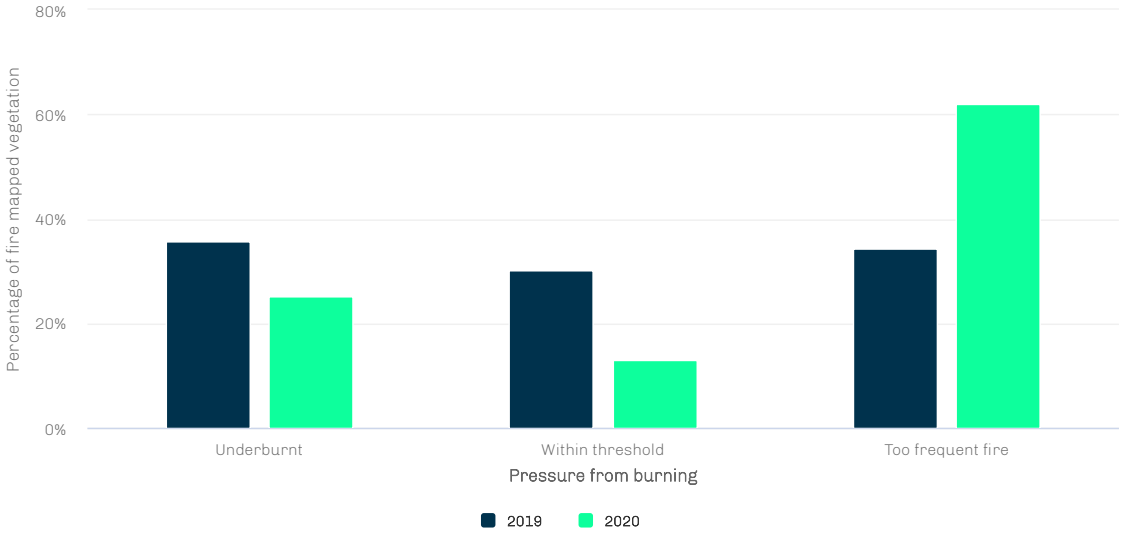
About 7% (5.5 million hectares) of NSW was burnt during the prolonged 2019–20 Black Summer fire season. The total area burnt was four times greater than the previous worst forest fires recorded in a fire season.

Over 450 threatened plant species and 293 threatened animal species occur in the footprint of the Black Summer fires. The prospects of long term survival of a significant proportion of these species have been impacted by the fires.

Rainforests have a low tolerance of fire and over 300,000 hectares or 37% of all NSW rainforest was burnt during the 2019–20 fire season.

Prior to the Black Summer fires, the fire interval status for vegetation communities was evenly spread - with about third each - within safe thresholds, or under pressure due to being too frequently burnt or insufficiently burnt. Following the fires, about 62% of vegetation communities are now under threat from too much burning and only 13% are within thresholds.

Spotlight figure 22: Vegetation fire interval status for 2019 and 2020 in NSW



Source:
Data from Bushfire Hub 2020

The **Spotlight figure 22** shows the change in status of vegetation fire intervals before and after the 2019–20 Black Summer fires. The time interval between fires is an indicator of the health of vegetation communities with the recommended time interval, which varies for different vegetation communities allowing for healthy regeneration and regrowth (apart from some specific communities, such as rainforest, where no fire is tolerated). If the time interval is not within the recommended threshold (i.e. it is too short or too long) this affects the condition and ultimately the integrity of the plant community.

Previously there was an even spread of fire interval status, but now they are strongly weighted towards overburning. This represents a fundamental shift in the ecological condition of vegetation communities and their response to fire.

Pressures

Increasing temperatures and the drying out of south-eastern Australia due to the effects of climate change are leading to longer fire seasons and more severe fire weather.

A trend is emerging for the more frequent development of fire-generated thunderstorms, where fires interact with the atmosphere to escalate the risk and spread of the blaze. Climate change is likely to amplify the conditions leading to the formation of such storms, through increasing dryness and atmospheric instability.

Over half of all bushfires in most years are started by humans, with arson a major cause. However, the Black Summer did not follow the usual pattern, with the majority of fires started by lightning, often in remote and inaccessible locations.

Responses

The key to achieving appropriate fire management is getting the balance right between maintaining natural ecosystems while ensuring community safety and protection of property, infrastructure and livestock.

All 76 recommendations from the NSW Bushfire inquiry announced in January 2020 were accepted by the NSW Government and around $460 million in funding allocated to their implementation in June 2020, including for new bushfire risk management plans, increased hazard reduction works, enhanced rapid response capacity, improved bushfire modelling and upgraded fire trails.

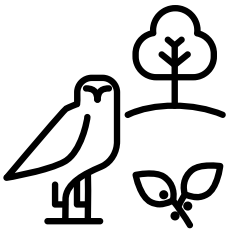
One of the principal tools for fire management is hazard reduction burning. The overall level of hazard reduction has increased over time but is quite variable from year to year, depending on assessed need and favourable conditions.

There is increasing interest in cultural burning, as part of the broader cultural practice of caring for Country in traditional Aboriginal land management. Cultural fire management protects and enhances ecosystems and cultural values, while reducing fuel loads.

Related topic: Climate Change

Biodiversity

soe.epa.nsw.gov.au



Biodiversity

The changes that have occurred to our natural environment affect the richness and diversity of the species and ecosystems found in NSW and their ability to survive into the future.

Introduction to Biodiversity

The topics in this theme describe how the native species and ecosystems of NSW are faring presently and the effects of introduced species.

Ensuring the long-term survival of the species and ecosystems of NSW means they will persist for the benefit and enjoyment of future generations. Many native species are considered to be threatened in NSW and the Threatened Species topic discusses current patterns in their status and trends. The broad patterns of survival and trends in animal populations are considered in Native Fauna.

The main threats to the survival of species are habitat destruction through the clearing of native vegetation and competition and predation by invasive species, with climate change an emerging and serious threat into the future. The impacts of invasive species on the survival of native species and ecosystems are discussed in the Invasive Species topic.

In this report:

- The number of species considered at risk of extinction continues to rise with 1,043 NSW species listed as threatened, 18 more than reported three years ago. A further 116 ecological communities are also listed as threatened.
- The conservation status of 64% of land-based NSW vertebrates is presently not considered to be threatened.
- Freshwater fish communities are in very poor condition across the state and are declining.
- Invasive species are widespread across the state's land and aquatic environments and regarded as a major threat.

Aboriginal Perspectives

From the beginning, Aboriginal people and cultures have cared for Country in a holistic way that ensures all animals and plants are able to thrive. Aboriginal cultural values and use of totems and kinship relationships with a range of species and special and sacred places impose obligations that protect these species and places.

Aboriginal people have seen many changes to the biodiversity of NSW and have for many years asked to be a part of decision-making. Biodiversity is central to Aboriginal people's cultures. Involvement would be a great opportunity to bring together Aboriginal knowledge and cultures with western science to promote better outcomes for the biodiversity of NSW.

Threatened Species

Programs that protect animals and plants and their habitats focus on threatened species, including those at greatest risk of extinction.

Extinct species

78

species are extinct in NSW (2020 data)

Number of threatened species

1,043

species are listed as threatened in NSW as at December 2020 (18 more species than in the last report)

Critically endangered species

116

critically endangered species were listed in NSW as at 2020 and face an extremely high risk of extinction in Australia in the immediate future

Increase in threatened species

↑ 2%

increase in species listed as threatened over the past three years

The number of species at risk of extinction continues to rise. As at 2020–21, 1,043 species and 115 ecological communities are listed as threatened under NSW legislation including 78 species declared extinct.

Why species and habitat are important

There has been a general pattern of decline in species diversity in NSW since European settlement. Some species of plants and animals, including fish, are at risk of extinction due to threatening processes such as removal of habitat. Conservation of threatened species is important to stabilise this loss of biodiversity. Programs such as ***Saving our Species*** are working to increase the number of species that will be secure in the wild for 100 years.

Aboriginal people attribute tremendous spiritual, cultural or symbolic value to many animals, plants and ecological communities, a value that is critical to identity and relationship with Country. The protection of these species and communities is fundamentally important in maintaining Aboriginal culture, language and knowledge.

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Number of threatened species, communities and populations	**POOR**	Getting worse	✓✓

Notes:
Terms and symbols used above are defined in About this report.

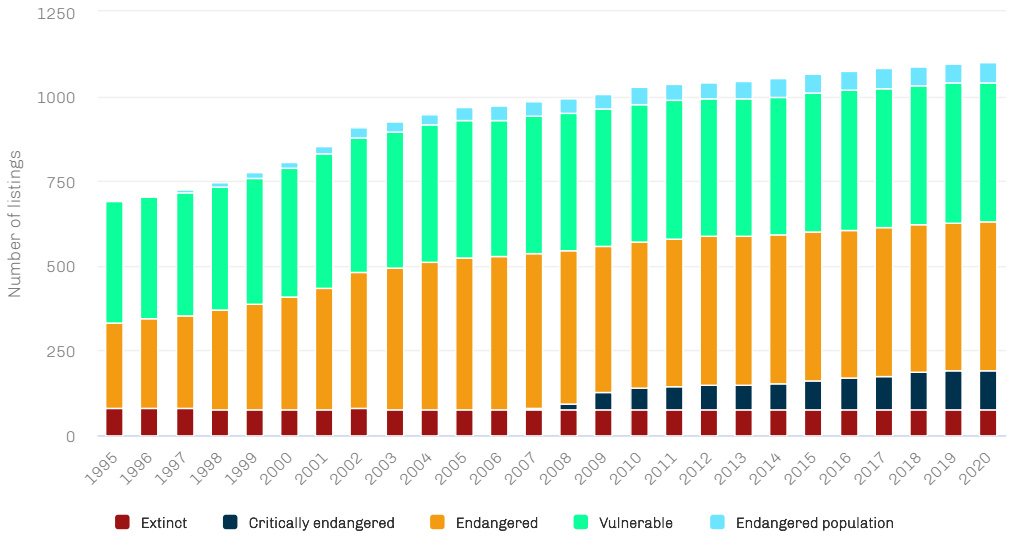
Status and Trends

In NSW in the three years to December 2020, the number of listings of threatened species increased by 18 (or 2%), with 1,043 species listed as threatened under the Biodiversity Conservation and Fisheries Management Acts (**Spotlight figure 11**).

The number of plants and animals and communities being managed under the ***Saving our Species*** program has steadily increased, with 465 projects in 2018–19 covering roughly 40% of the listed species, communities and populations in NSW.

However, modelling in the assessment of the NSW Biodiversity Indicator Program (BIP) predicts that only 496 or 50% of the 991 terrestrial species listed as threatened are predicted to survive in 100 years' time (DPIE 2020). Management and conservation efforts will not be enough to save many species without addressing key threats such as habitat removal and climate change.

Spotlight figure 11: Total listings of threatened species 1995–2020



Source:
Department of Planning, Industry and Environment (DPIE) and Department of Primary Industries (DPI) data

Pressures

A total of 47 key threatening processes have been identified as threatening the survival of species, communities and populations – 39 mainly terrestrial threats and eight aquatic. The most common threats are habitat loss due to the clearing and degradation of native vegetation and the spread of invasive pests and weeds. The capacity of species to adapt to these pressures is further constrained by climate change.

Altered fire regimes impact the ability of plant species and communities to regenerate or repropagate and extreme wildfires can decimate local animal populations. Water extraction and altered river flows and cycles affect a range of aquatic and bird species.

Responses

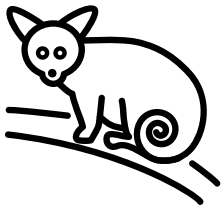
The Saving our Species (SoS) program is committed to maximising the number of threatened species and ecological communities secure in the wild for 100 years. In May 2018, the government released the NSW Koala Strategy to help secure the future of koalas in the wild.

Biodiversity legislation in NSW to protect threatened species includes the *Biodiversity Conservation Act 2016*, *Fisheries Management Act 1994* and the Common Assessment Method for national listing of threatened species.

Public national parks and reserves, the foundation of conservation efforts in NSW, play a vital role in protecting habitat and providing refuge for many threatened species that are sensitive to habitat disturbance. Threatened species are also increasingly being conserved on privately-owned land.

There are opportunities to further reintroduce locally extinct mammals in managed areas free of invasive species, such as foxes and cats, and assess longer term impacts of legislative change on threatened species and their natural habitats. There is a need to learn more about how Aboriginal cultures and practices improve the care, protection and management of species, their habitats and the overall environment. This includes qualitative data collection, oral stories and Aboriginal cultural knowledge. In this respect, the EPA Aboriginal Peoples Knowledge Group recommends that significant Aboriginal cultural species be included as an indicator for future State of the Environment reporting.

Related topics: Population| Greenhouse Gas Emissions| Native Vegetation| Protected Areas and Conservation| Native Fauna | Invasive Species | River Health



Native Fauna

It is important to preserve the full range of biodiversity in NSW and maintain healthy ecosystems for future generations. Healthy native fauna populations are an important factor in achieving these goals.

Decreased mammal ranges

64%

of native mammals have had long-term decreases in range

Survival of native vertebrate species

62%

of native terrestrial vertebrate species are not currently listed as threatened, but this is worsening

The overall diversity and richness of native species and communities in NSW remains under threat of further decline.

Why native animals are important

NSW has a rich biodiversity, much of which is recognised as being internationally significant. Shrinking distributions of species of mammals, birds, fish, reptiles and amphibians can indicate early that their populations are decreasing. Declines in population of many species have been under way for decades or longer but have largely gone unrecorded. Over the past three decades, heightened awareness of the plight of native fauna has revealed the extent of population declines and the threats that cause them.

Aboriginal people attribute tremendous spiritual, cultural or symbolic value to many animals, plants and ecological communities, a value that is critical to identity and relationship with Country. The protection of these species and communities is fundamentally important in maintaining Aboriginal culture, language and knowledge.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Native terrestrial mammals: Loss of long-term distribution over the past 200 years	POOR	Stable	✓
Native birds: Loss of long-term distribution over the past 200 years	MODERATE	Stable	✓

NSW indicators

Indicator and status		Environmental trend	Information reliability
Proportion of vertebrate fauna species that is presently non-threatened	MODERATE	Getting worse	✓✓
Birds: Decline in populations – short term (decades)	POOR	Getting worse	✓✓
Native fish communities	POOR	Getting worse	✓✓✓
Large kangaroos: Population	GOOD	Stable	✓✓✓

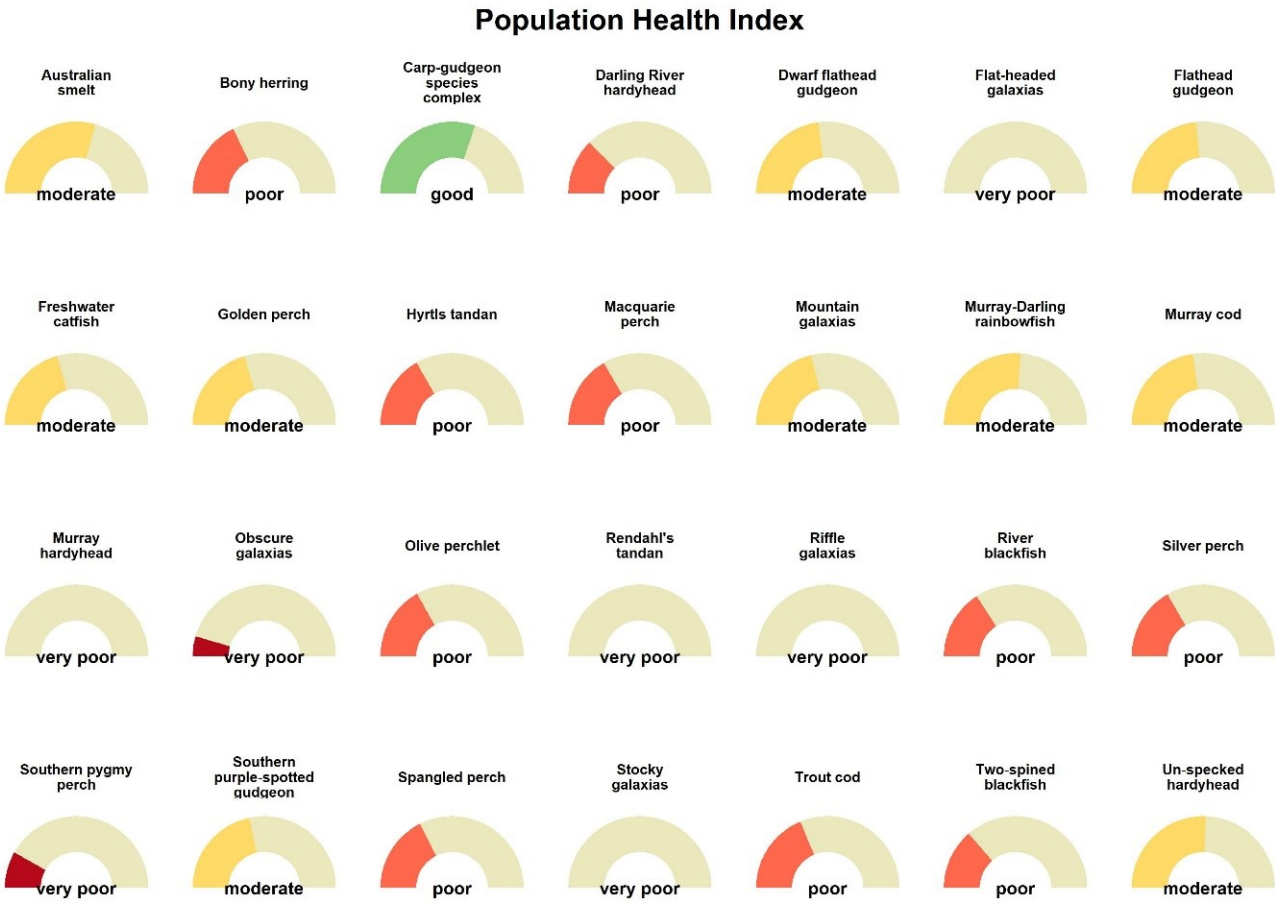
Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

A pattern of long-term decline in biodiversity is seen in the reduced range or abundance of many native vertebrate species. At the same time, many species less susceptible to current pressures have maintained their distributions, while a small number of adaptable species has flourished.

Over the past 200 years, birds have been more resistant to declines in range than mammals, which have experienced substantial declines, especially small- to medium-sized ground-dwelling species. However, over recent decades there is evidence that populations of some bird groups are declining.

Spotlight figure 12: Population health index (PHI) ratings for 28 native fish species in the NSW part of the Murray–Darling Basin in 2014–19



Notes:

Source: NSW DPI Fisheries

A good population health index (PHI) rating represents an overall improvement in general viability and resilience. In the **Spotlight figure**, only the carp-gudgeon species complex had a good PHI rating, meaning carp-gudgeons have a stable abundance, an improving distribution and adequate recruitment, and are in good individual condition.

Nine fish species had a moderate PHI rating, representing stable population health. The remaining 16 species (57%) were in poor or very poor population health, reflecting a substantial decline in one or more population health indicators and overall declining viability and resilience.

There are no PHI ratings for coastal fish species due to a lack of monitoring in coastal catchments.

Pressures

The decline in native fauna species is due to the cumulative impacts of threats such as vegetation clearing, habitat degradation and invasive species that prey on native animals and compete with them for habitat. Foxes and cats prey on native fauna on the mainland and introduced rodents affect species' survival on islands and on the mainland. Climate change is expected to be a major threat to the future survival of many species. Without significant action, climate change is expected to become one of the most significant of all the human-induced pressures.

Responses

The NSW Government has streamlined and integrated legislation for biodiversity conservation and protection. The main measures to address the decline in biodiversity are:

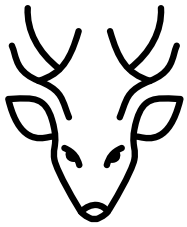
- conservation of native species in national parks and other reserves

- the Biodiversity Conservation Trust which funds landowners to manage, protect and conserve biodiversity on private land and through biodiversity offsets
- the *Saving our Species* program which aims to secure as many threatened species in the wild as possible
- an expanded NSW Biodiversity Offsets scheme to facilitate ecologically sustainable development.

Locally extinct mammals are being reintroduced in carefully managed areas in national parks and reserves kept free of invasive species, with more reintroductions planned for 2021–23 (see Protected Areas and Conservation).

There are opportunities to assess longer term impacts of legislative change on threatened species and their natural habitats, and to conserve threatened species on privately-owned land. There are also opportunities to continue to learn more about how Aboriginal cultures and practices improve the care, protection and management of species, their habitats and the overall environment. This includes qualitative data collection, oral stories and Aboriginal cultural knowledge.

Related topics: Threatened Species | Invasive Species | Native Vegetation | River Health



Invasive Species

Many invasive species are widespread across NSW. Once established, they are difficult to control. Invasive species prey on threatened native animals, take habitat from endangered ecological communities and threaten environmental health.

Pest animals and weeds threatened more than

70%

of threatened species and endangered ecological communities in NSW

Introduced carp dominated fish communities, making up more than

80%

of the biomass in some rivers in the Murray–Darling Basin in 2020–21

Pest animals cost the NSW economy

$170 million

every year in lost production and management costs

Weeds cost the NSW economy

$1.8 billion

each year in lost agricultural production and management costs

Invasive species are implicated in the decline of land and aquatic species and the extinction of many small Australian native mammals and birds.

Why managing invasive species is important

Australian native plants and animals have co-evolved over millions of years. As a result, the introduction of non-native pests and weeds can seriously threaten native species because native species have not evolved ways to deal with them. Invasive species are implicated in the decline and extinction of many Australian native plants and animals in both land-based and water-based ecosystems.

For example, weeds such as lantana can drive out native flora species and change the population of ecosystems. Invasive animals such as feral cats can prey on threatened animals, drastically reducing their numbers. Pests and weeds can also impact on agricultural productivity, social wellbeing and ecotourism (DPI 2018b).

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Number of new invasive species detected	MODERATE	Stable	✓✓
Spread of emerging invasive species	MODERATE	Getting worse	✓
Impact of widespread invasive species	POOR	Stable	✓

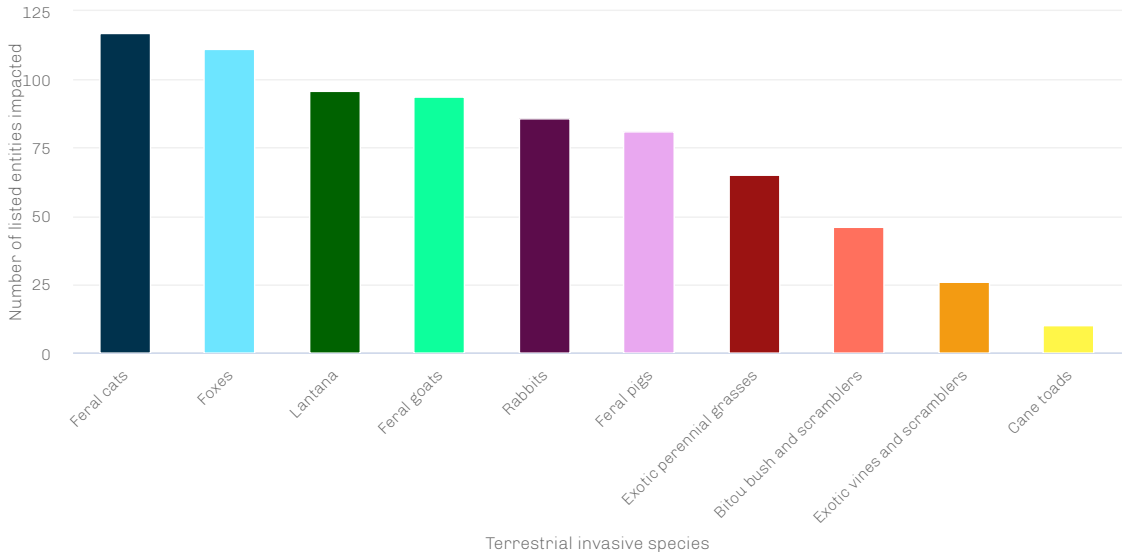
Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

The extinction or decline of numerous small- to medium-sized animals, particularly mammals, has largely been attributed to predation by foxes and cats, while rats introduced to Lord Howe Island caused nine of the 14 bird extinctions in NSW.

Grazing and browsing by introduced herbivores, such as rabbits, goats and deer, has led to habitat degradation and a decline in native vegetation diversity and productivity. Pest fish threaten native fish species and aquatic ecosystems, with carp dominating fish community biomass across most of the Murray–Darling Basin. Spotlight 15 shows species, populations and ecological communities threatened by key terrestrial invasive species.

Spotlight figure 15: Species, populations and ecological communities* threatened by key terrestrial invasive species**



Notes:
* Threatened species, populations and ecological communities listed under the *Biodiversity Conservation Act 2016*.
** The invasive species selected are generally those listed as key threatening processes.
Data compiled by aggregating the threats affecting each threatened species, identified at the time of listing, across all threatened species.

Source:
Modified form Coutts-Smith & Downey 2006 and Coutts-Smith et al. 2007

Considered individually, widespread pest animals, such as feral cats and foxes, have a far greater impact on threatened species than individual weed species. However, the overall number of weed species is much greater than pest animal species and their combined impact is broader than the impact of pest animals.

Pressures

Pest animals and weeds continue to spread, adding to other pressures on the natural environment such as addition of nutrients, changed hydrologic regimes, bushfires and climate change.

Invasive pathogens, particularly the root rot fungus (*Phytophthora*), myrtle rust and the amphibian chytrid fungus, are increasing threats to biodiversity.

New invasive species are being introduced by the black market pet trade, nursery industry and aquarium industry or as stowaways on boats. These newly introduced and emerging invasive species can have an impact on additional threatened flora and fauna, and potentially add to the cumulative impact of all invasive species on the environment.

Responses

The *NSW Invasive Species Plan 2018–2021* (DPI 2018a) sets out the priorities, goals, strategies and guidelines to exclude, eradicate or manage invasive species and their impacts. The *NSW Biosecurity Strategy 2013–2021* (DPI 2013) manages shared responsibility for effective biosecurity management, increases awareness of biosecurity issues in NSW and outlines ways in which the NSW Government works in partnership with other government agencies, industry and the community to manage biosecurity risks.

Response programs are important in mitigating the threats from invasive species. They include:

- the State Weed Committee which is responsible for ensuring a coordinated and strategic approach to weed management in NSW
- Regional Weed and Pest Animal Committees which coordinate regional pest and weed management activities
- Saving our Species which manages projects to protect threatened species from pests and weeds
- the National Carp Control Plan which helps manage carp populations.

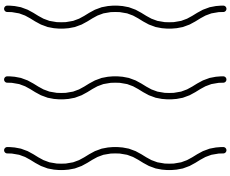
Other initiatives include:

- improvements to surveillance and biosecurity measures to help prevent new invasive species threats
- a better understanding of pathogens which continue to emerge as an increasing threat
- schemes such as aerial baiting which have been successful in controlling foxes in some areas and may even help control feral cats.

Related topics: Threatened Species | Native Fauna | Native Vegetation | River Health

Water and Marine

soe.epa.nsw.gov.au



Water and Marine

Water is a valuable resource and the challenge is to find the right balance between extracting water for human uses, while retaining sufficient water to keep aquatic ecosystems healthy.

Introduction to Water and Marine

The topics in this theme describe how water resources are used in NSW and the condition of freshwater and marine ecosystems.

One of the greatest challenges facing NSW is continued access to reliable sources of good quality water. Water use needs to be managed to provide an equitable balance between the numerous beneficial uses of water and maintaining the health of rivers and aquatic ecosystems. How water resources are allocated and the share of water available for the environment is described in the Water Resources topic for surface water and in Groundwater for sub-surface water. River Health reports on the ecological health of rivers and the effects of water extraction and flow regulation while the health of NSW wetlands is examined in the Wetlands topic.

Most NSW rivers flow to the sea through estuaries and the Coastal, Estuarine and Marine Ecosystems topic covers the health and impacts of pressures on these environments.

In this report:

- The period from 2017 to 2020 saw some of the worst droughts in recent record. During this time, significantly less environmental water was available for delivery into inland rivers and wetlands.
- The overall environmental condition of rivers is moderate but waterbirds and fish communities are in poor condition. The major river systems of the Murray-Darling Basin are generally in poorer condition than coastal rivers.
- The abundance of waterbirds declined in 2020 to about 40% below their long-term median.
- Groundwater provides 27% of all metered water use in NSW, a notable increase from three years ago when it was 11%.
- Marine and coastal environments are in good condition overall, but the state of estuaries is more variable.

Aboriginal Water

Water is essential for life to exist in NSW and for Aboriginal people always was and always will be at the core of their culture and ways of knowing, being and doing. Cultural and spiritual values may relate to a range of uses and issues, including spiritual relationships, language, songlines, stories, sacred places, customary use, the plants and animals associated with water, drinking water, and recreational or commercial activities (DAWE 2018). Water is also strong through lore, song, dance and dreaming and plays a significant role in the health and wellbeing of its people (Moggridge & Thompson 2021).

Australia is the driest continent on earth and Aboriginal knowledge of water is essential to the survival of its people. With thousands of generations of connection and observation of all Countries, the many Aboriginal Nations of NSW must be a part of its protection, especially the quality of its waters.

More recently, Aboriginal people have felt much sadness in witnessing the destruction of Country, the diversion, over-extraction, storage and pollution of their waters while their voice and control over the quantity of water on-Country is diminished under water laws that benefit postcolonial settlers to this day (Hartwig, Jackson, Markham & Osborne 2021). Modern water planning must evolve and consider new ways to share water resources fairly to ensure Aboriginal people can thrive through self-determination with free and prior informed consent over water decisions that close the gap in water ownership and improve wellbeing and caring for their countries.

Our freshwater surface and groundwaters are both important assets with value not as a commodity but as the essence of life. Where our freshwater meets the saltwater Country, this is also an important place to protect.

Connection to Country (Marine)

Coastal Aboriginal people have a strong connection to the marine environment. It is important to saltwater people that we keep that connection strong and it comes with a responsibility that was handed down from our ancestors. It is our duty to look after the saltwater Country that has sustained our people for thousands of years, so the next generation can have the same enjoyment that we have. The responsibility of looking after saltwater Country is everybody's business, but to the Yuin nation it's more than just a responsibility – it's our spiritual connection to our dreamtime that connects us to our saltwater Country.

This is our Dreamtime story that I will share with you about why Yuin people are connected to the ocean and the land we live on.

TOONKOO and NGARDI

Here is the meaning put into Aboriginal context:

In the stillness of the night slowly bobbing to the rhythm of the waves, the night sky guides our dreaming, the moon predicts the destined tides. This is where the magic begins upon the ocean and its horizon. Even in the day, with the sunrise and the sunset when we look and see the ocean and its magic is still there and still alive – the magic of spirt that still today shows us the trail from where Aboriginal people first came.

(Our dreaming story is Toonkoo and Ngardi coming down from a star to this land. This story and many other stories from other Aboriginal peoples all over Australia share stories of their dreaming coming from the stars.)

The oceans are the balances to the land and when we sit between the 'balance' we see the path ... to the Dreaming and creation.

The path to our dreaming is the magical space created in that balance which is called 'Mil-lum-ba-wa' or 'Mill-um-ba-wa' or 'Mill-um-bar-wa' which is interpreted as the 'sparkle of the waves'.

– Wally Stewart

Water Resources

A diversity of healthy and secure sources of water is essential to provide for a variety of beneficial water uses, including town water supplies and agriculture, while maintaining the condition of natural aquatic environments.

Water sharing plans

59

now developed, covering water extraction from all NSW water sources

Environmental water share

2,553 gigalitres

of entitlements, an increase of over 1,000 GL from 10 years ago

The period from 2018 to 2020 encompassed some of the most extreme weather ever experienced in NSW, including one of the worst droughts on record, followed by severe bushfires along the eastern seaboard. Water extraction fell quickly during this period and significantly less environmental water was delivered into inland rivers.

Why managing water resources is important

Water is a vital resource and effective management is necessary to balance competing human needs, maintain healthy and resilient aquatic environments, and protect river and groundwater systems.

A robust water resources management framework is important as it provides greater certainty about the water available for extraction, establishes rules for sharing water supplies between different types of uses, and allows for return of flows to the environment. NSW moves between extremes of weather, with abundant water quickly becoming scarce, making management and regulation of water resources both complex and critical.

This topic explores surface water resources, see the Groundwater topic for information on those resources.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Proportion of water extraction covered by water sharing plans	GOOD	Stable	✓✓✓

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Environmental share of available water	MODERATE	Stable	✓✓

Notes:
Terms and symbols used above are defined in About this report.

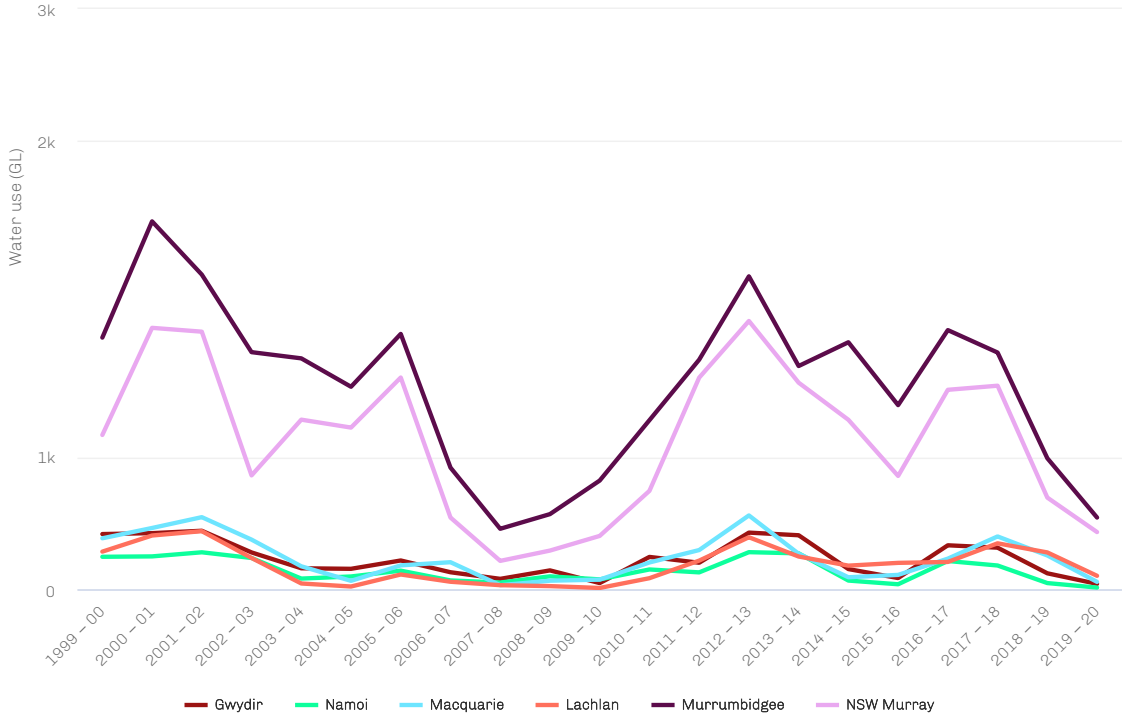
Status and Trends

After three years of severe drought, NSW climatic conditions and surface water availability improved after mid-2020. Water extraction and regulation alter river flows and continue to put pressure on the health of inland river systems. The impacts may be less severe during intermittent flooding events and periods of above-average rainfall.

About 80% of water used comes from regulated rivers, where flows are controlled by large water storages, while about 11% comes from groundwater and the balance is drawn from unregulated rivers. The amount of water extracted for use and the amount remaining in stream for environmental purposes differs significantly depending on annual rainfall and flow conditions.

Spotlight figure 16 shows water use by licensed users from 1999–00 to 2019–20 in all six major NSW inland regulated river valleys. All were quickly impacted by the extreme temperatures and very low rainfall experienced during the drought that occurred between 2018 and 2020.

Spotlight figure 16: Water use by licensed users in major NSW regulated valleys 1999–00 to 2019–20



Notes:
Water use is licensed account usage, including general security, high security, conveyance, water utilities, domestic and stock, and supplementary access. These use estimates include licensed water use for both consumptive and environmental purposes.
The Border Rivers valley is not included in the graph.

Source:
DPIE Water data 2021

The NSW Government's cumulative holdings of environmental water total about 902,400 megalitres (ML) within regulated rivers and about 27,500 ML in unregulated rivers. The Australian Government has also recovered substantial volumes of environmental water in the Murray–Darling Basin in NSW with current holdings of about 1,575,800 ML in regulated rivers and 46,000 ML in unregulated rivers. This gives a total of 2,553,000 ML of licensed environmental water for NSW.

During the three years 2017–18 to 2019–20, the volume of environmental water delivered back to locations across inland NSW was significantly less than in the previous three years. Volumes ranged from approximately 850,000 ML (2017–18) to 278,000 ML (2019–20), the lowest amount in a decade, and significantly less than the 1,396,000 ML peak in 2016–17. This highlights the impact of the recent drought and record-breaking high temperatures on water availability.

Pressures

Climate variability, periods of drought, above-average temperatures and low rainfall, and the increasing impact of climate change-related extreme weather events are significant pressures on water resources in NSW. More frequent drought conditions with only short periods of good rainfall in between dry periods reduce the ability of river systems and water storages to recover sufficiently.

Other pressures on water resources are the result of human intervention and activity. Water extraction can reduce total river flows and, particularly in times of reduced rainfall, these water diversions can affect water quality and ecosystem health.

The natural variability of river flows is also impacted by the regulation of rivers through structures that store or divert water such as dams and weirs. Although aquatic ecosystems in NSW are adapted to variable flow levels, changes to natural flow patterns and water temperatures, have contributed to biodiversity loss and declining aquatic health over time.

Another pressure on water resources is water pollution from catchment disturbances, land management practices and land-use changes including agriculture and urban expansion.

Responses

The state's water resources are managed through a framework of legislative instruments, strategies, policies and plans which aim to address and mitigate the pressures on water resources. Central to the management and control of demand are water sharing plans which are in force for all water sources in NSW. These plans provide a clear framework and rules for managing inland NSW basin water resources and coastal water resources and provide the basis for sharing water between the environment and extractive users. They play an important part in supporting water markets and enabling water trading for both commercial and environmental purposes. Water markets can help water managers to flexibly adapt to changing conditions and manage risk.

Water sharing plans are also an important component of regional water strategies which are currently being developed in NSW to understand how much water a region will need to meet future demand and identify the challenges and choices involved. Based on this, the plans will set out actions to manage risks to water security and reliability. They aim to consider the pressures on water resources in a region and bring together the latest climate evidence and a range of tools and solutions to plan and manage each region's water needs over the next 20 to 40 years.

Water sharing plans, with risk assessments, underpin 20 water resource plans developed by the NSW Government for both surface water and groundwater sources as part of its responsibilities for improving water resource management under the Murray–Darling Basin Plan.

The *NSW Water Strategy* was released by the NSW Government in September 2021 to draw the various water strategies and plans together into a strategic and integrated framework to better manage the state's water resources.

Related topics: River Health | Wetlands | Groundwater | Coastal, Estuarine and Marine Ecosystems

River Health

Healthy river ecosystems are vital for aquatic and terrestrial biodiversity and water quality, and to support human activities.

River condition index

38

out of 40 NSW river valleys have a 'moderate' or better rating

Health of fish communities

>90%

of Murray–Darling Basin river valleys are rated 'poor' or worse

Aquatic ecosystems in the major NSW rivers of the Murray–Darling Basin are generally in poorer condition than those in coastal rivers. The overall health of rivers across NSW is considered moderate.

Why river health is important

Healthy river ecosystems, comprising rivers, their riparian zones, floodplains and wetlands, are vital for aquatic and terrestrial biodiversity. Healthy rivers also provide the ecosystem services needed for good water quality and supply. They maintain cultural values, underpin economic growth and enable human activities, including agriculture, aquaculture, fishing, recreation and tourism.

Aboriginal culture and connection to Country rely on rivers to maintain traditional practices and communities.

A primary objective of effective river management in NSW is to preserve the integrity of natural systems while providing for a range of beneficial human uses.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Health of fish communities	POOR	Getting worse	✓✓
River condition index for NSW rivers *	MODERATE	Stable **	✓

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Salinity	**GOOD**	Stable	✓✓
Nitrogen and phosphorus levels	**MODERATE**	Stable	✓✓

Notes:

* Data for this indicator has not been updated during the last three years.

** Trend as at 2018. It has not been assessed for the latest reporting cycle.

Terms and symbols used above are defined in About this report.

Status and Trends

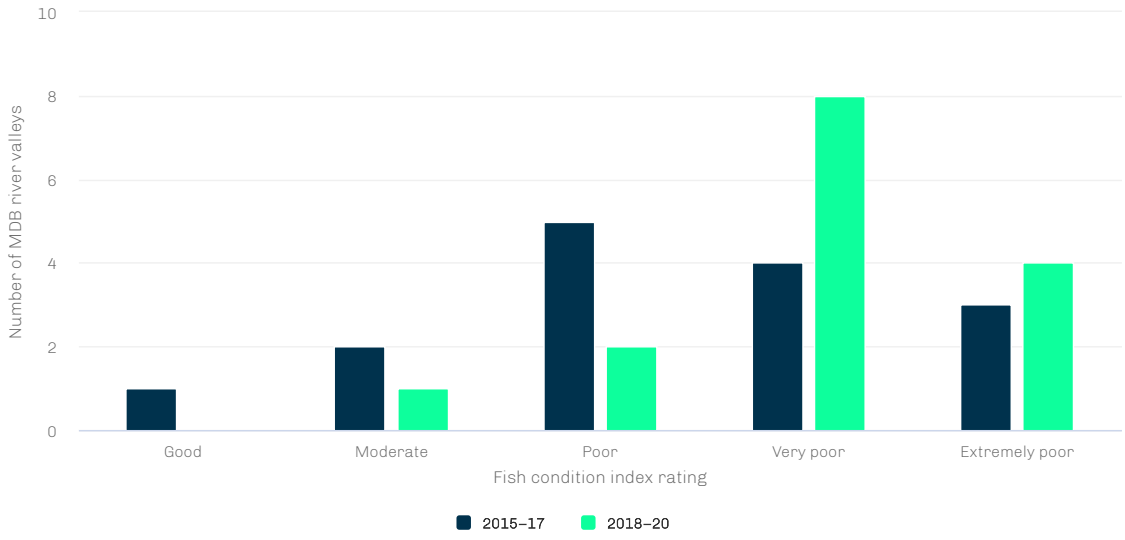
The period 2018 to early 2020 was marked by extreme weather events, including one of the worst droughts and the highest temperatures ever experienced in NSW, then severe bushfires along the eastern seaboard from September 2019 to February 2020. This was followed by intermittent heavy rain events and flooding in 2020, cooler and milder weather over the 2020–21 summer, and further rain events in 2021 resulting in improved river flows and replenished water catchments across NSW.

The state's major inland river systems have been affected by the ongoing impacts of water extraction, altered river flows, loss of connectivity caused by weirs and other instream structures and catchment changes such as altered land use and vegetation clearing. The greatest signs of ecosystem stress are generally where flow regimes have changed the most.

NSW coastal rivers are less affected by water extraction and flow regulation than inland rivers and are generally in better ecological health, except for their fish communities.

Fish communities are in poor condition across the state. They are declining in the Murray–Darling Basin where the widespread distribution of introduced carp, river regulation, degradation of habitat, and barriers to fish passage have reduced their health.

Spotlight figure 17: Summary of composite fish condition ratings for the 15 NSW Murray–Darling Basin valleys 2015–17 and 2018–20



Source:
DPI Fisheries data 2021

Spotlight figure 17 summarises the composite fish condition index rating for the 15 Murray–Darling Basin river valleys in NSW for the current and the previous reporting periods. The overall condition of freshwater fish communities in these river valleys deteriorated between the reporting periods 2015–17 and 2018–20 with more than 90% (14 out of 15 valleys) rated as poor, very poor or extremely poor during the current reporting period.

No freshwater species, populations or ecological communities in NSW were added to the threatened species lists in the 2018–20 reporting period, although none recovered sufficiently enough to be downgraded or removed from the list. The biggest threats to the health, abundance and diversity of fish in NSW include river regulation, destruction of habitat, and the cumulative impacts from a changing climate.

The instances of water quality being below the standards for the nutrients phosphorus and nitrogen decreased during 2018–20, though this was mainly due to less runoff washing nutrients into waterways during the extended drought. Salinity levels over time were relatively stable in most streams surveyed with some variability due to site-specific processes.

Pressures

Multiple pressures work together to influence river health in NSW. The key pressures fall into two broad categories: alterations to natural flow patterns and disturbances to river systems and catchments; and the impact of climate variability and change.

Alterations and disturbances, such as water extraction, changed river flows, infrastructure and blockages from dams, weirs and works on floodplains, all affect natural river processes. Agricultural and urban runoff, urban development, industrial uses, clearing of riparian vegetation and introduced aquatic species have had negative impacts on water quality and aquatic and terrestrial biodiversity.

Activities and structures that destroy aquatic vegetation, block channels and waterways, and disturb the balance between sediment and water flows in rivers and estuaries are also key threats to fish habitats.

Floods, droughts and fire have always brought pressures to the health of river systems. These natural events are now being exacerbated by climate change and resource competition. Climate change is adding to existing stressors, particularly water availability pressures, catchment and riparian condition and the impacts of altered river flows. Most climatic projections suggest an increase in the frequency and severity of drought in NSW, including more frequent prolonged droughts and more short, sharp droughts. Heavy, damaging rainfall is also expected to increase.

The predicted outcome of these continuing pressures is long-term decline in the ecological health of NSW rivers and aquatic ecosystems.

Responses

The NSW Government has developed a framework for improved water management which includes the *NSW Water Strategy* (released September 2021), regional water strategies and associated plans and risk assessments.

Water sharing plans, developed for all NSW water sources, continue to be central tools for addressing river health in NSW. They underpin water resource plans and are complemented by Long Term Water Plans. Both have been developed to meet requirements of the Murray–Darling Basin Plan to better align basin-wide and state-based water resource management, including water for the environment.

Water management initiatives and programs have been implemented to balance human uses of water with water for the environment to maximise the outcomes for river and wetland health. Examples of these include:

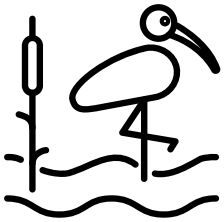
- *NSW Diffuse Source Water Pollution Strategy*
- floodplain management planning
- risk assessments for inland water resources and coastal water-dependent ecosystems
- Catchment Action NSW funding for approved environmental works by landholders.

In NSW, water has been purchased or recovered for the environment through water recovery programs funded by the NSW Government and the Australian Government. The cumulative total of licensed environmental water in NSW is approximately 2,478,812 shares or megalitres entitlement (ML) in regulated rivers and about 74,362 ML in unregulated rivers. Water released to the environment aims to restore, maintain and improve river and wetland sites across the state.

The NSW Government has invested in additional climate data and modelling to further develop an understanding of past and future climatic conditions. When combined with the NSW Government's NARCLiM climate change projections, the modelling helps with the analysis of climate variability and estimating risks to future water availability, mitigation of those risks and the benefits of medium and long-term solutions.

This modelling has been used in the development of NSW Regional Water Strategies to inform options for water management to improve river health.

Related topics: Threatened Species | Native Fauna | Invasive Species | Water Resources | Wetlands | Climate Change



Wetlands

Wetland ecosystems support high levels of biodiversity, providing habitat for a wide range of animals including waterbirds, fish, frogs, turtles, invertebrates, and water-dependent plants.

Waterbird abundance

162,824

birds in 2020, below the long-term median of 272,493

Wetland area index of eastern Australia

104,015

hectares in 2020, below the long-term median of 224,794 ha

A return to drier weather conditions from 2017 affected the health of some wetland areas and reduced opportunities for waterbird breeding.

Why wetlands are important

The protection and sustainable management and use of wetlands is important as they provide a range of benefits to both the natural environment and people.

Wetland ecosystems support high levels of biodiversity, providing habitat for a wide range of animals including waterbirds, fish, frogs, turtles, invertebrates and water-dependent plants.They also play a key role in keeping the environment healthy, for example by regulating regional water cycles and climate and reducing the impact of storm damage and flooding. Wetlands are culturally significant for Aboriginal people and provide them with a strong connection to Country. They also contribute to regional economies by providing environments for commercial fisheries, grazing and tourism.

NSW indicators

Indicator and status	Environmental trend	Information reliability
Wetland extent	MODERATE	Getting worse	✓
Wetland condition	MODERATE	Getting worse	✓

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Waterbird abundance and diversity		Getting worse	✓✓✓

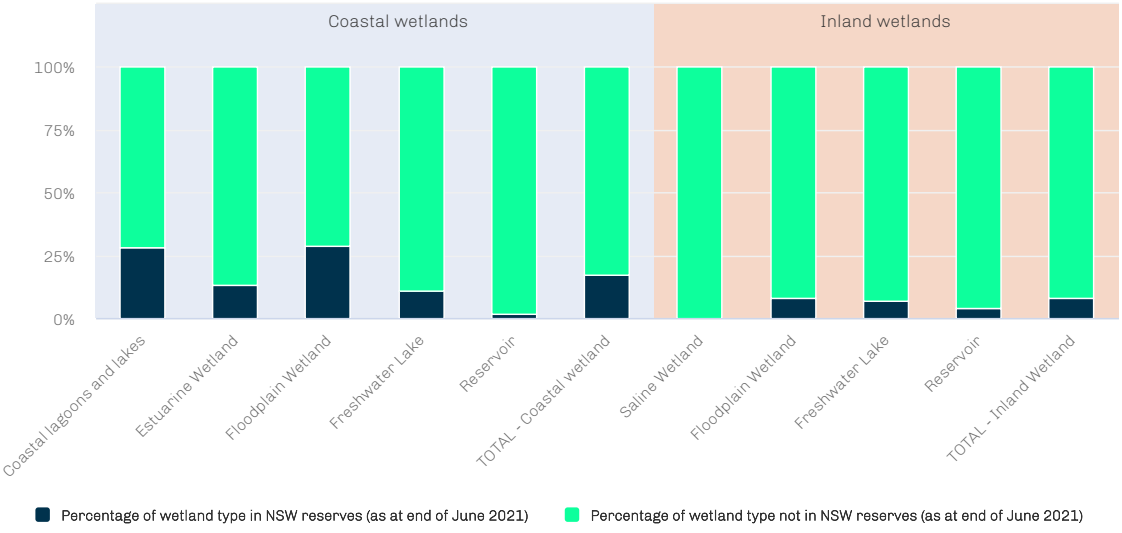
Notes:
Terms and symbols used above are defined in About this report.

Status and Trends

Eastern Australian Waterbird Survey data shows that the wetland area index across eastern Australia remained below the long-term median in 2020 and was the fifth-lowest since the survey began in 1983. However, the area of wetlands protected in the NSW parks estate increased between 2018 and 2020 with the addition of 209 hectares of coastal wetlands and 57,277 ha of inland wetlands.

Widespread rain and flooding during 2016 inundated many wetlands, increasing waterbird breeding. However, from 2017–19, drier conditions reduced the extent of wetland inundation and decreased waterbird breeding and waterbird abundance. Inland wetlands that have received water for the environment (held by the government and released in areas that need it) have acted as refuges for water-dependent species, including threatened frog species, during dry periods.

Spotlight figure 18: Percentage of coastal and inland wetland types in NSW reserves



Source:
East of the Great Dividing Range: Coastal Wetlands mapping | West of the Great Dividing Range: NSW Wetlands mapping | Reserves: National Parks and Wildlife Service

Spotlight figure 18 shows the percentage of coastal and inland wetland types protected in NSW reserves.

Pressures

Water availability is the most significant pressure on the health of many wetland ecosystems. Reduced water availability can be caused by altered flows from water extraction and the building of dams, levees and diversion structures, as well as by climate change, exacerbated by extreme weather events like heatwaves and droughts.

Other pressures on wetlands include human activities which can cause physical disturbance and adversely affect wetland water quality. For example, diffuse pollution from development and other land uses can raise the levels of nutrients and sediments entering wetlands. Lake bed cropping and floodplain clearing and grazing may also disturb soil, increase nutrients and impact vegetation and seed banks. Weed and invasive species are also threatening wetlands as they can affect wetland biodiversity and habitat value, ecosystem function and water quality.

Responses

A range of NSW Government legislation, policies and programs focus on protecting wetlands. For example, the *Water Management Act 2000* outlines requirements for water sharing plans for NSW rivers, one of the most important mechanisms for protecting wetlands; the NSW Wetlands Policy promotes the sustainable conservation, management and use of wetlands and the Marine Estate Management Strategy 2018–2028 and Catchment Action NSW improve and protect wetland water quality.

The Australian Clean Energy Regulator is currently finalising a method to enable landholders to claim carbon credits under the Emissions Reduction Fund for restoring some types of 'blue carbon' systems, specifically mangrove and saltmarsh. Any such future blue carbon projects in NSW would increase the state's wetland areas while removing carbon from the atmosphere and mitigating climate change.

Related topics: Water Resources | River Health

Groundwater

Used in agriculture and industry, groundwater is also the main water supply for many NSW regional communities and depended on for survival by important ecosystems.

Summary

Groundwater-dependent ecosystems

>90%

of the probable extent of dependent ecosystems in NSW has been mapped

Groundwater use in NSW

27%

of all metered water use comes from groundwater

Groundwater is often forgotten as it remains out of sight for most of its existence. It seeps (recharges) into the bedrock and may only appear as baseflow, adding to a river's flow, or emerging from a spring. Sometimes it may be tapped into by a bore or it might bubble up from a mound spring or at the coast through sands. Or it may sit just below the surface in shallow or perched permeable rock (aquifers).

Why groundwater is important

Groundwater can occur in dry landscapes across NSW and sometimes appears as a desert oasis and as the only source of water. Aboriginal people have always known about groundwater. It's been part their Dreaming, their stories, lore, dances and art for up to 65,000 years or since time immemorial (or Day One). The understanding Aboriginal people have of connected water through thousands of generations of observation is something to celebrate, especially knowing that deep groundwater, such as in the Great Artesian Basin, is very old or ancient water.

The cultural and spiritual connection Aboriginal people have with groundwater ranges from a source of water for survival or economic benefit, to dreaming stories where cultural heroes and creators exist, such as the Rainbow Serpent. With this strong Aboriginal connection, the SoE Aboriginal Peoples Knowledge Group has put forward that NSW water managers must protect groundwater quality and quantity from impactful drawdown, pollution from industry, mining and agriculture and over-extraction to ensure cultural values of groundwater are protected.

Overall average annual extraction from metered groundwater sources in NSW is being managed under the compliance rules in water sharing plans. Knowledge of NSW groundwater-dependent ecosystems has improved, but some uncertainty remains about their extent and condition.

In NSW there are water sharing plans that manage groundwater and surface water. There are 14 Regions identified by NSW, each with a number of surface water and groundwater plans. Aboriginal people currently have little say in groundwater management and even less ownership of groundwater resources. This is in spite of their long, deep connection with it.

Groundwater is an important source for communities' water supply, especially during droughts. Throughout NSW, 180 towns and villages rely on groundwater as their main water source for farming, irrigation and domestic use.

Certain ecosystems (groundwater-dependent ecosystems) depend either partially or mostly on the availability of groundwater to function when surface water is scarce.

NSW indicators

Indicator and status		Environmental trend	Information reliability
Long-term extraction limit: Entitlement	GOOD	Stable	✓✓
Aquifer integrity	GOOD	Stable	✓
Groundwater quality	MODERATE	Stable	✓
Condition of groundwater-dependent ecosystems*	UNKNOWN	Unknown	✓

Notes:
Terms and symbols used above are defined in
About this report
.

*While the condition of some groundwater-dependent ecosystems is known at a local level, the information in this report takes a statewide perspective

Spotlight figure 19 shows that groundwater extraction levels can fluctuate dramatically due to factors such as local sustainability levels and climatic conditions such as drought.

Status and Trends

Groundwater extraction increased between 2017–18 and 2019–20, reflecting significant demand for groundwater during a period of severe drought.

Water sharing plans ensure that groundwater use is managed within the long-term average annual extraction limit of the source. Extraction from some of the inland alluvial groundwater sources of the Murray–Darling Basin and one porous rock groundwater source fluctuates around local sustainability limits. However, the overall level of groundwater extracted from all metered groundwater sources in NSW is much lower than the cumulative sustainable extraction limits.

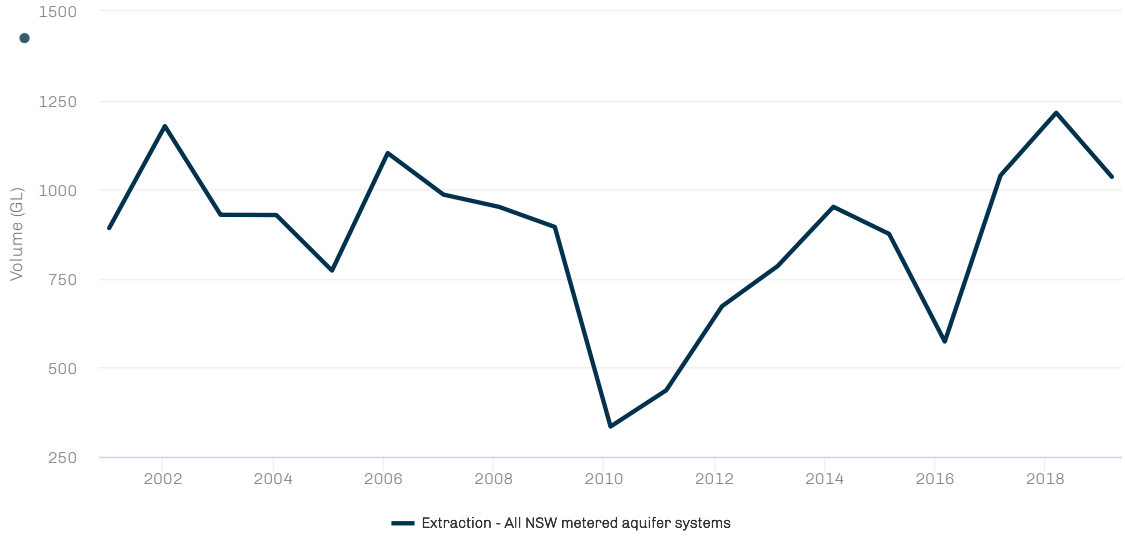
Eleven water resource plans focusing on groundwater sources in the Murray–Darling Basin were developed in 2020 and submitted for Commonwealth accreditation. These will set out arrangements to share water for consumptive uses, establish rules to meet environmental and water quality objectives and take into account potential and emerging risks to water.

Demand for groundwater increased significantly between 2017–18 and 2019–20 from roughly 11% of the state's overall metered water use to 27%, mainly due to extended and severe drought.

Overall, the quality of known groundwater sources is moderate, while the aquifer integrity is stable.

Water sharing plans rely heavily on groundwater sources. These plans manage the average annual extraction limits from metered groundwater sources under their compliance rules. Extraction from some inland alluvial groundwater sources in the Murray–Darling Basin and one porous rock groundwater source can at times exceed local sustainability limits. However, the overall level of groundwater extracted from all metered groundwater sources in NSW is much lower than the cumulative sustainable extraction limits.

Spotlight figure 19: Annual levels of NSW groundwater extraction from all metered groundwater systems 2001–02 to 2019–20



Source:
WaterNSW – Water accounting system data June 2021

Pressures

Factors affecting the quality and availability of groundwater include excessive demand and extraction, saline intrusion and chemical contamination.

Responses

The *Water Management Act 2000* legislates that all groundwater sources must be managed sustainably. Under the *Contaminated Land Management Act 1997*, contaminated groundwater must be reported to the Minister administering the Water Management Act.

Other responses include various policies and programs.

- The NSW State Groundwater Dependent Ecosystems Policy contains guidelines to protect and manage groundwater-dependent ecosystems.
- The NSW Aquifer Interference Policy balances the water requirements of towns, farmers, industry and the environment.
- The Cap and Pipe the Bores Program provides financial incentives for landowners to offset the costs of replacing uncapped artesian bores and open drains with rehabilitated bores and efficient pipeline systems.

Eleven water resource plans for groundwater sources in the Murray–Darling Basin were developed in 2020 and submitted for Commonwealth accreditation. These set out arrangements to share water, rules to meet environmental and water quality objectives and potential and emerging risks to groundwater quality and availability.

Related topics: Water Resources | Wetlands | Coastal, Estuarine and Marine Ecosystems

Coastal, Estuarine and Marine Ecosystems

The coastal, estuarine and marine waters of NSW contain high levels of biodiversity due to their wide range of oceanic, shoreline and estuarine habitats, and their subtropical and temperate current influences.

Recreational water quality

89%

of monitored swimming sites scored very good or good for recreational water quality in 2019–20

Marine species

47

marine species are listed as threatened under NSW legislation

Saltmarsh in estuaries

38%

of estuaries mapped in the past five years have shown a decrease in areas of saltmarsh

Estuarine water quality

71%

of estuaries in NSW had water quality rated as being in good condition

Water quality and ecosystem health in marine and beach environments are generally good. The condition of NSW estuaries, coastal lakes and lagoons is more variable with more disturbance and negative impacts.

Why coastal, marine and estuarine ecosystems are important

The coastal, marine and estuarine waters of NSW contain high levels of biodiversity due to their diverse range of oceanic, shoreline and estuarine habitats and the influence of subtropical and temperate currents. These varied environments and the habitats they support provide many important ecosystem services, such as:

- mitigating coastal and seabed erosion
- maintaining coastal water quality and healthy aquatic ecosystems
- acting as critical habitats for fish and other marine life
- providing recreation, visual amenity and food production.

NSW indicators			
Indicator and status		**Environmental trend**	**Information reliability**
Percentage of ocean and estuarine beaches with beach suitability grades for swimming of good or better	GOOD	Stable	✓✓✓
Estuarine water quality (chlorophyll *a* and turbidity)*	MODERATE	Stable	✓✓✓
Extent of estuarine macrophytes	MODERATE	Stable**	✓✓
Levels of estuarine catchment disturbance	MODERATE	Getting worse	✓✓

Notes:
Terms and symbols used above are defined in About this report.

* Water quality by algae (chlorophyll *a*) and water clarity (turbidity).
** Stable reflects a variable result with extent decreasing in some areas and increasing in others.

Status and Trends

Recreational water quality is rated as 'very good' or 'good' at 89% of NSW beaches. The Beachwatch program ratings are based on levels of pollution from stormwater runoff and sewage contamination (enterococci data). The results show that 98% of ocean beaches and 85% of estuaries are rated 'very good' or 'good' but that only 42% of coastal lakes and lagoons are rated at this level. This indicates that the majority of coastal lakes and lagoons were susceptible to faecal pollution, with water quality not always suitable for swimming.

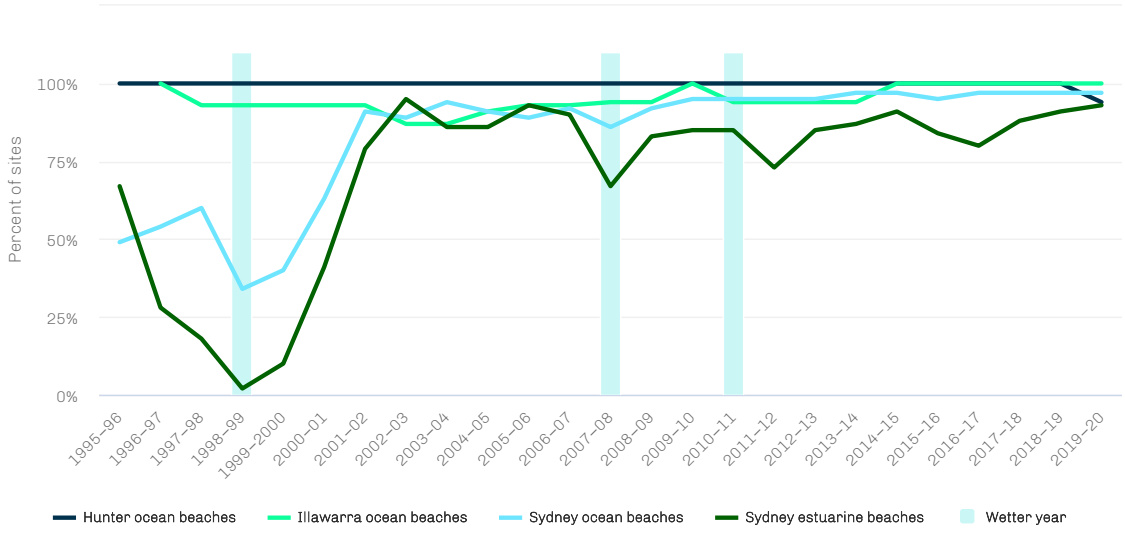
The condition of individual estuaries and coastal lakes is highly variable and depends on their level of resilience to change and the level of disturbance of their catchment. The health of estuarine ecosystems is heavily influenced by water quality. The NSW Government's Estuary Health Monitoring Program monitors estuarine water quality by algae (chlorophyll *a*) and water clarity (turbidity) showing 71% of estuaries are in good condition and 10% of estuaries are in poorer condition. Other parameters that impact water quality fall outside this program, such as acidity (pH), pesticides, herbicides, heavy metals and other contaminants.

Aquatic plants have a role in maintaining water quality and sediment stability and supporting aquatic biota. The impacts of climate change and sea temperature rise are contributing to loss of kelp. Kelp is also being lost from offshore reefs on the mid-north coast, correlating with increases in populations of herbivorous fish.

Long-term trends show mangroves have been spreading in many NSW estuaries, often into areas of saltmarshes, and may be related to various human activities and sea level rise. Matching upslope migration of saltmarsh is often constrained by public infrastructure and land uses; and also less evident than mangrove spread. The 2019–20 bush fire season saw some of the most extensive and intense fires recorded in NSW with blazes occurring in areas that would not have usually burnt due to the ferocity of the fires. In coastal areas, this can be seen in the burnt or heat effects on mangroves and varied impacts on saltmarsh. The largest areas affected by fire include 71% of saltmarsh and 32% of mangroves in Wonboyn Lake and 48% of saltmarsh at Berrara Creek, 40% at Lake Tabourie and 38% at Khappinghat Creek.

Forty-seven marine species or populations are currently listed as threatened under NSW legislation, including 22 marine seabird species, eight fish species, seven marine mammal species, three reptile species and seven other species. See Threatened Species topic.

Spotlight figure 20: Percentage of Sydney, Hunter and Illawarra beach and estuary monitoring sites rated with low levels of faecal contamination 1995–96 to 2019–20



Notes:
Includes Beachwatch Program data. Data from the Beachwatch Partnership Program is not included.

Source:
DPIE 2021

Spotlight figure 20 shows the percentage of sites with low levels of faecal contamination over the past 25 years at ocean and estuarine beaches in Sydney, the Hunter and the Illawarra. Microbial Assessment Categories are used to determine levels of enterococci found in faecal matter in water and, to determine levels over time, the categories have been applied to historical enterococci data. Microbial Assessment Categories A and B indicate generally low levels of faecal contamination, and are part of the assessment for a swimming site to achieve a beach suitability grade or rating of 'very good' or 'good'.

The trend shows a significant reduction in bacterial levels at swimming locations in the Sydney region since 1998–99, with most fluctuations due to rainfall patterns and the associated variation in the frequency and extent of stormwater and wastewater inputs. Significant changes in recreational water quality occurred around 2000 and was mostly attributed to large-scale sewage infrastructure works.

Pressures

The greatest threats to the coastal and marine environment come from land-use intensification, resource use activities and climate change. Most coastal and estuarine areas have been modified to some extent, increasing pressure on the species that depend on them. Coastal development and land use continue to affect the viability of faunal populations, including threatened species. Only about one in five estuaries and coastal lakes retains more than 90% of natural, uncleared vegetation in their catchments, mostly along the south coast.

The desirability of coastal lifestyles and increasing settlement along the coast are placing estuaries and coastal lakes under higher levels of stress. The waters and ecosystems near urban, industrial and agricultural areas are particularly exposed to the effects of pollution from urban and agricultural runoff, stormwater and sewage discharge. The main threats to coastal, estuarine and marine waters are:

- land-use intensification, point discharges, poor diffuse water quality discharges and hydrologic modification mostly via floodplain drainage
- resource use, activities including shipping, boating, fishing, aquaculture, recreation and tourism, dredging, mining, flow modification, entrance modification and infrastructure

- climate change resulting in altered ocean currents and nutrients, air and sea temperature rise, ocean acidification, altered storm and cyclone activity, sea level rise, coastal erosion, flooding and storm inundation (MEMA 2017).

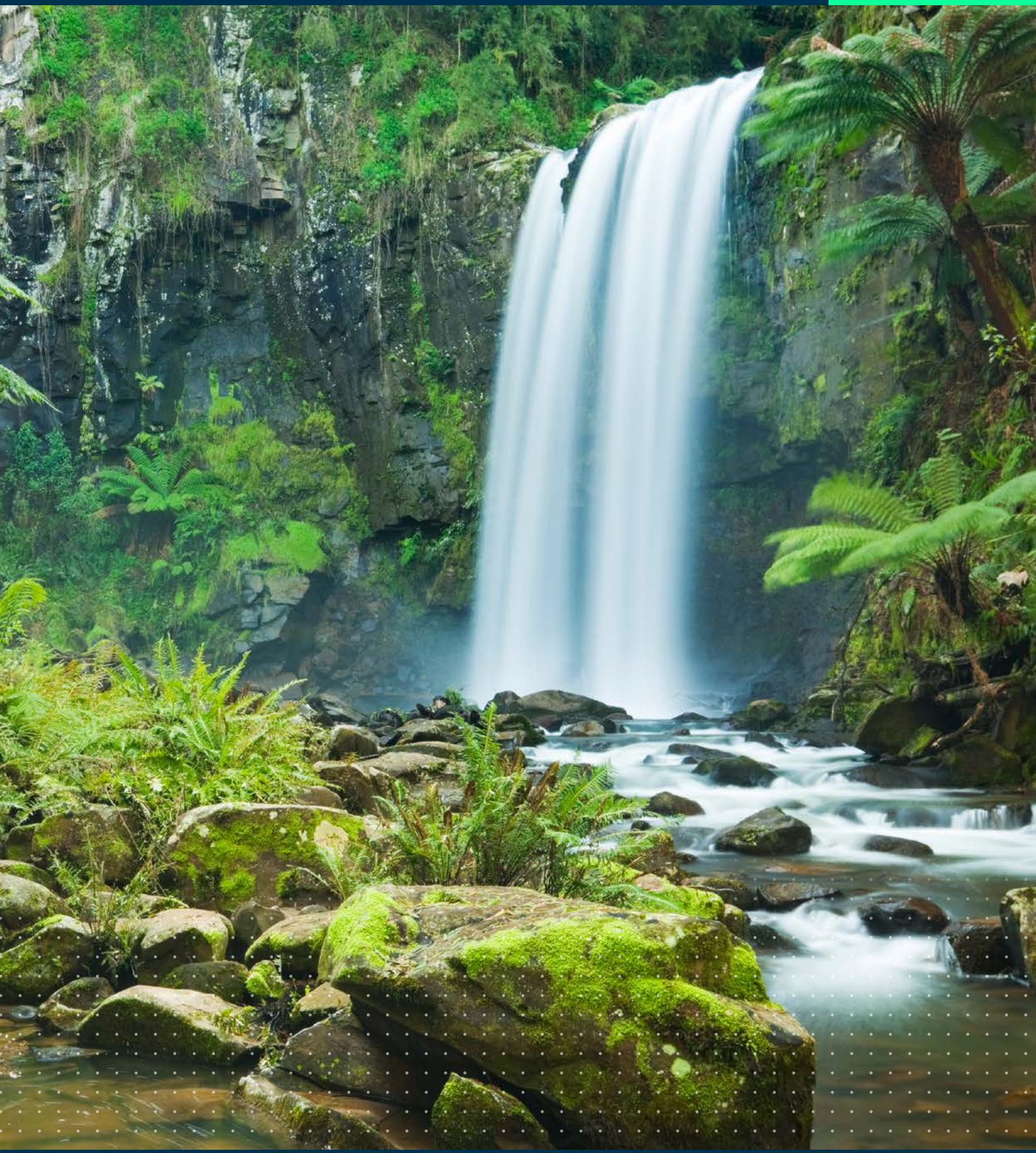
Responses

NSW has frameworks and legislation to manage the marine estate, with objectives for coastal management, environment protection and fisheries management. Strategies in place include coastal management programs, the Marine Estate Management Strategy , Marine Water Quality Objectives, waterway health outcomes and risk-based frameworks to consider waterway health. Sustainability in the marine environment is also considered across commercial fisheries, harvest strategies and sustainable aquaculture strategies.

Marine-protected areas comprise a large network of marine parks and aquatic reserves to conserve biodiversity and maintain ecosystem function and the integrity of bioregions in NSW waters. See Protected Areas and Conservation topic.

Related topics: Protected Areas and Conservation | Invasive Species | Climate Change | Fire | Threatened Species

Appendices



soe.epa.nsw.gov.au

Net Zero Plan Stage 1: 2020–2030

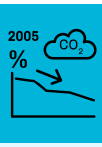
The Net Zero Plan requires NSW State of the Environment to report on the plan's implementation and progress towards meeting its net zero emissions goal.

Summary

NSW greenhouse gas emissions projected to be abated by the plan

28.6–37.3 Mt CO_2-e

in 2030



Greenhouse gas emissions in 2030 are projected to be

47–52% lower

than in 2005

The NSW Government has an objective to achieve a 50% reduction in emissions on 2005 levels by 2030 and to reach net zero emissions by 2050. The *Net Zero Plan Stage 1: 2020–2030* is the foundation for NSW action on climate change. Under current policy settings, NSW emissions in 2030 are projected to be 47–52% lower than 2005 levels. This will put NSW on the path to achieving net zero emissions with further action and investment in decarbonisation initiatives needed to reach net zero emissions by 2050.

The *Net Zero Plan* highlights the NSW Government's commitment to maintaining a strong economy, improving the quality of life for the people of NSW and protecting the environment. Initiatives under the plan will reduce emissions and also grow the economy and create jobs over the next decade.

NSW greenhouse gas emissions in 2018–19 were inventoried to be 136.6 million tonnes carbon dioxide-equivalent (CO_2-e) or 16.9 tonnes CO_2-e per capita. Emissions peaked in 2007 and in 2019 were 17% lower than in 2005.

Projections show that taking a business-as-usual approach will reduce emissions to 30% below 2005 levels by 2030. NSW Government policies under the *Net Zero Plan*, including the *NSW Electricity Infrastructure Roadmap*, will deliver further emission reductions. Total NSW emissions are projected to fall to 78.9–87.6 Mt CO_2-e by 2030, which is 47–52% below 2005 levels. Overall output of carbon dioxide in the atmosphere will continue to rise under both scenarios, contributing to greater concentrations of carbon dioxide and amplifying the effects of climate change. However under the net zero plan CO_2-e emissions produced each year in NSW are projected to be 47–52% below 2005 levels, reducing the annual emissions rate to 78.9–87.6 Mt CO_2-e by 2030.

Stage 1 of the *Net Zero Plan* will put NSW on the path to achieving net zero emissions by 2050 through investment in new technologies, including energy systems and low emission ways of living. However projections show that further effort and investment will be required in the decades beyond 2030 to achieve the net zero emissions objective.

Related topics: Energy Consumption | Climate Change | Greenhouse Gas Emissions

Context

Released in March 2020, the *Net Zero Plan Stage 1: 2020–2030* (DPIE 2020a) is the foundation for NSW Government action on climate change over the next decade. It sets the state up to achieve its objective of halving emissions on 2005 levels by 2030 and its long-term objective of reaching net zero emissions by 2050.

The plan, which aims to strengthen the prosperity and quality of life for the people of NSW, has four key priorities. Priority

1: Drive the uptake of proven emissions reduction technologies

Priority 2: Empower consumers and businesses to make sustainable choices

Priority 3: Invest in the next wave of emissions reduction innovation

Priority 4: Ensure the NSW Government leads by example

These priorities support initiatives that will reduce emissions across the areas of electricity and energy efficiency, transport, primary industries and land, clean technology and industry innovation, buildings and planning systems, organic waste and sustainable finance.

The *Net Zero Plan* delivers on the objectives of the *NSW Climate Change Policy Framework* (OEH 2016), which sets out the policy directions for action to mitigate and adapt to climate change. This includes the long-term objectives of NSW being more resilient to a changing climate and achieving net zero emissions by 2050.

Policies under the plan are also being delivered as part of the *NSW Electricity Infrastructure Roadmap* , *NSW Electric Vehicle Strategy* and *NSW Waste and Sustainable Materials Strategy 2041* . For more about these and other plans and strategies, go to the Greenhouse Gas Emissions, Energy Consumption, Transport and Waste and Recycling topics.

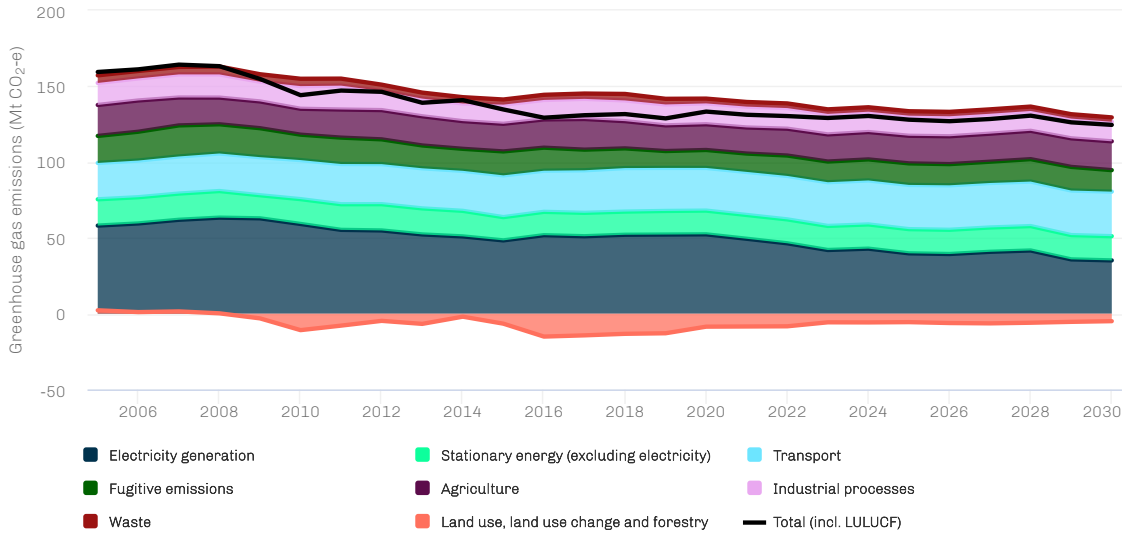
NSW emission projections

In 2018–19, NSW net greenhouse gas emissions were inventoried to be 136.6 megatonnes carbon dioxide-equivalent (CO_2-e), representing 26% of Australia's total emissions. Per capita NSW emissions, including land use, land-use change and forestry, stood at 16.9 tonnes CO_2-e, below the national average of 20.9 tonnes. Emissions peaked in 2007 and in 2019 were 17% lower than 2005 levels.

In 2018–19, stationary energy (mostly from electricity generation) was the largest source of emissions in NSW at 49% of the total, followed by emissions from transport (20%), agriculture (12%), industrial processes and product use (9%) and fugitives from coal and gas (9%) – see **Figure 23.1**. The land use, land-use change and forestry sector is currently a carbon 'sink' as it stores more carbon than it emits and thus reduces the state's emissions by 3%.

Four of NSW's five coal-fired power stations that currently provide around three-quarters of the state's energy supply are scheduled to close by 2035. This provides enormous potential to decarbonise the electricity sector.

Figure 23.1: Net NSW greenhouse gas emissions as inventoried (2005–2019) and projected with Net Zero Plan Stage 1 policies implemented (2020–2030)



Notes:
Non-CO_2 emissions are expressed as CO_2 equivalents using 100-year global warming potential values from the IPCC Fifth Assessment Report.
Emissions projections were prepared using the latest activity data and assumptions based on the advice of NSW and Australian government agencies. The projections are modelled to indicate what NSW future emissions could be if the assumptions underpinning the projection occur. It is dissimilar to a forecast, which predicts actual future events and changes. Projections are given as a range – for simplicity a central estimate of emission projections is shown for 2020–2030 and discussed in the related text.
References to a particular year refer to financial year, i.e. the 12 months ending 30 June of that year

Source:
Emissions to 2019 are as inventoried by the Australian Department of Industry, Science, Energy and Resources (Australian Greenhouse Emissions Information System).
| Emission projections for 2020 to 2030 are based on NSW Department of Planning, Industry and Environment modelling and analysis.

Projections show that, if a business-as-usual approach is followed, NSW emissions will fall to 30% below 2005 levels by 2030. This is because industry and the electricity sectors are already decarbonising by moving to more reliable and affordable sources of energy. Australia's three biggest trading partners, China, Japan and South Korea, have all committed to net zero emissions targets. It is important that NSW manages the risk this poses to our economy and takes advantages of new opportunities.

NSW Government policies under the *Net Zero Plan*, including the *NSW Electricity Infrastructure Roadmap* (DPIE 2020b), are projected to deliver further emission reductions taking the total to 78.9–87.6 Mt CO_2-e in 2030, which is 47–52% lower than in 2005.

Further information on the status of emissions in NSW and projected emissions to 2030 taking current policies in the plan into account is available in the Greenhouse Gas Emissions topic.

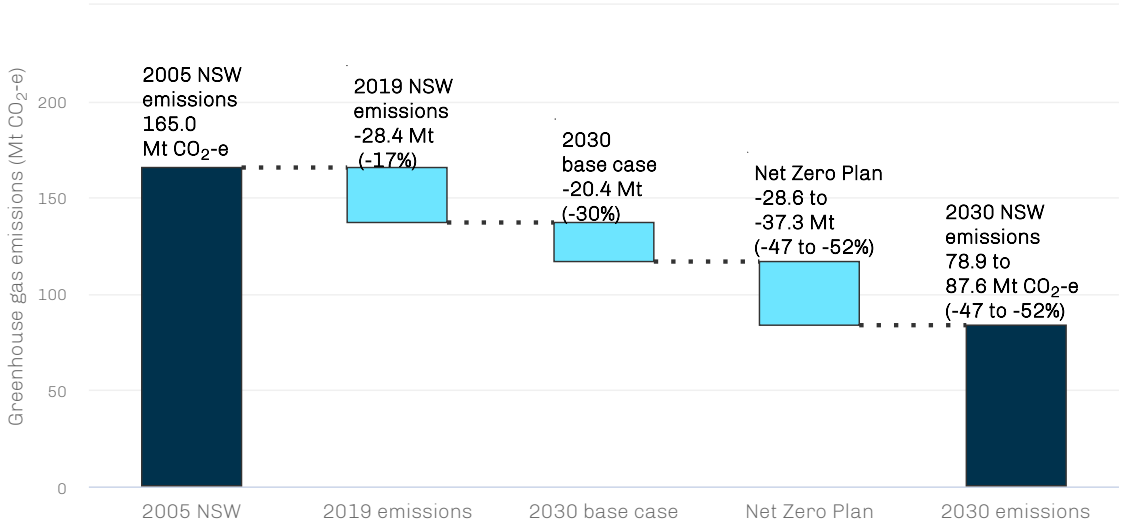
Impact of the Net Zero Plan

Emissions reduction

Upon its launch, the *Net Zero Plan Stage 1: 2020–2030* (DPIE 2020a) was forecast to reduce total NSW emissions by 35.8 Mt CO_2-e by 2030, which is 35% below 2005 levels. However, since the plan's publication, further modelling and analysis on trends in NSW emissions and the likely impact of the plan have revised projections significantly.

By 2019, total NSW emissions had already fallen by 28.4 Mt CO_2-e or 17% below 2005 levels (see **Figure 23.2**). 'Base case' trends in NSW emissions, which exclude the impact of the plan, are now projected to result in a further reduction of 20.3 Mt CO_2-e reduction in annual emissions by 2030 (**Figure 23.2**).

Figure 23.2: Projected reductions in annual NSW emissions in 2030 under base case and Net Zero Plan scenarios



Notes:
Emissions are expressed as CO_2 equivalents using 100-year global warming potential values from the IPCC Fifth Assessment Report and are given for financial year 2030. Emissions projections were prepared using the latest activity data and assumptions based on the advice of NSW and Australian government agencies. The projections are modelled to indicate what NSW future emissions could be if the assumptions underpinning the projection occur.

The graph depicts a central estimate of the emission reductions as a result of *Net Zero Plan Stage 1*, with lower and upper emission reduction projections referenced in the text on the graph.

Source:
Emission projections for 2020–2030 are based on NSW Department of Planning, Industry and Environment modelling and analysis.

Factors contributing to the downward revision of the NSW emissions trajectory include:

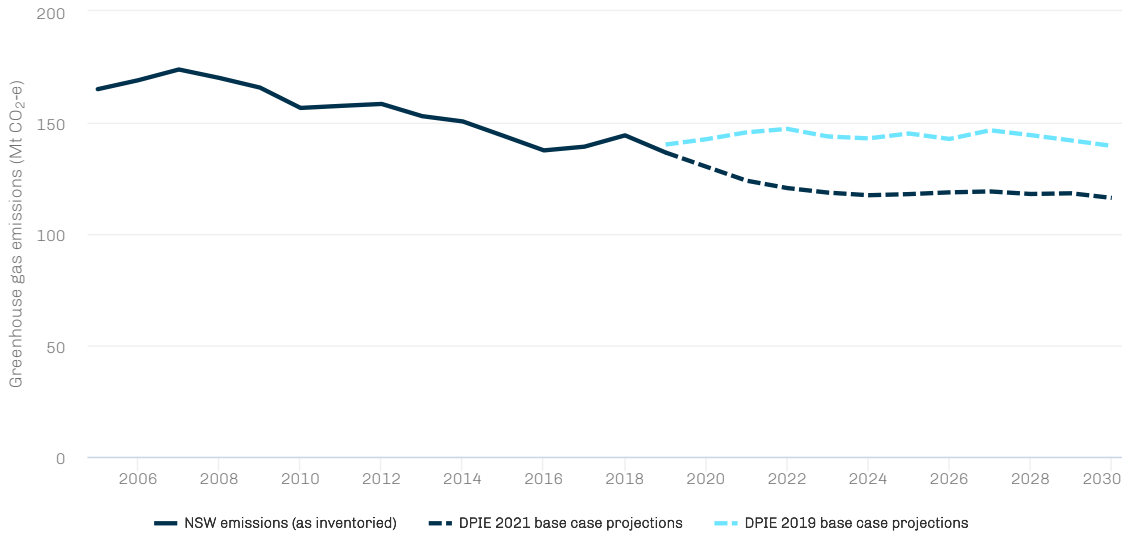
- lower electricity generation emissions due to a higher than expected increase in rooftop solar and updated projections by the Australian Energy Market Operator indicating more rapid growth in the renewables share of the National Electricity Market (AEMO 2021)
- lower agricultural emissions in the near term due to the impact of the recent drought on livestock numbers and crop productivity (DISER 2021b, 2021c)
- upgraded base case rates for electric vehicle uptake and downgraded coal production outlooks in response to global technology and energy market trends (IEA 2021).

Initiatives in the *Net Zero Plan* are projected to deliver further reductions in annual NSW emissions of between 28.6 and 37.3 Mt CO_2-e by 2030. Accounting for base case trends and NSW Government initiatives under the plan, total annual NSW emissions are projected to fall to 78.9–87.6 Mt CO_2-e in 2030, which is 47–52% lower than 2005 levels (**Figure 23.2**).

Forecast emission reductions under the plan include abatement from a range of initiatives including the *NSW Electricity Infrastructure Roadmap*, the Net Zero Industry and Innovation Program, *NSW Electric Vehicle Strategy*, and policies under the *NSW Waste and Sustainable Materials Strategy 2041*.

The projected emission reductions under *Net Zero Plan* initiatives do not include the impact of some policies still in development. For example, the estimate includes the impact of developing hydrogen hubs under the NSW Net Zero Industry and Innovation Program but does not account for the full impact of the NSW Hydrogen Strategy published in October 2021 or the NSW Renewable Gas Certification Scheme announced in June 2021. Both were still under development at the time of the modelling and analysis.

Figure 23.3: 2019 and 2021 base case projections for NSW emissions (that is, without the Net Zero Plan)



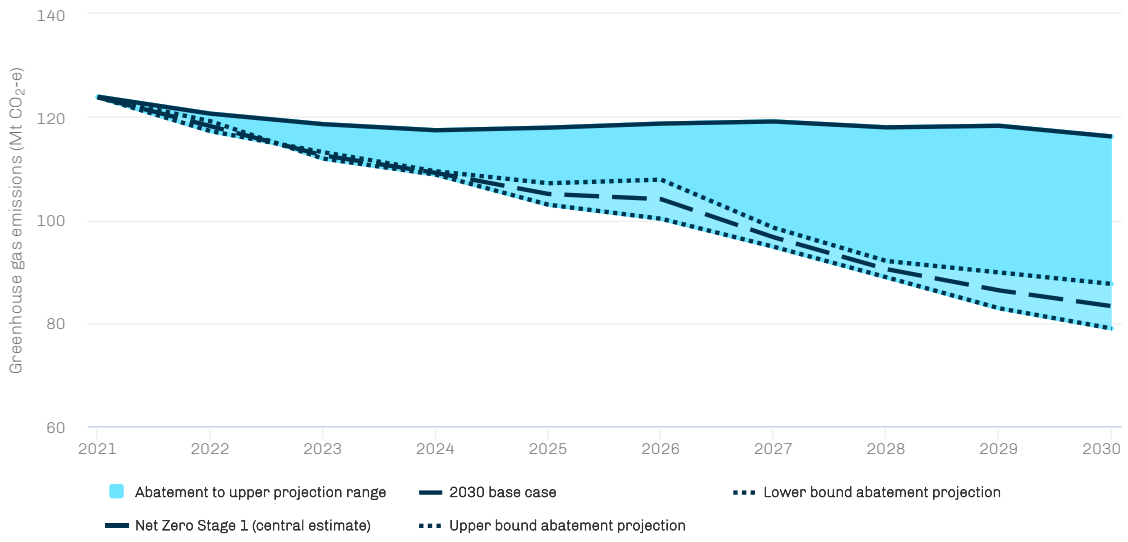
Notes:
Emissions are expressed as CO_2 equivalents using 100-year global warming potential values from the IPCC Fifth Assessment Report and are given for financial years.
Emissions projections were prepared using the latest activity data, assumptions and advice at the time of their derivation. The projections are modelled to indicate what NSW future emissions could be if the assumptions underpinning the projection occur. The graph depicts NSW emissions as inventoried and published within the National Greenhouse Accounts (2005--2019) and base case projections developed by the NSW Department of Planning, Industry and Environment in 2019 and 2021.

Stage 1 of the *Net Zero Plan* will put NSW on the path to net zero emissions by 2050 through investment in proven and new emissions reduction technologies, energy systems and low emission ways of living (**Figure 23.4**). A large proportion of emission reductions this decade will come from reducing emissions associated with stationary energy.

Annual emission reductions to be delivered by the plan are projected to increase over the next decade as initiatives are implemented:

- coal-fired power stations close and renewable energy generation ramps up
- the share of electric vehicles on the road increases
- carbon markets expand, supporting greater carbon sequestration by the land sector
- technologies for abating agricultural, industrial and mining emissions mature
- more organic waste is diverted from landfill
- a growing number of households and businesses reduce their electricity and gas use under the expanded Energy Security Safeguard
- more consumers and businesses are empowered to make sustainable choices.

Figure 23.4: Projected reductions in NSW emissions due to NSW Government action between 2021 and 2030



Notes:
Emissions are expressed as CO_2 equivalents using 100-year global warming potential values from the IPCC Fifth Assessment Report and are given for financial years.
Emissions projections are prepared using the latest activity data and assumptions based on the advice of NSW and Australian government agencies. The projections are modelled to indicate what NSW future emissions could be if the assumptions underpinning the projection occur. The graph depicts base case and current policy projections to 2030 given emission reductions to be delivered by the Net Zero Plan Stage 1, including central estimates and upper and lower bound projections of the emission reductions.

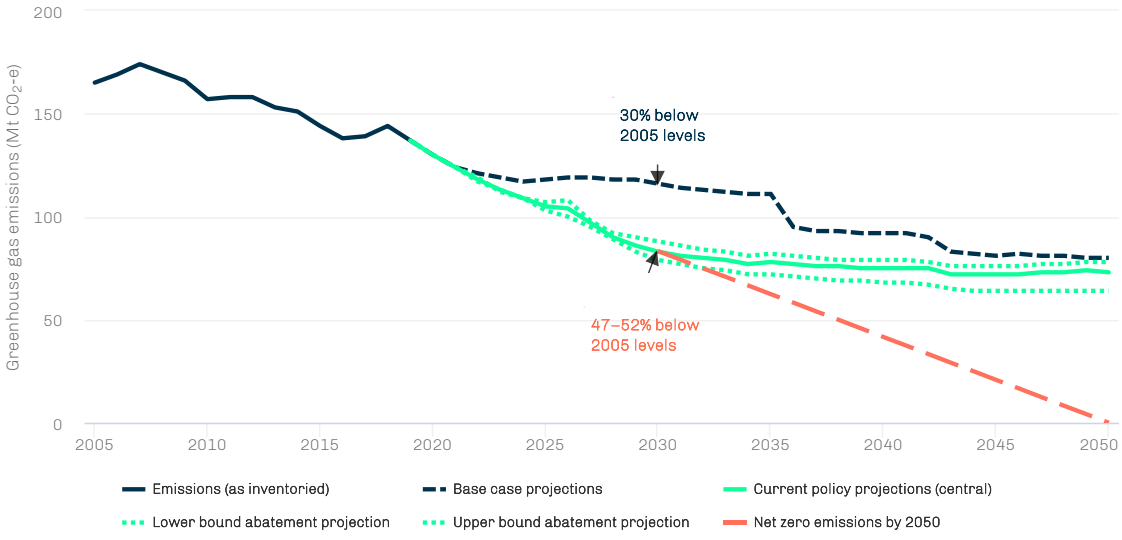
Emissions reduction beyond 2030

With the initiatives in Stage 1 of the *Net Zero Plan* implemented and emissions at 47–52% below 2005 levels, reductions will need to continue beyond 2030. Projections show that further effort and investment will be required in the following decades to achieve the reductions necessary to meet the net zero objective by 2050 (see Figure 23.5).

Projections indicate that action beyond current policies will be needed to address emissions from most sectors, including heavy duty vehicles, agriculture, stationary energy, industry, mining, aviation and land clearing (see Figure 23.6). More support may also be required to bolster carbon sequestration and support the expansion of premium carbon markets.

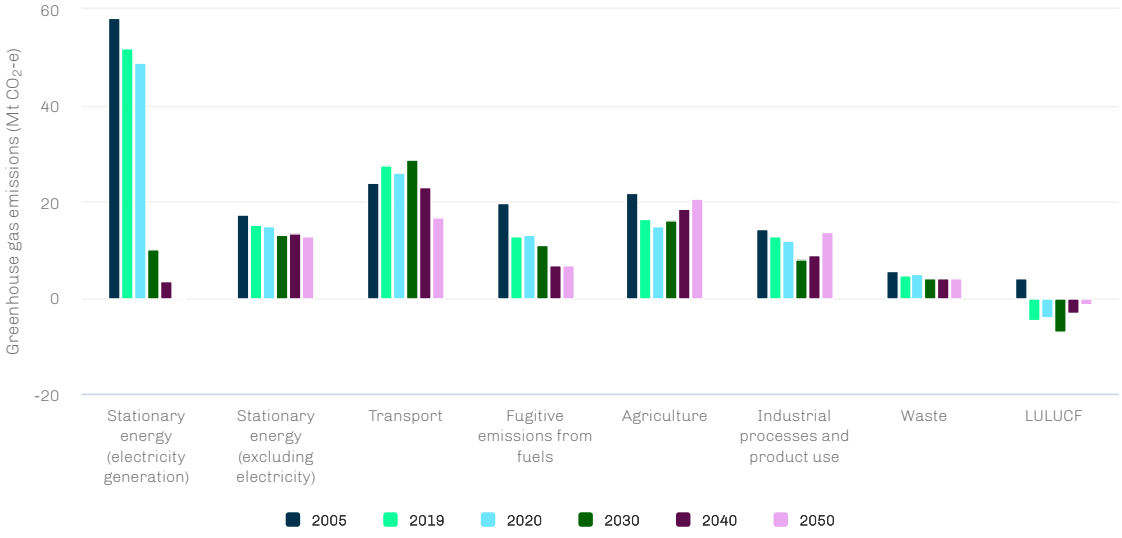
The International Energy Agency notes that, while technologies on the market today can offer immediate emission reductions, almost half the reductions needed to meet a global goal of net zero by 2050 will need to come from technologies that are currently at the demonstration or prototype phase (IEA 2021). This means that major innovation efforts will be required this decade to develop new technologies and bring them to market. Stages 2 and 3 of the Net Zero Plan will be developed ahead of 2030 and 2040 to address this challenge.

Figure 23.5: Projected NSW emissions to 2050 under base case and current policy scenarios and the path ahead to net zero emissions by 2050



Notes:
Emissions are expressed as CO_2 equivalents using 100-year global warming potential values from the IPCC Fifth Assessment Report and are given for financial years.
Emissions projections are prepared using the latest activity data and assumptions based on the advice of NSW and Australian government agencies. The projections are modelled to indicate what NSW future emissions could be if the assumptions underpinning the projection occur. The graph depicts base case and current policy projections to 2050 given emission reductions to be delivered by *Net Zero Plan Stage 1*, including central estimates and upper and lower bound projections of the emission reductions.

Figure 23.6: Projected NSW emissions by sector with current policies implemented



Notes:
LULUCF = Land use, land-use change and forestry
Emissions are expressed as CO_2 equivalents using 100-year global warming potential values from the IPCC Fifth Assessment Report and are given for financial years.
Emissions projections are prepared using the latest activity data and assumptions based on the advice of NSW and Australian government agencies. The projections are modelled to indicate what NSW future emissions could be if the assumptions underpinning the projection occur. The graph depicts current policy projections taking into account central estimates of the emission reductions projected to be delivered by *Net Zero Plan Stage 1*.

A report by the Office of the NSW Chief Scientist and Engineer (OCSE) – Decarbonisation Innovation Study (OCSE 2020) – details economic opportunities associated with decarbonisation and climate adaptation across all sectors of the NSW economy, including services, electricity, industry, the built environment, land and transport. OCSE will update this report every two years to inform future policy and program design.

Economic impacts

Apart from helping to ameliorate the impacts of climate change by contributing to global reduction in emissions, current NSW efforts are expected to bring significant economic benefits to the state. These will be in the form of short- and long-term job creation as the result of increased economic activity. Likely benefits will not be confined to metropolitan areas, as significant investment is forecast in the regions. For example, planned Renewable Energy Zones, hydrogen hubs and land sector offset projects will primarily occur in regional NSW.

The following metrics will be reported on to determine the economic impact of the *Net Zero Plan*:

- $ per tonne of CO_2-e reduced
- jobs created in metropolitan and regional NSW
- government investment in metropolitan and regional NSW
- non-government investment in metropolitan and regional NSW
- increased economic activity in metropolitan and regional NSW.

Other environmental impacts

Initiatives under the *Net Zero Plan* will have environmental benefits, including improvements in air quality, biodiversity and soil health. The NSW Government will develop metrics to measure and evaluate the environmental impacts of these initiatives

Air quality

Air quality is determined by the types and amounts of pollutants emitted into the atmosphere. The main sources of human-made pollutants come from industry, motor vehicles, other transport and domestic wood smoke. Climate change also impacts air quality, with extreme climate-related events, such as bushfires and dust storms, worsening air pollution across large areas of the state.

Air pollution is known to shorten the lives of people in NSW. It has been estimated (Broome et al. 2020) that 5,900 years of life are lost each year due to long-term exposure to fine particles in the NSW Greater Metropolitan Region (GMR). This equates to a mortality effect equivalent to 420 premature deaths. Air pollution from fine particles is estimated to result in $3.3 billion in health costs each year in the GMR. Read more about the health impacts of air pollution in the Air Quality topic.

The *Net Zero Plan* will deliver improvements in air quality by supporting the transition to cleaner energy, industry and transport. This in turn will reduce the associated health costs, hospitalisations and deaths attributable to poor air quality.

As NSW transitions to net zero emissions, further work will develop measures to track the associated air quality and health benefits of reducing human exposure to fine particles and other air pollutants.

Electric vehicles, cleaner air and health benefits

Reducing tailpipe emissions from vehicles through initiatives outlined in the *NSW Electric Vehicle Strategy* will deliver significant health benefits for NSW. All vehicles contribute to air pollution through road, brake and tyre wear. The transition to battery and fuel cell electric vehicles will reduce the health impacts of air pollution with an end to tailpipe emissions of particle and gaseous air pollutants from petrol and diesel vehicles.

Statistics show that in 2013 motor vehicles accounted for 55% of Sydney's anthropogenic nitrogen oxide (NOx) emissions, 13% of volatile organic compound (VOC) emissions and 13% of particulate matter ($PM_{2.5}$) emissions (EPA 2019) – all of which have direct and indirect effects on the health of the community. Motor vehicles are also a significant contributor to fine particle and ozone pollution in the Sydney basin (Chang et al. 2019; Duc et al. 2018). Moreover, about 70 premature deaths each year are associated with long-term exposure to vehicle pollution in the NSW Greater Metropolitan Region, with vehicle exhaust emissions contributing 69% of the fine particle exposures associated with these deaths (Broome et al. 2020).

Biodiversity and soil health

Biodiversity refers to the variety of living animal and plant life and the complex interactions that make up the natural environment. Soil degradation is the decline in soil condition caused by its improper use or poor management, usually for agricultural, industrial or urban purposes. Soils and native vegetation are natural carbon sinks.

Climate change, pollution, invasive species and habitat clearing through intensified agricultural activity and urban expansion are pressures that are having an impact on biodiversity in NSW. Likewise, business-as-usual land management practices and climate change will exacerbate the loss of the soil's organic carbon and thus reduce productivity. It is important to protect biodiversity and soil heath so that environmental services which support human health, wellbeing and traditional cultures can continue to provide and thrive for future generations.

Initiatives under the *Net Zero Plan* in the agriculture and land sectors will support landholders and traditional owners to protect and manage biodiversity and soil health on their lands while reducing emissions. Carbon farming is one example of this. It aims to reduce greenhouse gas emissions by sequestering or capturing emissions in vegetation and soils. Such initiatives can mitigate land degradation by encouraging landholders to retain and enhance native vegetation on their land, improve groundcover, and manage stock, crops and waste in more sustainable ways.

The increase in soil organic carbon content derived from carbon farming has many co-benefits including greater productivity resulting from improved soil structure, increased nutrient cycling and greater diversity of soil organisms (Kragt et al 2016; Baumber et al 2019). Premium carbon projects have environmental and social co-benefits, such as biodiversity outcomes, coastal and wetland regeneration and Aboriginal community development. (DPIE 2020). For traditional owners, carbon farming may also have the added benefit of caring for Country. These activities are done in return for carbon credits which landholders can sell in carbon markets to businesses to offset emissions.

The opportunity to improve soil health is not just confined to agricultural land. Pollution from waste can greatly impact soil and contaminate urban lands. A focus on re-use, recycling and reducing waste will result in lower emissions and positive outcomes for soils. Better management of organic waste by diverting it from landfill will help reduce the release of nutrients that pollute soils and waterways. Where organics are properly sorted and processed, they can be turned into compost and natural fertilisers, which can enrich soils when used in farming or gardening.

Indicators have been developed to measure the condition of biodiversity and ecological integrity at statewide and regional scales through the Biodiversity Indicator Program. The NSW Department of Primary Industries is also developing indicators to measure the co-benefits of carbon farming, including biodiversity, soil health and other socio-economic benefits (DPI 2021). Building on these indicators will help to develop measures of the impact of the plan's initiatives.

Status of initiatives

Since the *Net Zero Plan* was released in March 2020, extensive scoping and development of initiatives to support NSW's transition to net zero emissions have been underway. This section outlines how key sectors are being transformed and tracks their performance across the plan's priority areas:

Energy

Initiative	Status
The *Net Zero Plan* includes a range of lower emissions energy initiatives being delivered as part of the *NSW Electricity Infrastructure Roadmap* (DPIE 2020b). The roadmap supports the development of new electricity infrastructure in NSW. It will support the private sector to bring 12 gigawatts of renewable energy and two gigawatts of storage, such as pumped hydro, online by 2030. The roadmap will help NSW deliver on its ambitions to reach net zero emissions by 2050 by reducing NSW electricity emissions by up to 90 million tonnes CO2-e over the period to 2030. The roadmap will support the development of five Renewable Energy Zones (REZs) in the Central-West Orana, New England, South West, Hunter-Central Coast and Illawarra regions of NSW. The Central-West Orana REZ is expected to be shovel-ready by the end of 2022 to unlock up to 3,000 megawatts of new electricity capacity by the mid-2020s and bring as much as $5.2 billion in private investment to the region by 2030.	**Being delivered** *First REZ to be shovel-ready by 2022 and plans for two more REZs announced*
Under the *Net Zero Plan*, the Energy Savings Scheme (ESS) has been extended through to 2050 to continue to encourage energy savings. The country's longest running energy efficiency certificate trading scheme has saved an estimated 15 megatonnes of greenhouse gas emissions between 2009 and 2019 by: • encouraging the private sector to develop products and services that are scalable and sustainable • helping households and businesses to reduce their energy use. The ESS is now a component of the new Energy Security Safeguard with energy savings targets gradually increasing from 2022 and an expanded set of eligible activities. From late 2022, the safeguard will also include a new Peak Demand Reduction Scheme (PDRS) to create incentives for activities that reduce electricity demand at peak times. The PDRS will help improve the sustainability of electricity by increasing load flexibility in response to variable renewable generation. Initiatives are also being developed under the *Net Zero Plan* to accelerate the transition of businesses and industry to the new safeguard.	**Being delivered** *Scheme expanded and new energy savings targets set* *Expanded Safeguard is in design*
The majority of energy initiatives so far are delivering outcomes that support Priority 1 of the *Net Zero Plan* which is to drive the uptake of proven emission reduction technologies. Other initiatives are designed to empower customers to make informed decisions about their energy use, which addresses Priority 2 of the plan. Energy Saver provides information about how households and businesses can switch to lower emission retailers and energy solutions that best fit their needs.	**In design**

Transport

Initiative	Status
The *NSW Electric Vehicle Strategy* (DPIE 2021a) was launched in June 2021, giving effect to the state's commitment to increase the uptake of electric vehicles (EVs). Targets include growing EV sales of new passenger and light commercial vehicles to 52% of the market by 2030–31 and the vast majority by 2035. The strategy includes: • targeted rebates for purchasing EVs • phased removal of stamp duty on EVs • targets for the uptake of EVs for the NSW Government passenger fleet • incentives to increase EVs in council and private fleets • investment to ensure widespread and world-class EV charging infrastructure across the state. Rebates of $3000 were available on sales of the first 25,000 EVs valued at under $68,750 from 1 September 2021*.These rebates are designed to encourage EV uptake and are targeted to the cars more people can afford. Stamp duty has also been removed from EVs under $78,000 purchased from 1 September 2021 and from all other EVs and plug-in hybrids from 1 July 2027 or when EVs reach at least 30% of new car sales, at which time a road user charge will be introduced. These initiatives will support Priorities 1, 2 and 4 of the *Net Zero Plan* by driving the uptake of proven emission reduction technologies, supporting consumers to make sustainable choices, as well as reducing government transport emissions.	**Being delivered** *Rebates and tax incentives available for EVs*

*Due to the COVID-19 pandemic, NSW Parliament's normal operations were suspended in August. As a result, some legislation was delayed. This included the *Electric Vehicles (Revenue Arrangements) Bill 2021*. To avoid potential delays to the uptake of electric vehicles, the NSW Treasurer announced that stamp duty exemptions and rebates would retrospectively be available from 1 September 2021.

Industry

Initiative	Status
The Net Zero Industry and Innovation Program was announced by the NSW Government in March 2021. Delivery of programs are now in the market-sounding stage. The $750-million program focuses on supporting NSW industry and business to capitalise on the opportunities in the global transition to net zero. The program has three areas of focus: • New Low Carbon Industry Foundations will lay the foundations for low emissions industries by building enabling infrastructure and increasing the capability of NSW supply chains. The program will also support the establishment of low emissions manufacturing precincts to help grow low carbon industries. • High Emitting Industries will support existing, high-emitting industrial facilities in NSW to transition their plant, equipment and other assets to low-emission alternatives. • Clean Technology Innovation will support the development and continued innovation of emerging clean technologies by enabling knowledge sharing, capacity building and collaboration between researchers, industry and government. As part of this stream, the Office of the NSW Chief Scientist and Engineer will establish a Decarbonisation Innovation Hub to support research collaboration that develops the technologies of the future. The *Net Zero Plan* committed to a coal innovation program that would provide incentives for coal mines to reduce their fugitive emissions and support the development and commercialisation of new fugitive abatement technologies. Under the Net Zero Industry and Innovation Program, coal mines will be eligible to apply for incentives to implement large-scale abatement projects.	**In design** *Industry consultation underway with over 400 registrations of interest received*
The *Net Zero Plan* set an aspirational target of up to 10% hydrogen blending in the gas network by 2030. Streams across the Net Zero Industry and Innovation Program will help scale up hydrogen as an energy source and feedstock. As part of the New Low Carbon Industry Foundations stream, at least $70 million has been allocated to develop hydrogen hubs in the Hunter and Illawarra regions. These hubs will combine demand from existing and emerging hydrogen users to deliver the fuel in a coordinated fashion that will drive scale, reduce costs, focus innovation and grow workforce skills. The hubs aim to accelerate the growth of the state's clean hydrogen industry and unlock the heavy transport sector as a key new market for clean hydrogen demand. The NSW Hydrogen Strategy is a plan to support scientists, researchers and industries to rapidly increase the scale and competitiveness of green hydrogen in NSW. As well as delivering the $70 million to develop the state's hydrogen hubs in the Illawarra and the Hunter outlined above, the NSW Hydrogen Strategy will provide up to $3 billion in support for the hydrogen industry through: • exemptions for green hydrogen production from government charges • a 90% exemption from electricity network charges for green hydrogen producers who connect to parts of the network with spare capacity • incentives for green hydrogen production • a hydrogen refuelling station network to be rolled out across the state. The strategy is expected to attract up to $80 billion of investment to NSW and to drive deep decarbonisation.	**Being delivered** *Hydrogen hubs will help deliver on gas target*
These industry initiatives will support Priorities 1 and 3 of the *Net Zero Plan* by driving the uptake of proven emission reduction technologies and investing in innovative future emissions reduction technologies.	**Being delivered** *Businesses supported to implement energy efficiency measures*

Waste

Initiative	Status
In June 2021, the NSW Government launched the *NSW Waste and Sustainable Materials Strategy 2041: Stage 1 2021–2027* (DPIE 2021b). The strategy outlines the NSW Government's approach to making the transition to a circular economy over the next 20 years and outlines actions to achieve the organic waste target of net zero emissions from landfill by 2030, as outlined in the *Net Zero Plan*. The $356-million strategy will help deliver priority programs and policy reforms that minimise waste and value resources while decarbonising the economy. Strategy actions include: • mandating the collection of food and garden organics for all NSW households by 2030 and select businesses by 2025, with $65 million to help with the transition • introducing regulatory measures to require gas capture and net zero emissions from landfills with $7.5 million invested in the installation of landfill gas capture infrastructure • investigating a new regulatory framework to incentivise the uptake of anaerobic digestion facilities and biogas production with the $37-million Carbon Abatement and Recycling fund including funding to support biogas recovery from waste. The Waste and Sustainable Materials Strategy contributes to the plan's Priorities 1 and 2 to drive the uptake of emission reduction technologies and empower consumers and businesses to make sustainable choices.	**In design** *Strategy launched and programs in development* *Target: Net zero emissions from organic waste to landfill by 2030*

Land use

Initiative	Status
NSW has abundant land, a strong agricultural sector, technical expertise and a rigorous financial and legal infrastructure, all of which should allow the state to take advantage of the opportunities provided by carbon markets and the transition to net zero while enhancing the state's productivity and wellbeing. The *Net Zero Plan* is supported by joint funding from the NSW and Commonwealth Governments, as agreed in the NSW Energy Package Memorandum of Understanding. As part of the MoU, the Commonwealth has committed $450 million through the Climate Solutions Fund to support NSW businesses, farms and land managers to take practical, low-cost actions to reduce emissions. This commitment will provide important environmental, economic and social benefits to local businesses and communities. Under the plan, the NSW Government is working to improve the management of carbon across all land tenures through the Primary Industries Productivity and Abatement Program. Among other things, initiatives will be developed to: • support the uptake of proven technologies and practices in the primary industries and land sectors to increase abatement of emissions and optimise productivity • support farmers and land managers to access revenue from carbon markets and realise a market advantage from low-emission products. These will work to achieve the plan's Priorities 1, 2 and 3 to drive the uptake of proven emission-reduction technologies, and empower consumers and businesses to make sustainable choices and invest in innovative future reduction technologies.	**In design**

Built environment

Initiative	Status
Launched in early 2021, the Low Emissions Building Materials Program is a partnership with industry to grow the demand for these building materials in the construction and infrastructure sectors by driving the modification, adoption and use of voluntary standards. To achieve this, the Materials & Embodied Carbon Alliance (MELCA) has been formed in partnership with the World Wide Fund and includes professionals from the building industry and government. Organisations that are big purchasers of steel, concrete and other materials are actively participating in the development of agreed standards for low-emission alternatives.	**Being delivered** *Over 50 industry bodies have joined MELCA*
The National Australian Built Environment Rating System (NABERS) is a rating system that measures the energy, water, waste and indoor environmental impact of buildings in Australia using a six-star scale. NABERS can be used to rate a variety of buildings, including offices, apartments, shopping centres, hotels and data centres. Since the highly regarded program began in 1999, NABERS has helped users save over $1 billion in energy bills and 6 billion litres of water and remove 7 million tonnes of CO_2 emissions – equivalent to one year's worth of power from 93,430 homes (based on Office Energy ratings only). Currently 78% of Australia's office space is rated with NABERS. In 2020–21, NABERS offered NSW building owners free energy and carbon neutral ratings through the Energy Starters and Carbon Neutral Leaders pilots. This supported NSW building owners to overcome barriers to energy efficiency by enabling them to obtain their first NABERS energy rating and streamlining access to the NSW Energy Savings Scheme. NABERS is also working with industry to investigate an embodied carbon framework for commercial buildings and how this can align with existing building ratings, such as NABERS and Green Star. These initiatives address Priority 2 of the *Net Zero Plan* by empowering consumers and businesses to make sustainable choices in designing and using the built environment.	**Being delivered** *NABERS is accelerating the transition to net zero buildings*

Government

Initiative	Status
Under the NSW Government Resource Efficiency Policy, all NSW Government agencies are required to achieve resource-efficiency targets to reduce energy use, water consumption, waste disposal and air emissions. The policy seeks to achieve significant cost savings from over $400 million of government expenditure. The *Net Zero Plan* set a new target for government buildings to generate 126,000 megawatt hours per annum of solar energy by 2024. Feasibility assessments for statewide deployment of rooftop solar systems are underway to deliver this ambitious solar generation target. Government land assets also present an enormous opportunity to support investment in renewable energy infrastructure, including solar, wind, pumped-hydro, battery storage and a range of other renewable energy technologies, that will contribute to the transition of the electricity sector. Agencies have been encouraged to identify sites that could support diverse renewable energy infrastructure developments in partnership with business and communities.	**Being delivered** *Feasibility assessments for solar and other renewables on government property are underway*
As part of a 10-year contract with Shell Energy, a 100-megawatt battery is being constructed to help power schools, hospitals and government buildings across NSW under the state's new electricity supply contract. The battery will be near Darlington Point in the Riverina. It will be built and operated by Edify by November 2023 and will support up to 35 jobs during construction.	**In design** *100 megawatt battery due to be built by 2023*
In addition to electricity, other whole-of-government procurement policies and processes are also being reviewed to include sustainable and low carbon procurement for goods, services and infrastructure projects. Under the *NSW Waste and Sustainable Materials Strategy 2041* (DPIE 2021b), NSW Government departments will be required to preference products that contain recycled content, including building materials and office fit-outs and supplies, on an 'if not, why not' basis. By 2026, all NSW Government-owned and leased buildings over 1,000 square metres will need to obtain and publish a NABERS Waste Rating.	**In design** *Programs in development*
The *Net Zero Plan* identified commitments to transition the NSW public transport system to low emissions, including the replacement of the state's 8,000-vehicle bus fleet with electric buses. Transport for NSW rolled out over 50 electric buses across Sydney in early 2021 in the first phase of this work. The *NSW Electric Vehicle Strategy* (DPIE 2021a) commits $33 million to electrify the NSW Government passenger fleet by 2030. It sets an interim target of 50% EV procurement for the fleet by 2026. These initiatives are in line with Priority 4 of the plan for the Government to lead by example on the road to net zero emissions.	**Being delivered** *8000 new electric buses in Sydney* *$33 million to transition government fleet to EVs*

How we are keeping track

The status of initiatives in the *Net Zero Plan* are being reported in this and future NSW State of the Environment Reports.

The NSW Government's action on climate change is informed by science and economics. It will continue to refine the forecast emission reduction figures to reflect data validations in the national emissions accounts. This, along with program evaluations, may lead to improved understanding and adjustment of programs.

The NSW Government is also looking ahead to determine what it will need to do in the next decades to reduce emissions and get to net zero. The Office of the NSW Chief Scientist and Engineer (OCSE) will prepare a report every two years on emerging technologies that reduce emissions and are commercially competitive. The first of these reports, the *NSW Decarbonisation Innovation Study* (OCSE 2020), was published in August 2020.

The NSW Net Zero Emissions and Clean Economy Board is an advisory body established under section 34W of the *Energy and Utilities Administration Act 1987*. The Board will provide advice on the implementation and development of net zero policy and programs, development of emission reduction technologies, low emissions research and other relevant matters.

Units

Quantity	Unit	Symbol
Acidity/alkalinity	pH	pH
Area	hectare	ha
	square kilometre	km^2
Electrical conductivity	microsiemens per centimetre	µS/cm
Length	micrometre	µm
	millimetre	mm
	centimetre	cm
	metre	m
	kilometre	km
Mass	microgram	µg
	kilogram	kg
	tonne	t
	megatonne	Mt
	gigatonne	Gt
Power	megawatt	MW
	kilowatt-hour	kWh
	gigawatt-hour	GWh
Time	second	s
	hour	hr
	day	d
	year	y
Velocity and speed	kilometres per hour	km/hr
	metres per second	m/s

Quantity	Unit	Symbol
Volume	cubic metre	m^3
Volume (fluids)	litre	L
	kilolitre	kL
	megalitre	ML
	gigalitres	GL
	gigalitres per year	GL/y
Work and energy	petajoule	PJ
Other abbreviations	carbon dioxide equivalent units	CO_2-e
	parts per million	ppm
	micrograms per cubic metre	$\mu g/m^3$

Prefixes for SI units

Fraction	Prefix	Symbol
10^{-6}	micro	μ
10^3	kilo	k
10^6	mega	M
10^9	giga	G
10^6	peta	P

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