



# Australia's Environment | 2021 REPORT



Australian  
National  
University

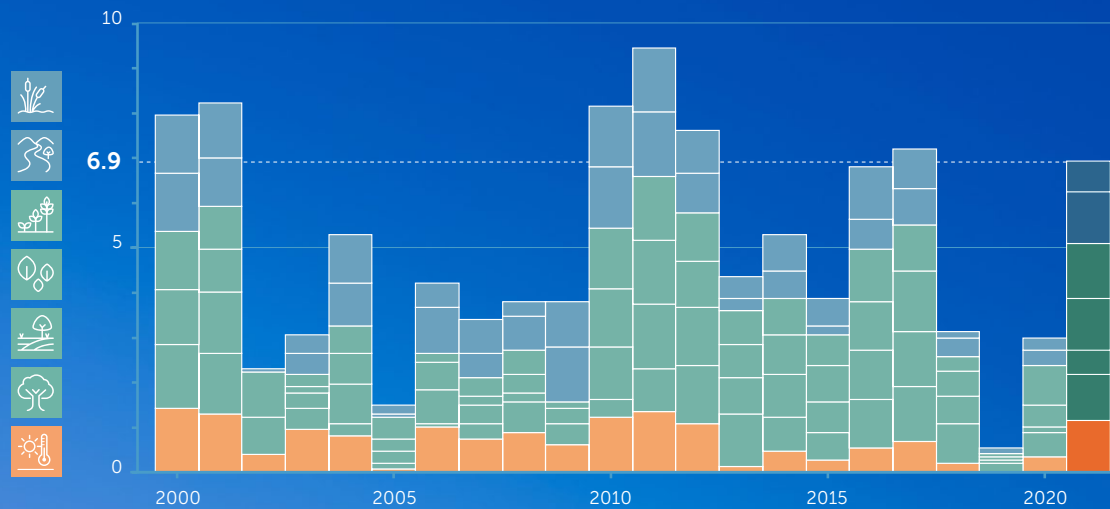






## Summary Indicators

Widespread good rainfall and less hot temperatures supported a strong recovery of key indicators of Australia's environment, reaching values not seen for several years.



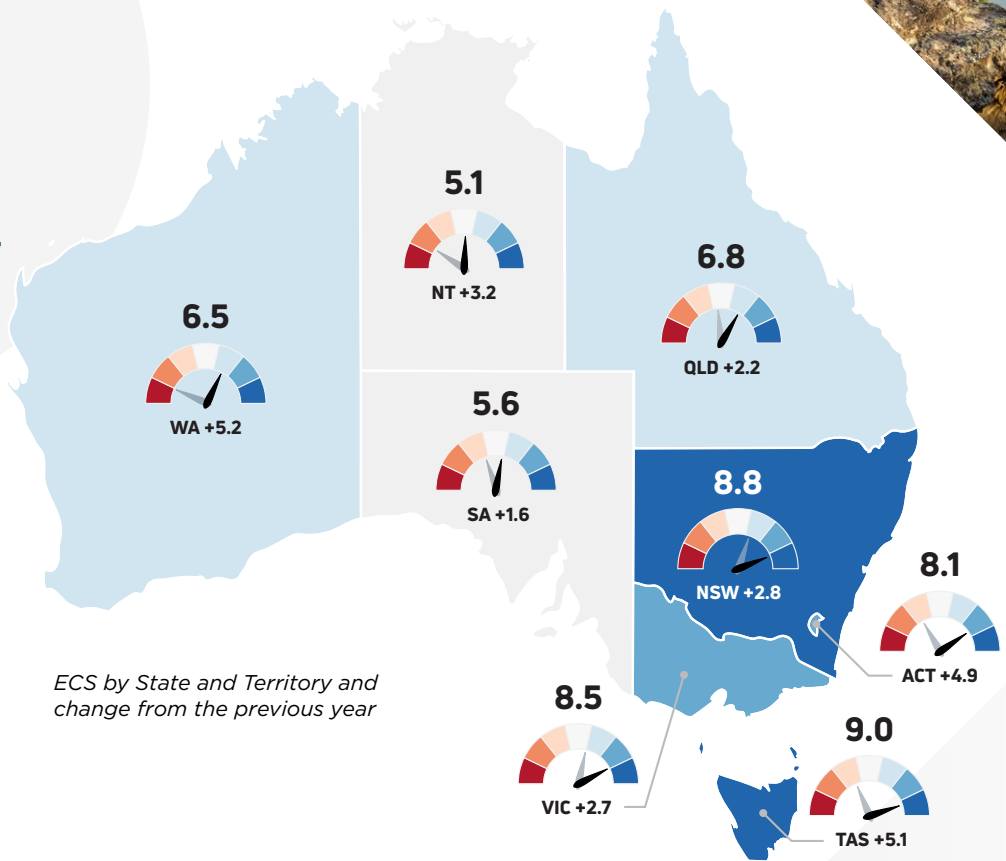
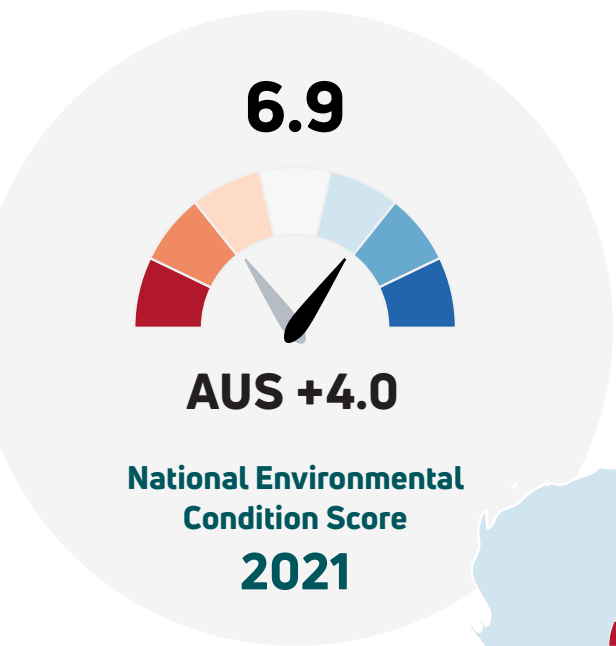
National ECS and its components for 2000–2021

The National Environmental Condition Score (ECS) improved 4.0 points out of ten to reach 6.9 points. Scores improved in all states and territories.

The best conditions occurred in Tasmania (TAS), New South Wales (NSW), Victoria (VIC) and the Australian Capital Territory (ACT). The largest improvements occurred in Western Australia (WA) and Tasmania. Less good but still above-average conditions occurred in the Northern Territory and South Australia.

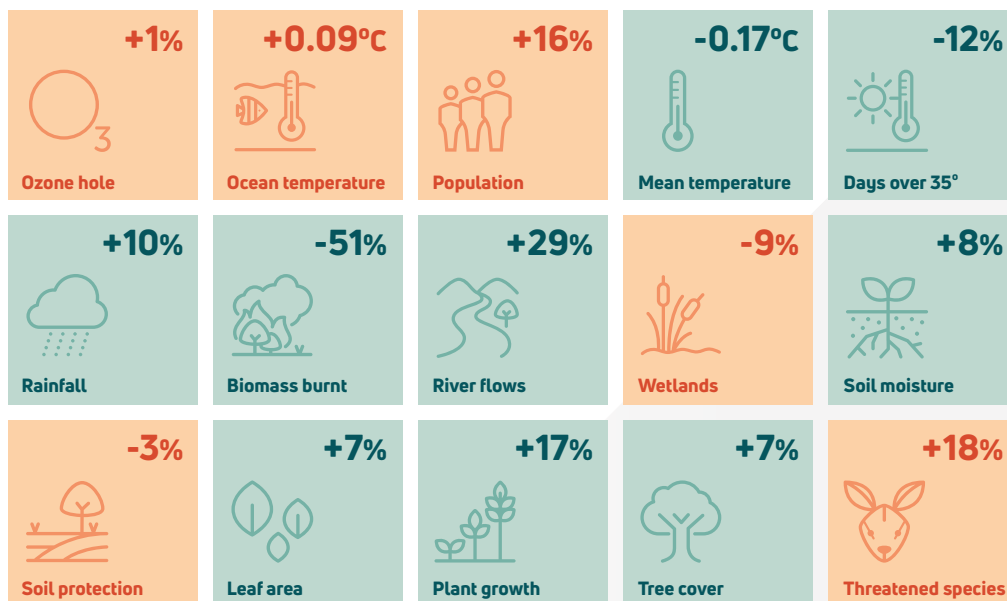
*The Environmental Condition Score is a score between 0 and 10 expressing condition relative to previous years. It is calculated as the average rankings of component scores (from top to bottom in the bar graph): inundation, streamflow (blue), vegetation growth, leaf area, soil protection, tree cover (green) and the number of hot days (orange).*





*ECS by State and Territory and change from the previous year*

## National Environment Indicators at a glance



Numbers represent the relative change from 2000-2020 average conditions.

Such a change can be part of a long-term trend or be within normal variability.

Details on each of the indicators shown are provided in this report.



## Global Change

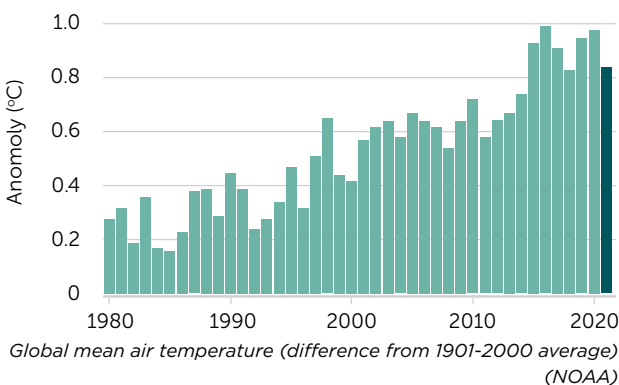
Greenhouse gas concentrations continued to increase. Global temperature, the ozone hole and sea ice extent were comparable to previous years.

Atmospheric CO<sub>2</sub> concentration increased by 2.5 ppm - 6% faster than the previous year and 11% faster than the average 2000–2020 growth rate. This was in part due to economic recovery from COVID-19 pandemic conditions. Average CO<sub>2</sub> concentration reached 416 ppm; a 31% increase from 1960.

Global average air temperature in 2021 was 0.14 °C lower than the previous year but was still 0.82 °C above the twentieth-century average and the sixth warmest year on record.

The ozone hole remained stable compared to the previous year and very close to the 2000–2020 average.

Sea ice extent increased slightly in the Arctic. Ice extent on both hemispheres combined was 1.4% greater than the previous year, but still 2.1% lower than the 2000–2020 average.



## Oceans

The Great Barrier Reef showed rapid but fragile recovery from previous bleaching events.

Oceans absorb 93% of excess heat from climate change. Unlike the atmosphere, global ocean heat content increased considerably, by 6.5% compared to the previous year. This was in line with a steady increase in ocean heat over the last three decades.

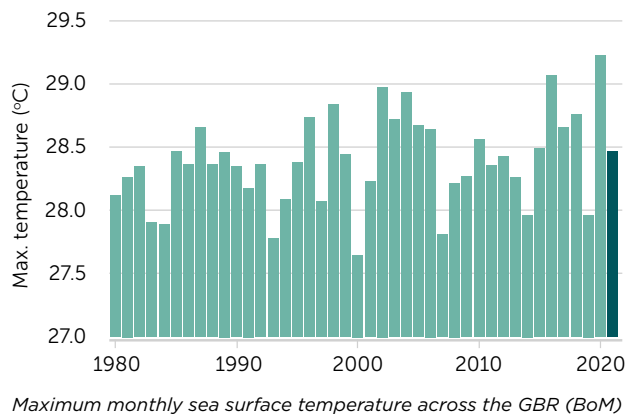
Global sea level also continued its steady rise, rising by 5.0 mm in 2021. Sea level has increased 80 mm since 2000 and 103 mm since 1993.

Sea level around Australia has been rising faster than the global average. The fastest rate of rise was in the Tasman Sea, which has risen by more than 150 mm since 1992.

Ocean surface temperatures around Australia were slightly lower than the previous year, but 2021 was still the sixth warmest on record. The mean temperature was 0.52 °C above the 1961–1990 average and 0.09 °C above the 2000–2020 average.

La Niña conditions contributed to a marine heatwave off the coast of Western Australia in early 2021.

Favourable conditions in the Great Barrier Reef led to rapid but fragile hard coral recovery from the three bleaching events in the previous five years. Later in the year, in December, the warmest sea temperatures on record for that month were observed, but thanks to cooler weather conditions, these did not develop into a bleaching event.





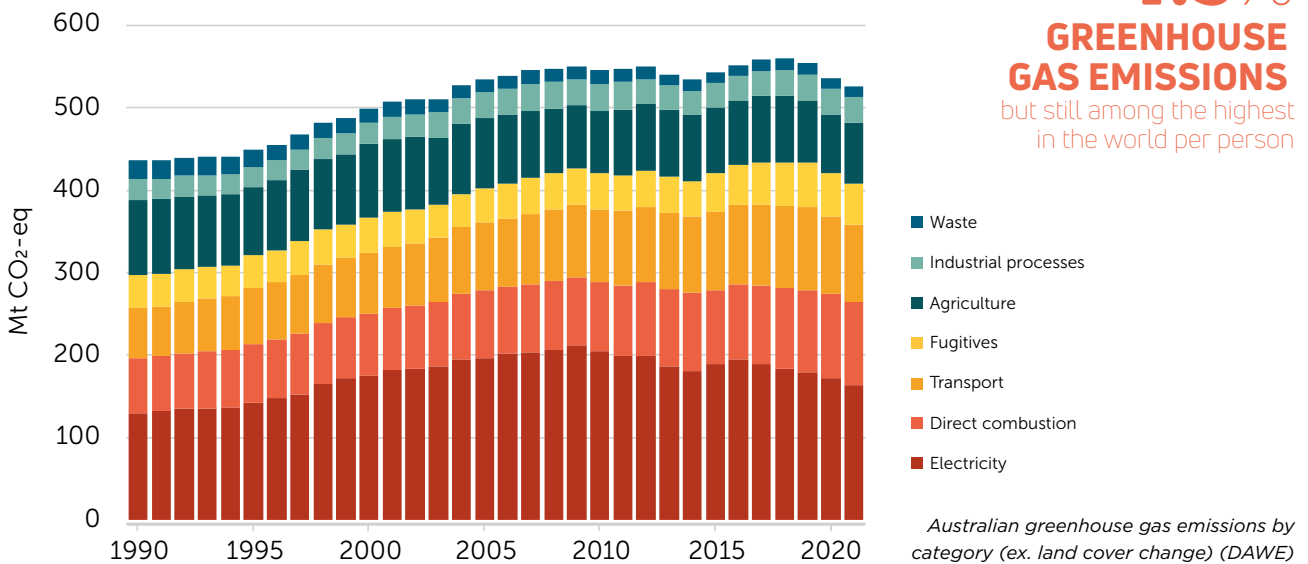


## People



Population growth halted and carbon emissions declined, primarily due to the COVID-19 pandemic.

**-1.9%**  
**GREENHOUSE GAS EMISSIONS**  
 but still among the highest in the world per person



Australia's population barely grew, remaining stable at 25.7 million. Population growth slowed to a record low of 34,000 primarily due to COVID-19 border closures. This is only a tenth of the average 2000–2020 rate of population increase.

Demand for building space and materials increased sharply. Building approvals for new dwellings increased by 23% from 2020 to achieve the highest number since 2016.

Greenhouse gas emissions decreased 1.9% from the previous year, due mainly to the impact of COVID-19. Emissions were 2.3% below the 2000–2020 average.

Emissions decreased most strongly from fugitive gases (-5.0%) and electricity generation (-4.4%), and to a lesser extent from direct combustion (-1.9%) and transport (-1.2%), while emissions

changed little from waste (-0.3%) and industry (+0.4%). Emissions increased in agriculture (+3.7%).

According to Government statistics, new forests exceeded forest removals, resulting in a net uptake of 24.5 Mt CO<sub>2</sub>-eq; very similar to the previous five years. This number only accounts for a small part of the landscape carbon balance and does not include net gains or losses related to weather conditions or bushfires, for example.

Emissions per person fell 2.1% from the previous year to 20.4 tonnes CO<sub>2</sub>-eq, 22% below the peak per-capita emissions reached between 2000–2005.

Australia contributed 1.4% to global emissions in 2021, compared to 1.5% in 2020. However, per-capita emissions remain among the highest globally due to high individual energy use, the continued use of polluting coal, and large non-CO<sub>2</sub> emissions.



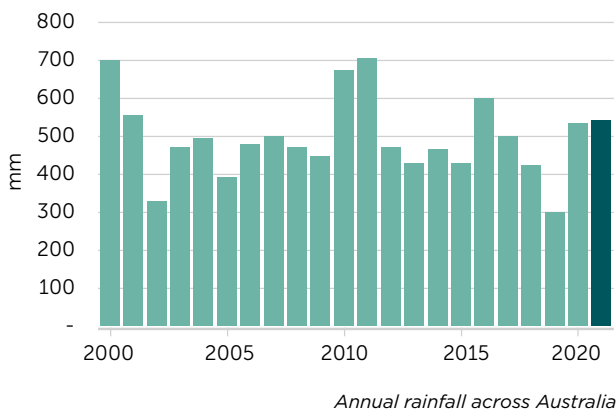
## Weather

**+10%**  
**MORE RAINFALL**  
 than the 2000–2020 ave.

Rainfall was above average and temperatures lower than the previous eight years.

National average rainfall was the highest since 2016 but very close to rainfall the previous year. Average rainfall was 542 mm or 10% above the 2000–2020 average.

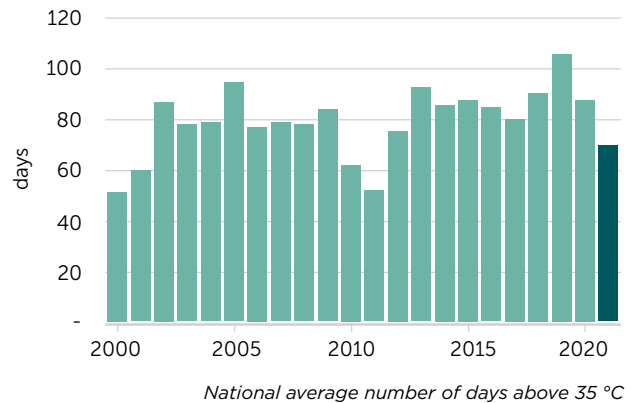
Unusually, rainfall was near or above-average across the entire country. Rainfall was the highest or second-highest since 2000 along the east coast from Eastern Victoria to Brisbane and along the west coast from Geraldton to Bunbury.



Average temperatures were lower than the previous eight years, although still above-average, in line with global warming. The national average temperature was 0.18 °C below the 2000–2020 average but 0.56 °C above the 1961–1990 average.

Maximum temperatures were the lowest since 2010: the average maximum temperature was 41.0 °C or 0.89 °C below the 2000–2020 average.

Annual maximum temperatures were especially low along the central east coast. Unusually



high temperatures occurred on the west coast south of Perth in December. Record warm July temperatures were measured in inland Australia, but otherwise, few records were broken.

The number of days exceeding 35 °C was the lowest since 2011. Nationally there were an average 70 hot days: 12% or 10 days less than the 2000–2020 average.

Nights were cooler than the previous year. The national average minimum temperature was 0.25 °C above the 2000–2020 average. Night frost was slightly more common than the previous year but 13% below the 2000–2020 average.

Snow cover was above average for the first time since 2017 and was 15% above the 2000–2020 average.

The absence of large bushfires and dust storms led to good air quality conditions, with NSW recording the best conditions since 2015.



## Water

River flows were the highest since 2011.

National river inflows were well above average at 115 mm or 882,000 GL; 29% above the 2000–2020 average and 75% more than the previous year.

River inflows were near or above average almost everywhere. High to extremely high river flows occurred in catchments in southwest WA as well as along the Victorian and NSW coast and in the Border, Gwydir and Namoi Rivers.

Tropical lows caused major flooding in the Herbert and Lower Burdekin Rivers in Queensland in January and in the northwest in February.

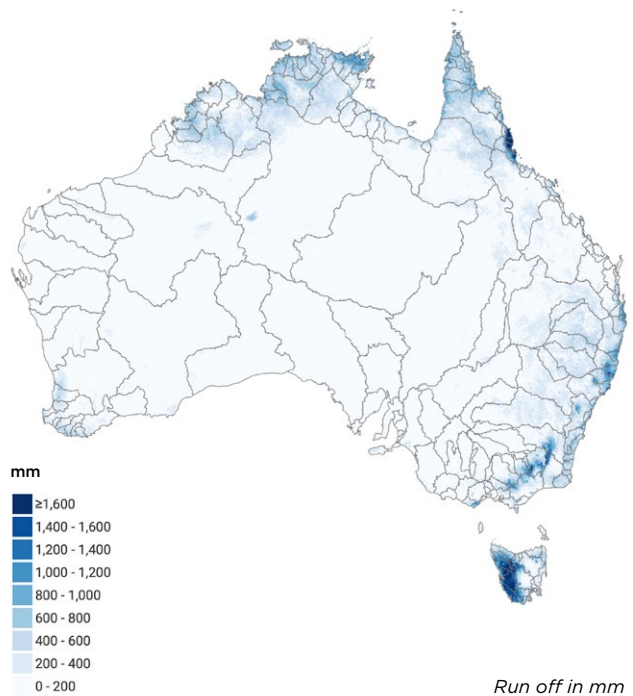
In March, major flooding occurred in several coastal NSW catchments, especially in the Hastings, Camden and Manning Rivers, as well as in the Gwydir and Condamine rivers in the northern Murray-Darling Basin. Flooding occurred again across large areas of NSW and Queensland after high rainfall in November and locally in Victoria and South Australia.

There were no large algal blooms or fish kills in the Murray-Darling Basin in 2021.

Storage in the Murray-Darling storages increased, with combined storage in the five largest storages increasing from 57% to 90% of capacity, reaching levels last seen in 2013.

Reservoir storage in the Ord system in the Kimberly region increased after three years of decline, from 29% to 58% of capacity.

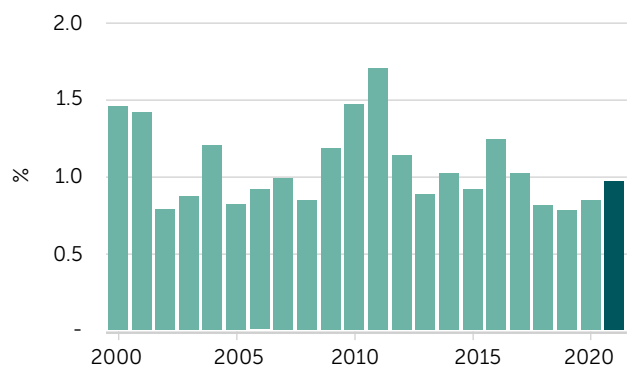
Urban water supplies increased for all cities. The Sydney and Canberra supply systems remained near full capacity, while storage increased in Melbourne, Brisbane, Perth and Adelaide.



Run off in mm

The national extent of wetland flooding was greater than the previous year and reached the greatest total extent since 2016, but it was still 9% below the 2000–2020 average.

Wetland extent was the greatest since at least 2000 in several catchments along the southern WA and South-east coast, and in the Border, Gwydir and Namoi rivers in the northern Murray-Darling Basin. Wetland extent was below-average in only a few isolated catchments.



National annual area inundated





**+10%**  
**SOIL MOISTURE**  
 An increase of 31mm



## Soils

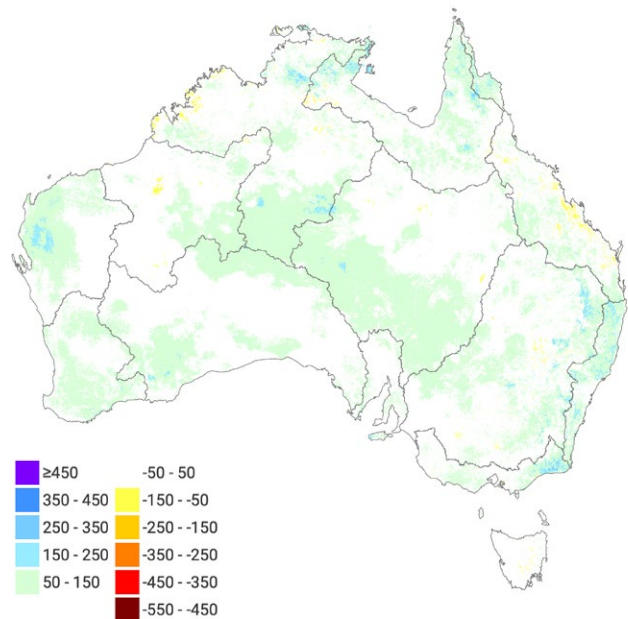
Soil moisture and soil surface condition improved across most of Australia.

National average top-6m moisture availability increased by 28 mm to reach values not seen since 2011. Values were 10% more than the previous year and 8% above the 2000–2020 average.

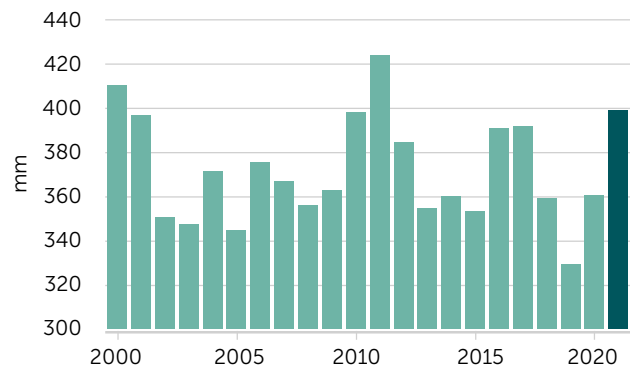
Soil moisture increased or remained stable nearly everywhere, with the greatest increases along the coast and Great Dividing Range of NSW and Gippsland due to rains in March and November.

Considerable increases also occurred in the WA Gascoyne region, the Top End and Cape York, and Central Australia.

Soil moisture remained below average along the Queensland coast between Mackay and Noosa.



Soil moisture change from previous year (mm)

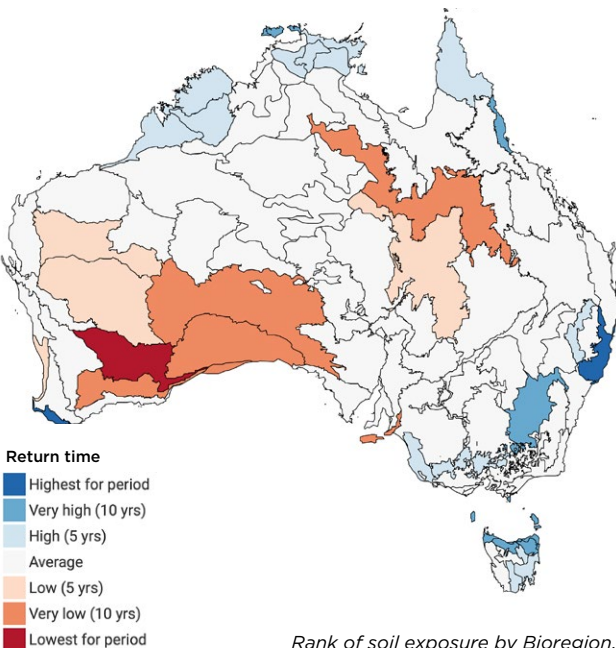


National average soil moisture content.

National average soil protection by vegetation and leaf litter improved from poor conditions in the previous two years. Soil exposure was 7% better than the previous year and 3% worse than the 2000–2020 average.

Soil surface conditions improved across much of Australia. The best conditions since 2000 were observed in many coastal regions, including a strong recovery in areas affected by the 2019/2020 bushfires.

Soil surface conditions declined to below-average conditions in the Channel Country and Mitchell Grass Downs due to a lack of large-scale flooding. Soil condition remained stable below the 2000–2020 average due to the cumulative impact of fire in previous years in inland WA, especially in the Goldfields Region.



Rank of soil exposure by Bioregion.





Download your *Regional Report Card* and see how your backyard compares to the rest of Australia's Environment.



[ausenv.online](https://ausenv.online) >





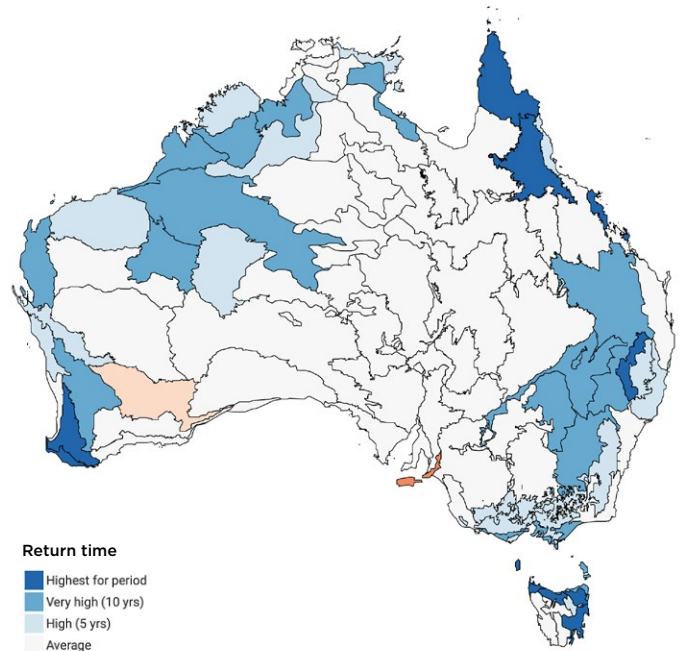
## Vegetation

Nationally vegetation conditions improved nearly everywhere.

National vegetation condition improved to levels last seen in 2017: 11% more than the previous year and 7% above the 2000–2020 average.

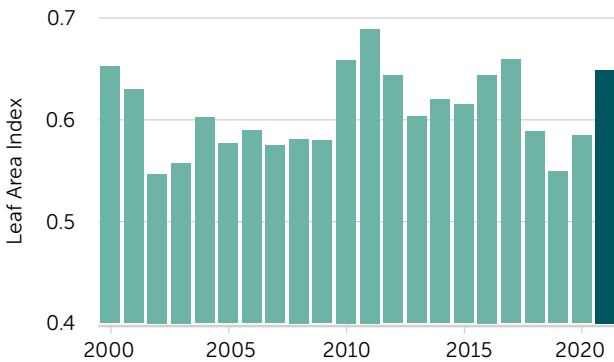
Vegetation conditions remained stable or improved nearly everywhere. The best conditions since 2000 were recorded in southwest WA, the Top End and parts of Tasmania. The greatest improvements occurred in bushfire-affected areas in southeast Australia.

Vegetation condition improved but was still below average in the WA Goldfields region and southern South Australia.



**Return time**  
 Highest for period  
 Very high (10 yrs)  
 High (5 yrs)  
 Average  
 Low (5 yrs)  
 Very low (10 yrs)  
 Lowest for period

*Rank of leaf area index by bioregion*

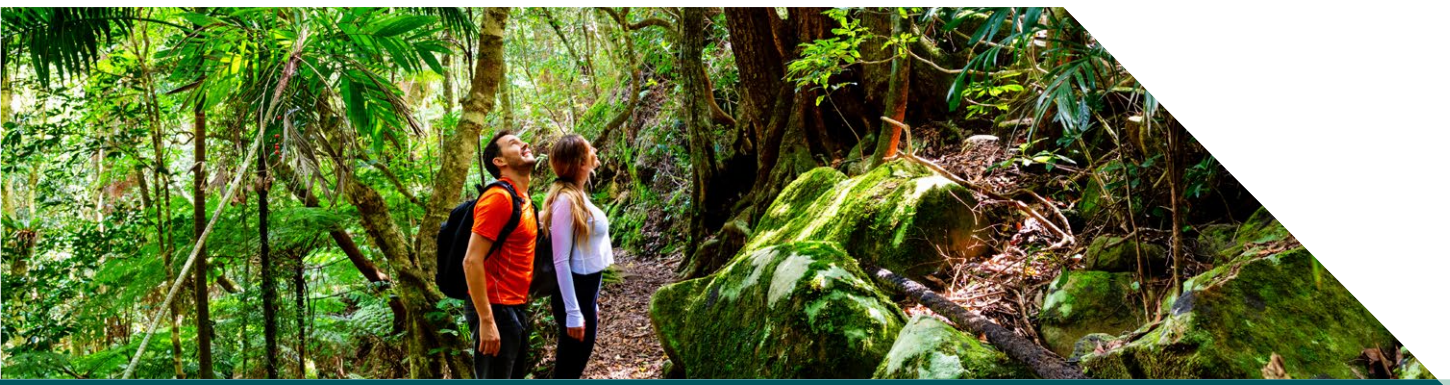


*National average leaf area index*

National vegetation growth rates, estimated from weather and satellite data, were the best since 2011.

Nationally, growth was 16% better than the previous year and 17% above the 2000–2020 average.

Growth conditions were well above average or the best since at least 2000 in all major cropping







# +8% TREE COVER

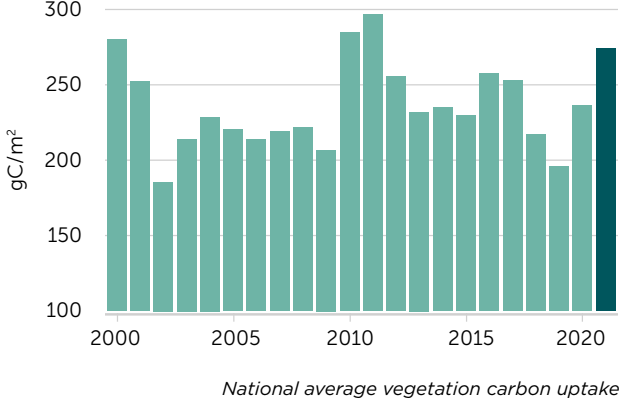
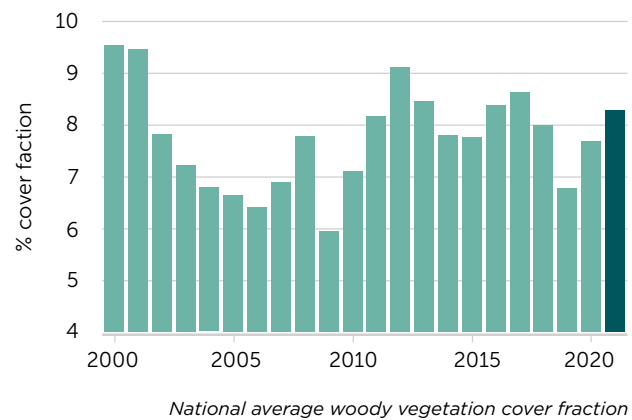
increase from 2020

regions except South Australia. Growth conditions improved but remained below average in inland WA.

Farming conditions were good. Agricultural growth rates were well above average 2000–2020 levels in dryland cropping (+38%), irrigation (+27%) and grazing (+16%).

Growth conditions were also above average in native and plantation forestry (+10%) and natural environments (+16%).

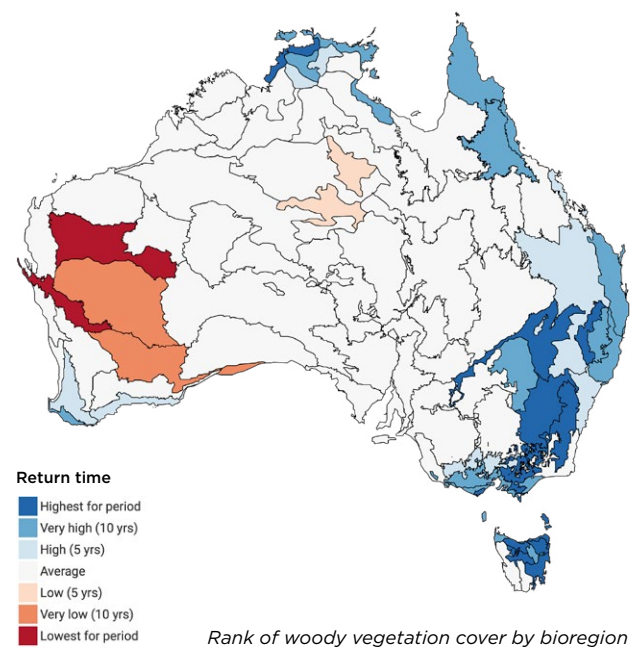
Increased water availability and few bushfires led to expanded tree cover. Tree cover, the canopy fraction of vegetation >2 m tall, increased by 8% or 5 Mha from the previous year, reaching 7% above the 2000–2020 average extent.



Tree cover increased most in southeast Australia, recovering losses in previous years due to drought and bushfire, and along the coast of southwest WA.

Woody cover declined most strongly in inland WA, reaching the lowest values since at least 2010 or longer despite improved water availability.

Nationally, net increases occurred on grazing land (+2.0 Mha), in natural environments (+1.2 Mha) and on cropland (+0.7 Mha).



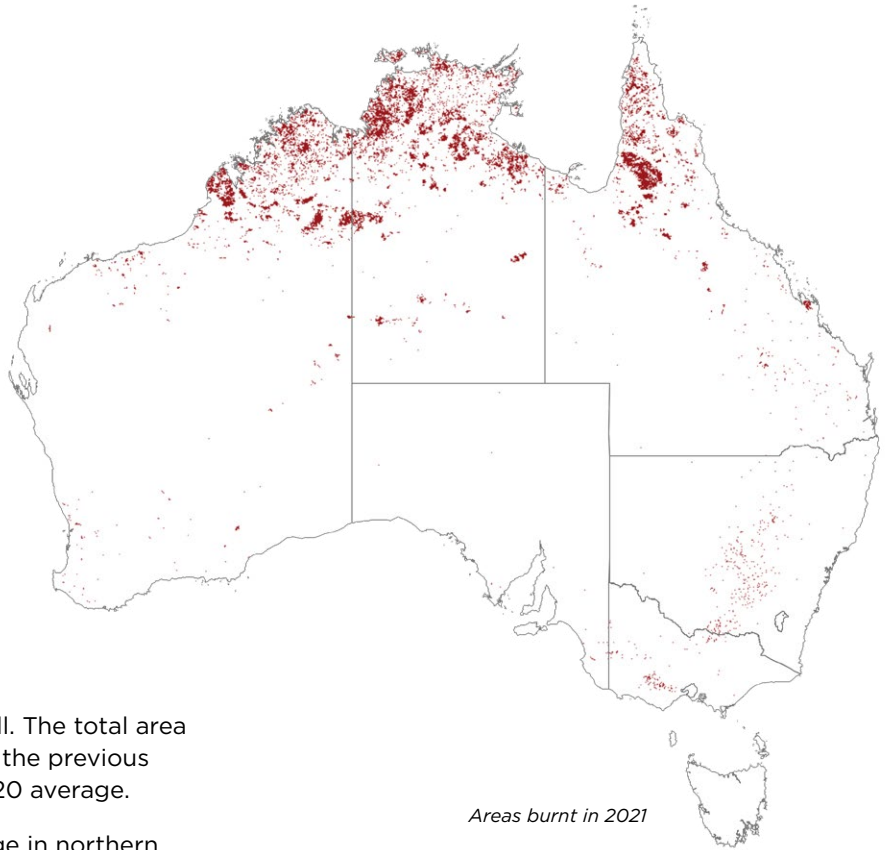


## Fire

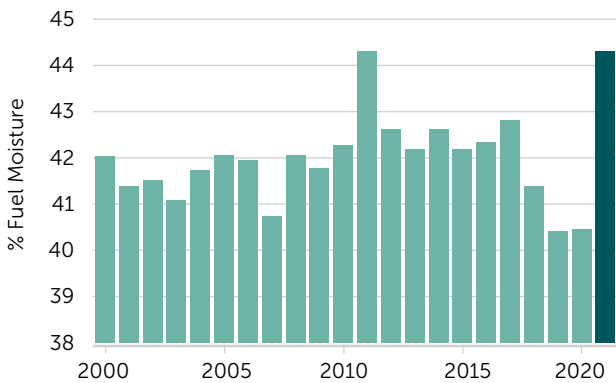
Fire activity was low in 2021 due to a lack of prolonged hot and dry conditions.

Nationally the area burnt was small. The total area burnt was 22 Mha, 36% more than the previous year but 50% below the 2000–2020 average.

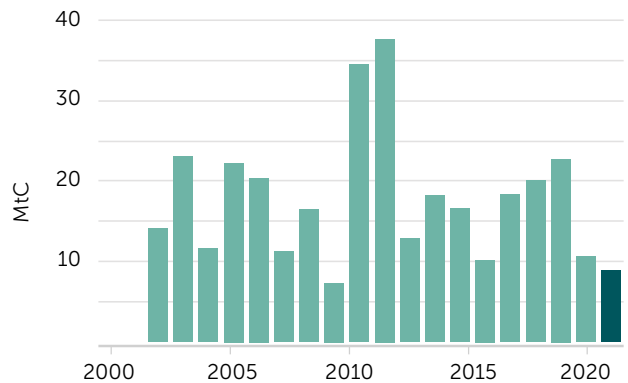
Fire activity was well below average in northern Australia and across most of the country. Relatively high fire activity was recorded for the western regions of Victoria and NSW associated with intentional burning on agricultural land in autumn 2021.



Total fire carbon emissions were well below average and the lowest since 2010. Fire emissions were 67 Mt carbon, 51% below the 2000–2020 average and 17% less than in the previous year.



*National minimum live fuel moisture content*



*National Carbon emissions from fire*





Giant Barred Frog (*Mixophyes iteratus*) improved its threatened status in 2021. Photo by Wes Read

**105**  
**SPECIES**  
declared extinct



## Biodiversity

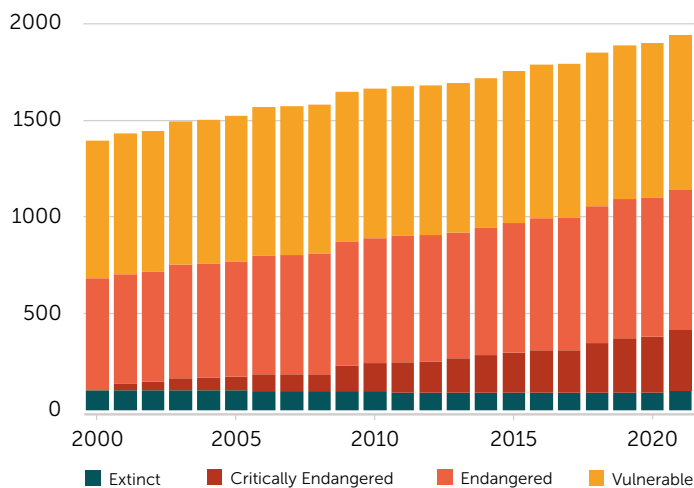
Biodiversity continued to decline.

Biodiversity continued to decline. Another 34 species were added to the Threatened Species List, bringing the total number to 1943. This represents a 2.3% increase from the previous year and a 39% increase since 2000. The newly listed species comprised 18 plant, eight bird, four frog, two fish, a mammal and a snail species. One-quarter of the newly listed species were birds endemic to Kangaroo Island in South Australia, which suffered severe fire disturbance in 2019/2020.

Ten species (0.5% of all threatened species) were up-listed to a higher risk category for extinction: six plant, two frog and two mammal species, mostly due to the loss of habitat in bushfires in previous years.

Only two species (0.1%) were down-listed to an improved conservation status: the Golden Sun Moth (*Synemon plana*) and the Giant Barred Frog (*Mixophyes iteratus*) are now listed as Vulnerable. No species were removed from the list.

Twelve species were declared extinct, an increase of 13% on the previous year and a 21% increase since 2000. Ten of the 12 were historical mammal extinctions, presumed to have occurred between 1850-1960. Two extinctions were recent: the Christmas Island Pipistrelle (*Pipistrellus murrayi*) last seen in 2009 and the Christmas Island Forest Skink (*Emoia nativitatis*) last seen in 2010. The Pipistrelle had an evidently unsuccessful recovery plan in place since 2004.



Number of species listed as threatened or extinct (DAWE)

Other species and groups can be used as barometers of biodiversity and ecological health. Waterbirds continued to decline in numbers in Eastern Australia, despite above-average rainfall and runoff across most of the area. Breeding increased compared to 2020 but remained lower than the long-term average ([UNSW Centre for Ecosystem Science](#)).

The Threatened Species Strategy was reviewed in 2021. During 2015-2020, five out of 13 strategies were achieved. Notably, 67% of threatened flora are now stored in seed banks. In 2015-2020, priority species were bird, mammal and plant taxa, expanded in 2021 to include reptiles, frogs, invertebrates and fish. The only threat targeted in 2015-2020 were feral cats, since expanded to include foxes, gamba grass, and myrtle rust.

Additionally, new species were discovered in 2021. They included a carnivorous tobacco plant (*Nicotiana insecticida*), the Star Octopus (*Octopus djinda*), the first millipede that truly has more than 1000 legs (*Eumillipes persephone*), a 'marsupial' tadpole-carrying frog (*Assa wollumbin*), an existing tree frog species (*Litoria dentata*) that was split into three separate species, seven new spider species including the 'Nemo' Peacock spider (*Maratus nemo*), a rainforest walnut (*Endiandra wongawallanensis*) and a desert fig (*Ficus desertorum*).

Recently discovered Peacock spider (*Maratus nemo*)  
Photo by Joseph Schubert





## About this report

The annual Australia's Environment Report summarises a large number of observations on the trajectory of our natural resources and ecosystems.

On the website ([www.ausenv.online](http://www.ausenv.online)) you will find a national summary report, as well as report cards for different types of administrative and geographical regions.

In the accompanying data explorer, the spatial data can be viewed as maps, accounts or charts by region and land use type, and downloaded for further use.

## Acknowledgements

Australia's Environment is produced by the Centre for Water and Landscape Dynamics, part of the Fenner School for Environment & Society, Australian National University (ANU), with support from the Terrestrial Ecosystem Research Network (TERN), an NCRIS-enabled National Research Infrastructure.

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## About the data

Measures of the condition of natural resources and ecosystems were derived from several spatial data sources.

Weather data was derived by combining data from stations, satellites and weather forecast models. Data on land cover, inundation, fire, soil condition and vegetation leaf area were derived by automated interpretation of satellite imagery.

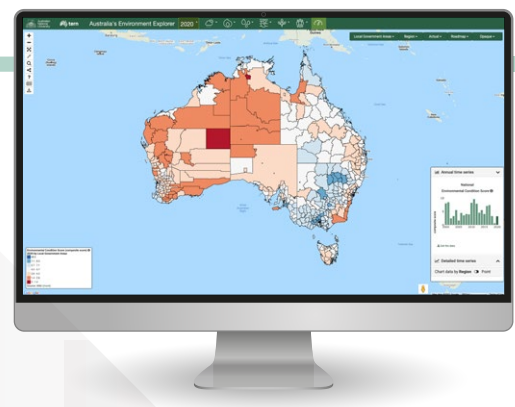
The other indicators were estimated by combining the weather and satellite data in ANU's environmental data assimilation system, OzWALD.

For further details on data and methods or to download any of the data shown here, visit the web site ([www.ausenv.online](http://www.ausenv.online)).

## About Us

The ANU Centre for Water and Landscape Dynamics develops new methods to measure, monitor and forecast climate, water availability and landscape conditions. Our solutions often combine large amounts of data from satellites and sensor networks with field research, biophysical modelling and machine learning.

Our focus areas are extreme weather, bushfires, water resources, agriculture, forestry and Australia's natural environment. Our activities span education and training, research, and developing practical solutions to help make decisions. Among others, we develop innovative web-based platforms to help you find, explore and interpret environmental information derived from satellites and on-ground networks.





For details on the environmental condition  
of any region within Australia, visit

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