

Australia's Environment | 2022 REPORT



Australian National University

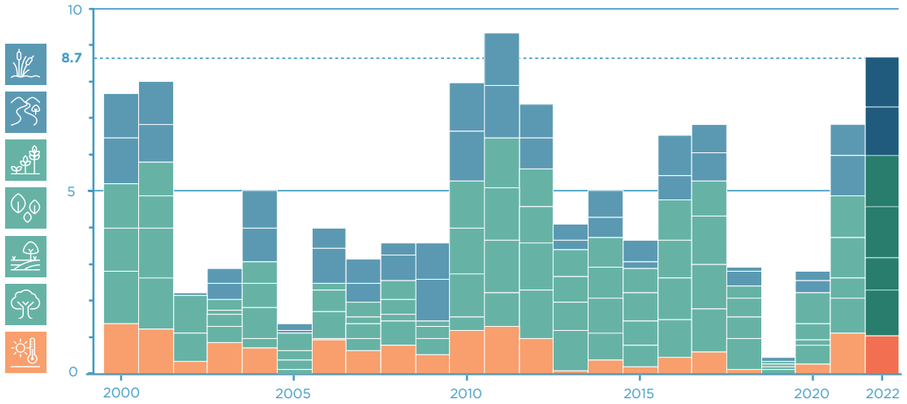
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Summary Indicators

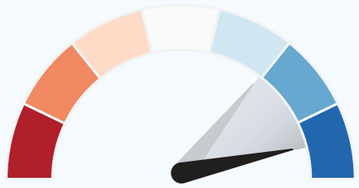
A third and very wet La Niña year brought very good wetland and vegetation growth conditions to most of the country. Several key indicators reached their highest value since 2011.



National ECS and its components for 2000–2022

The National Environmental Condition Score (ECS) improved by 1.8 points out of ten to reach 8.7 points, the highest score since 2011.

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).

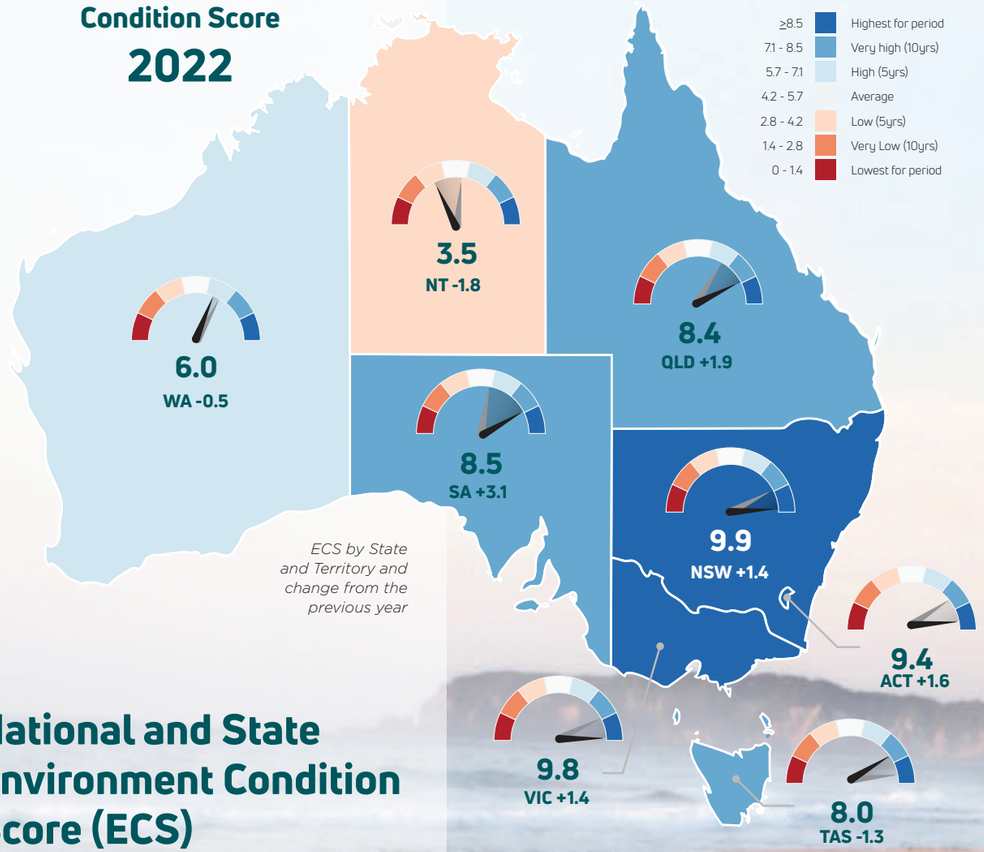


8.7

AUS +1.8

Australia's Environmental Condition Score

2022



ECS by State and Territory and change from the previous year

National and State Environment Condition Score (ECS)

The ECS score was the highest since before 2000 in New South Wales (NSW), Victoria (Vic) and the Australian Capital Territory (ACT). There were also improvements in South Australia (SA) and Queensland (Qld).

Conditions declined somewhat in Tasmania (Tas) and Western Australia (WA) but remained above average. However, after a reprieve in 2021, poor conditions returned to the Northern Territory (NT).

National Environment Indicators at a glance

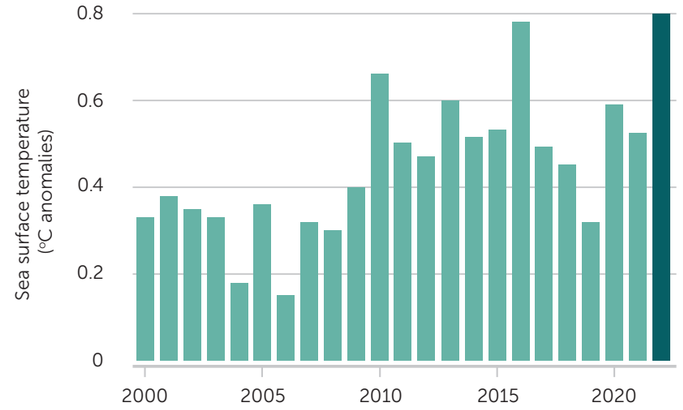
+8% Ozone hole	+0.37°C Ocean temperature	+16% Population	-0.23°C Mean temperature	-6% Days over 35°
+34% Rainfall	-49% Biomass burnt	+52% River flows	+54% Wetlands	+13% Soil moisture
+2% Soil protection	+10% Leaf area	+28% Plant growth	+13% Tree cover	+19% Threatened species

Numbers represent the relative change from 2000–2021 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.

-62% Birds	-33% Mammals	-72% Plants	-62% All threatened species

Change in abundance relative to 2000 (latest data are for 2019)





Australian region average sea surface temperature expressed as the difference from 1961-1990 average values (BoM / NOAA)

Global Change

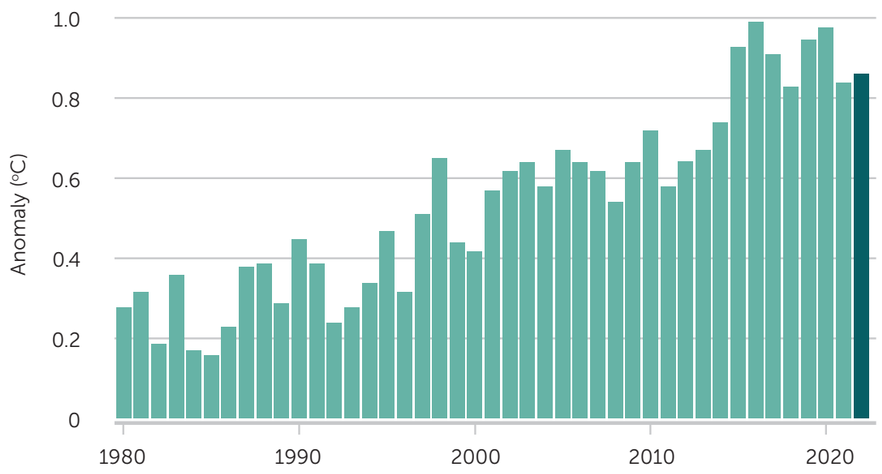
The growth rate of greenhouse gas concentrations was less than the previous year, while global temperature and the ozone hole increased. Antarctic sea ice extent was the lowest on record.

Atmospheric CO_2 concentration increased by 2.1 ppm - 11% slower than the previous year and 5% slower than the average 2000–2021 growth rate. The reduced rate was partly due to slowly falling global emissions and La Niña conditions in 2022. The average CO_2 concentration reached 419 ppm, a 32% increase from 1960.

Global average air temperature in 2021 was 0.02 °C higher than the previous year and 0.86 °C above the 20th-century average. 2022 was the sixth warmest year on record. The last nine years (2014–2022) all rank as the nine warmest on record.

The maximum ozone hole extent increased by 7% from the previous year. It was 8% larger than the 2000–2021 average but remained 11% below the maximum extent observed in 2000.

Sea ice extent was similar to the previous year in the Arctic but around Antarctica it was the lowest on record. Ice extent on both hemispheres combined was 3.7% less than the previous year, the third lowest on record and 5.3% lower than the 2000–2021 average.



Global mean air temperature (difference from 1901-2000 average) (NOAA)

Oceans

Despite record-high sea temperatures, the Great Barrier Reef showed widespread recovery

Oceans absorb 93% of excess heat from climate change. Global ocean heat content increased by 5.1% compared to the previous year, in line with a steady increase in ocean heat over the last three decades.

The global mean sea level rose by 2.8 mm in 2022. Sea level has increased by 80 mm since 2000 and 98 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.

Australian ocean surface temperature was the highest on record in the open ocean east of Australia, along the northern coast of Queensland and the west coast of Tasmania.

Mean sea surface temperature was also the highest on record, 0.80 °C above 1961–1990 average and 0.37 °C above the 2000–2021 average. The increase in temperature is in line with clearly rising ocean temperatures since around 1970.

In early 2022, the Great Barrier Reef (GBR) experienced the fourth mass coral bleaching event in seven years. Nonetheless, the low levels of acute and accumulated stress in the preceding few years contributed to low coral mortality and allowed coral cover to continue to increase in the Northern and Central GBR. Crown-of-thorns starfish outbreaks generally decreased, although some remained in the Southern GBR.





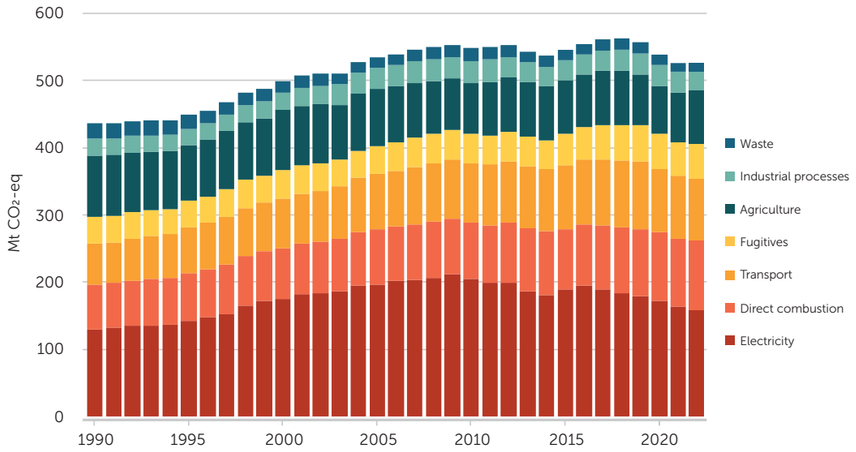
People

Population growth resumed, and Australia's carbon emissions stopped declining

AUSTRALIA'S EMISSIONS PER PERSON ARE

7x INDIA's

2.8x UK's



Australian greenhouse gas emissions by category (ex. land cover change) (DCCEEW)

Australia's population grew by 1.1% to about 26.0 million people during 2022. Population growth was the highest since 2019, mainly due to the return of overseas migration, but remained 9% below the 2000–2021 mean population growth rate.

Building approvals provide a ready if imperfect measure of land and resource use for construction. Approvals in 2022 declined 17% from the sharp peak the preceding year and returned to a similar level as in 2019 and 2020. Approvals were still 3% above the 2000–2021 average.

Greenhouse gas emissions remained almost identical to the previous year and were 2.2% below the 2000–2021 average.

Compared to the previous year, emissions decreased in electricity generation (-3.7%) and transport (-1.0%) but remained unchanged for waste (0.0%) and industry (+0.2%) and increased for fugitives (3.4%), agriculture (+3.3%) and stationary energy (+3.1%). Emissions from stationary energy (including manufacturing, mining, residential and commercial fuel use) were the highest on record. Their increase alone nearly offsets emissions reductions achieved in electricity generation.

According to Government statistics, new forests exceeded forest removals, resulting in a net uptake of 39 Mt CO_2 equivalents, nearly identical to the preceding 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.

Because of population growth, emissions per person fell 1.0% from the previous year to 20.2 tonnes CO_2-eq, 23% below the peak of per-capita emissions around 2000–2005.

Australia is the world's 14th highest emitter, contributing just over 1% of global emissions in 2022. However, emissions per person are among the highest globally due to high individual energy use, polluting coal, and large non-CO_2 emissions. Australia's emissions per individual were 2.8 times greater than those of the UK and more than seven times greater than India's.

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

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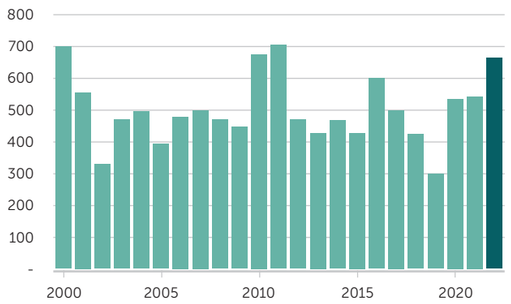
+34%
MORE RAINFALL
than the 2000–2021 ave.

Weather

Rainfall was the highest in a decade.

National average rainfall was the highest since 2011 and the fourth highest since 2000. Average rainfall was 663 mm or 34% above the 2000–2021 average.

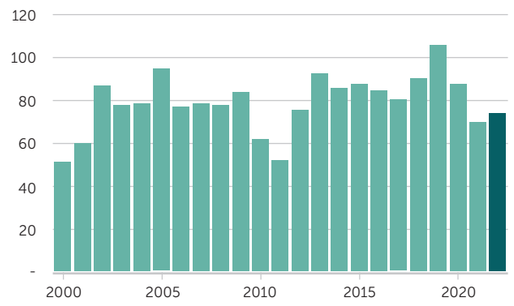
Rainfall was near- or above-average across the country except for western Tasmania, the Top End and parts of southwest WA. Rainfall was high, in many cases the highest since before 2000 in parts of SA, Victoria, eastern Tasmania, NSW and the southern half of Queensland.



Annual rainfall (mm) across Australia

The latter part of the 2021-22 northern wet season was particularly dry, with reduced monsoon bursts and warm waters in the Indian Ocean possibly playing a role. Despite this, tropical systems brought heavy rain several times during the year.

Thanks to weather patterns and cloud cover, average temperatures were the lowest since 2012. The national average temperature was 0.23°C below the 2000–2021 average but still 0.50°C above the 1961-1990 average, in line with global warming.



National average number of days above 35 °C

The average maximum temperature in 2022 was 41.5 °C, 0.50 °C higher than the previous year but still 0.42 °C below the 2000–2021 average. Maximum temperatures were especially muted along the southeast coast.

Severe to extreme heat waves affected parts of the north and the west during 2022. Record high temperatures above 45 °C were measured in the western Pilbara region in WA.

The number of days exceeding 35 °C was slightly higher than the previous year. Nationally, there were on average 74 hot days: 6% or five days less than the 2000–2021 average.

Nights were cooler than the previous year. The national average minimum temperature was the lowest since 2012. The national average was 0.51 °C below the 2000–2021 average but still well above long-term average minimum temperatures observed before 2000.

The average number of nights with night frost was less than the previous year and 14% below the 2000–2021 average.

Snow cover was the most extensive since 2001 due to above average snowfall in Victoria and NSW. Snow cover was below average in western Tasmania. Total snow occurrence increased 61% from the previous year and was 50% above the 2000–2021 average.



Water

River flows were the highest since 2011.

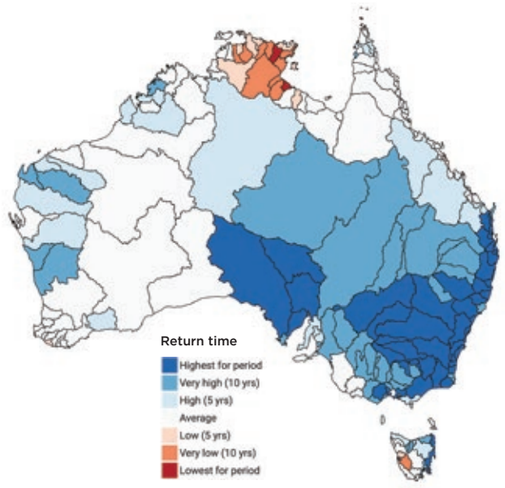
National river inflows were well above average at 138 mm or 1,051,000 GL; 19% more than the previous year and 52% above the 2000–2021 average.

River inflows were near- or above average everywhere except the Top End. River flows were the highest since before 2000 in many catchments in inland NSW, along the NSW and southeast Queensland coast and in South Australia.

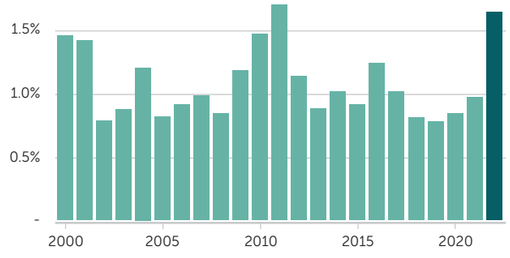
On the other hand, river flows in the Rosie and Goyder Rivers along the NT coast experienced their lowest river flows since before 2000.

Multiple severe flooding events occurred in 2022. There was widespread flooding in the NSW and Victorian parts of the Murray-Darling Basin and eastern Tasmania.

Extreme multi-day rainfall in February and March resulted in record flooding across southeast Australia. Century-old rainfall and river height



Rank of 2022 river flows by catchment



National annual area inundated

records were broken in some cases, such as the Mary River in Gympie, Queensland.

A tropical cyclone brought heavy rainfall and flooding in the Fitzroy River in the Kimberley region of WA in the last days of 2022.

Storage in the various water reservoirs in the Murray-Darling increased from 90% to 96% of capacity in 2022. Reservoir storage in the Ord system in the Kimberley region also increased from 58% to 73% of capacity.

Urban water supplies for all eastern capitals remained full or increased further. The Sydney and Canberra supply systems remained close to capacity, Melbourne storages increased from 90% to 97% of capacity, and water supplies for Brisbane and Adelaide increased by around 20% to 82% and 84%, respectively, respectively. Perth's surface water supply remained at 57% of capacity.

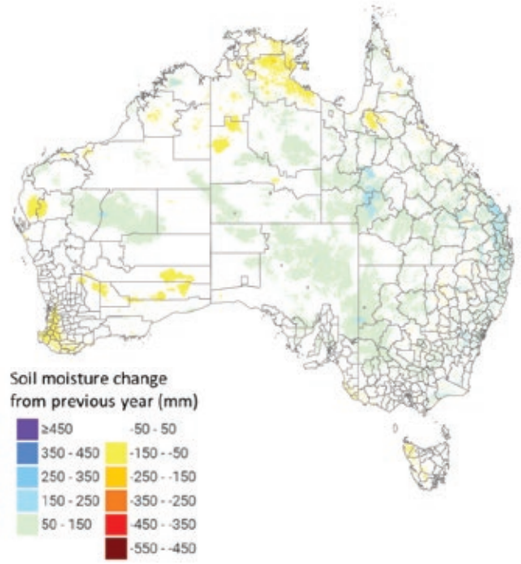
The national extent of wetland flooding was the greatest since 2011 and 54% above the 2000–2021 average.

Maximum flood extent was the greatest since before 2000 in many catchments across the eastern states, southwestern WA and Northern Australia. Water extent was below average only in inland southern WA.

Extensive flooding contributed to increased organic matter concentration, low oxygen conditions and blackwater events across the Murray-Darling river system. Reports emerged in late 2022 of mass native fish losses along the middle and lower Murray River.



+13%
SOIL MOISTURE
on 2000–2021 ave.



Soil moisture change from previous year (mm)

Soils

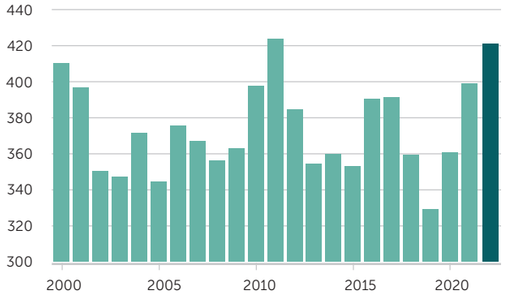
Soil moisture and soil surface condition improved across most of Australia.

Soil moisture availability and soil condition improved across most of Australia

National average moisture availability in the top 6 m of soil increased by 22 mm to reach values not seen since 2011. Values were 5% more than the previous year and 13% above the 2000–2021 average.

Soil moisture increased or remained stable nearly everywhere, with the greatest increases along the central east coast and some inland regions in NSW and Queensland.

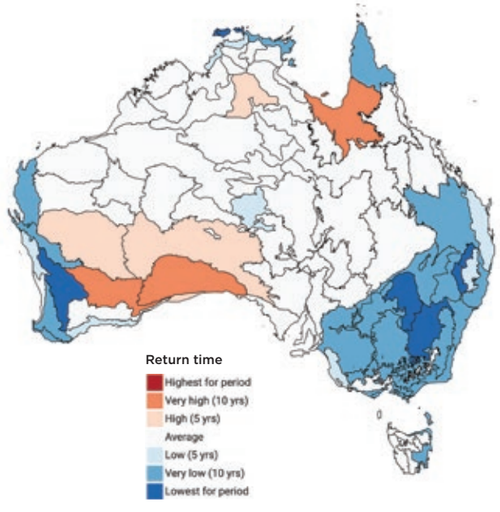
Declines in average soil water availability occurred in the northern part of NT and the southern and western regions of WA. Soil moisture fell to the lowest level since before 2000 in western Tasmania. Below average conditions also occurred in Arnhem Land and the Margaret River region in WA.



National average soil moisture content (mm)

National average soil protection by vegetation and leaf litter improved for the fourth year in a row and was the best since 2017. Soil exposure was 4% less than the previous year and 2% less than the 2000–2021 average.

The best conditions since before 2000 were measured in parts of southeast and southwestern Australia. Soil surface conditions fell well below the 2000–2021 average in the WA Goldfields region.



Rank of 2022 average soil exposure by bioregion



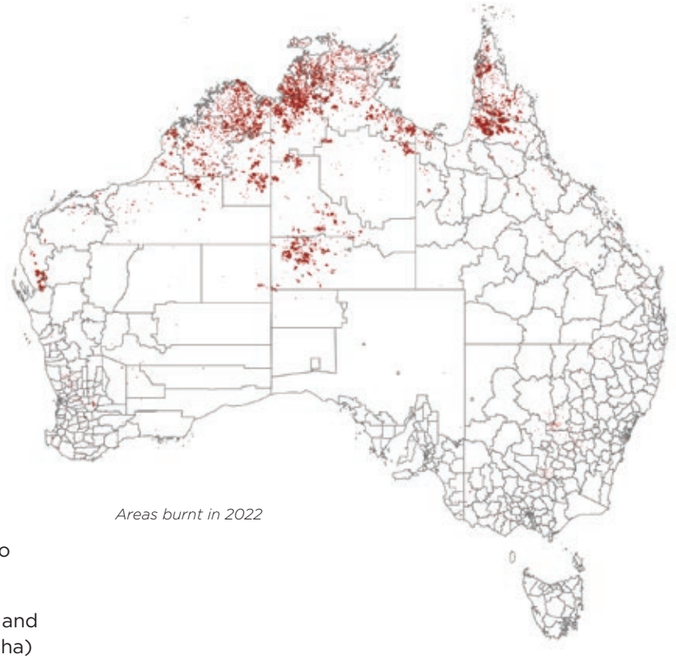
Fire

Fire activity was low in 2022 due to a lack of hot, dry weather.

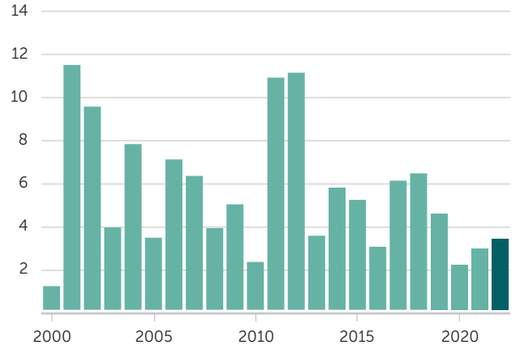
The majority of notable fire incidents occurred in January and February of 2022. On 1 January, a fire started in the Melbourne suburb of Maribyrnong in Victoria, while another fire from South Australia crossed into Victoria burning forest and farmland.

In WA, a fire on 11 January around Eagle Bay and Dunsborough consumed over 220 hectares (ha) of bushland. A fire near Lucindale (SA) started on 19 January and burned out of control, leading to the death of one firefighter and serious injury to another.

Heatwave conditions in the west of WA contributed to extreme fire danger in early February, leading to multiple fires between 4 and 6 February.



Areas burnt in 2022



National percentage of area burnt

At least four homes and 45,000 ha of bushland were burnt.

Nationally the area burnt was small. The total area burnt was 27 Mha, 17% more than the previous year but still 40% below the 2000–2021 average. Fire activity was near or below average across almost all of Australia. Relatively high fire activity only occurred in the Gascoyne region in western WA.

Remotely sensed fuel moisture content provides a measure of landscape flammability. Nationally, the minimum value observed during the year was the highest since before 2000, indicating unfavourable conditions for bushfires.

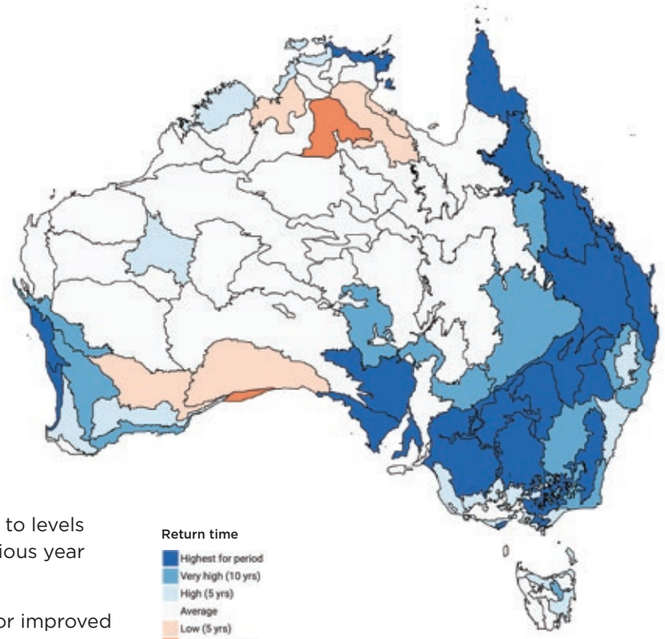
Regionally, drier than average fuel moisture conditions occurred in several regions in WA, especially in the southern inland parts of the state.

Total fire carbon emissions were 72 Mt carbon. They were 2% greater than in 2021 but still 49% below the 2000–2021 average emissions. As in other years, savanna fires in northern Australia were responsible for the majority of fire emissions.



Vegetation

Vegetation condition improved to levels last seen in 2011.

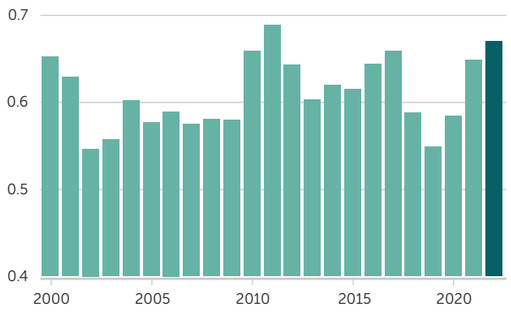


Rank of leaf area index by bioregion

National vegetation condition improved to levels last seen in 2011: 3% more than the previous year and 10% above the 2000–2021 average.

Vegetation conditions remained stable or improved in most of the country. The best conditions since 2000 were recorded in several regions of the eastern states and southwest WA. The strongest increases occurred in native forests in the coastal Victoria-NSW border region and the Fraser Coast in Queensland.

Vegetation condition declined from the previous year in southwest WA, parts of the Victorian south coast and Tasmania but remained above the 2000-2021 average. Very low vegetation cover was measured in the Goldfields region in WA.



National average leaf area index

National vegetation growth rates, estimated from weather and satellite data, were the best since at least 2000, when estimates began. Nationally, growth was 11% better than the previous year and 28% above the 2000–2021 average.

National carbon uptake was dominated by excellent growing conditions in the major cropping and sheep grazing regions on both sides of the country.

Growth conditions remained poor for the fourth year in a row in the inland WA Goldfields and Nullarbor regions.

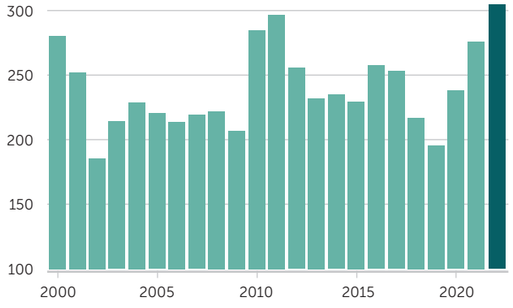
Vegetation primary production was high across all land use sectors. Growth conditions were the best since before 2000 in dryland cropping (49% above 2000–2021 average conditions), irrigation cropping (+43%), forestry (+18%), and intensive agricultural, industrial and urban land uses (+26%). Growth conditions were the second-highest after 2011 on grazing land (+36%) and in natural environments (+15%).

+6%
TREE COVER
increase from 2021

Increased water availability and low fire activity led to expanding tree cover. Tree cover, the canopy fraction of vegetation >2 m tall, increased by 6% or 3.5 Mha from the previous year, reaching 13% above the 2000–2021 average extent and the highest since 2017.

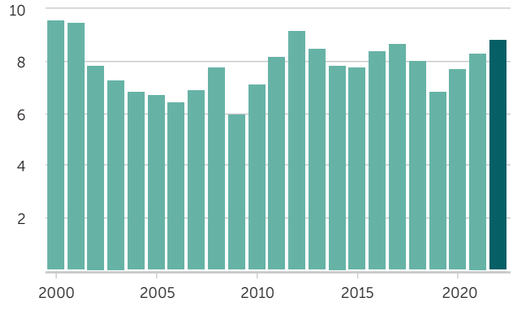
Tree cover increased most in inland southeast Australia and in Queensland.

Tree cover declined somewhat from the previous year in isolated regions in the cropping regions of southwest Australia, Victoria and NSW but remained above the 2000-2021 average. Below-average tree cover occurred in the Northern Territory and in inland WA, with record low values observed in the Mid-West region of WA.



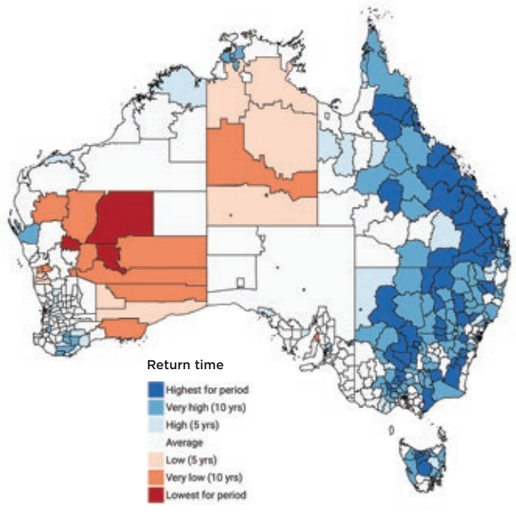
National average vegetation carbon uptake (gC/m^2)

Nationally, the net increase in woody cover was almost entirely on grazing land (+3.0 Mha), followed by forestry (+0.35 Mha) and wetlands (+0.06 Mha).



National average woody vegetation % cover fraction

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



Rank of woody vegetation cover by Local Government areas



The humpback whale (Megaptera novaeangliae) *made a remarkable recovery*



Corrigin grevillea (Grevillea scapigera)



62%
DECLINE IN ABUNDANCE
since 2000

Gang gang cockatoos (Image: Lachlan Read)

Biodiversity

A third wet year helped post-fire recovery and wetland communities, but biodiversity continues to decline

Three consecutive years of high rainfall and widespread flooding had mixed effects on biodiversity. As wetlands filled across south-eastern Australia, waterbird numbers nearly doubled from the previous year. On the other hand, high sediment runoff impacted seagrass meadows along the Queensland coast, leading to the starvation of dugongs and the threatened green sea turtle.

The Threatened Species Index (TSX) estimates the changing abundance of threatened and near-threatened species with a three-year lag. Estimates for 2019 (before the Black Summer fires) show a continued decline in the abundance of Australia's threatened birds, mammals and plants.

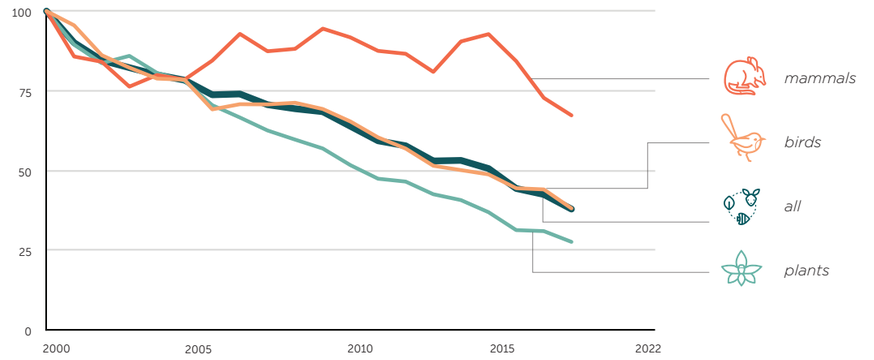
Among species listed as threatened on the Environmental Protection and Biodiversity Conservation Act (EPBC Act) and included in the TSX, abundance in 2019 was 62% lower than the year 2000, with an average annual rate of decline of 3%. Threatened plants showed the greatest declines (72%), followed by birds (62%) and mammals (33%).

According to the TSX, species protection and management have been effective at slowing declines, and even stabilising and recovering some species. For example, the abundance of mammals at actively managed sites remained stable at 24% below 2000 values, whereas those without protection declined by 44% since 2000.

The abundance of medium-sized mammals — considered the most at risk due to fox and cat predation — has stabilised due to intensive management, while that of large mammals increased by 105% since 2000 on average, with significant recovery of humpback and southern right whales contributing to this trend.

Another 30 species were added to the EPBC Act List of Threatened Species, bringing the total number to 1,973 — a 43% increase since 2000. Eight species were uplisted. Currently, 5.7% of Australian plants and 5.9% of animals are threatened with extinction.

All eight uplisted species and 24 of the 30 newly listed species were affected by the 2019/2020 Black Summer fires. The entire range of some plant species was burnt, putting them at immediate risk of extinction. The bushfires also compounded existing threats for many other species. For example, the Mount Kaputar rock skink and the gang gang cockatoo were listed as Endangered for the first time. Some species were less impacted than feared: land snails in northern NSW were remarkably resilient, with just 3 of 30 species identified as of conservation concern due to the fires.



Abundance of different categories of threatened species since 2000 (source: Threatened Species Index)

No species were declared extinct in 2022 under the EPBC Act, and only two were downlisted. The humpback whale was removed from the list due to a remarkable population recovery. In the history of the threatened species list, only 14 species have recovered sufficiently to be delisted and two of those were subsequently re-added.

Over 130 new species were discovered in 2022. A new species of mountain frog from the Gondwana Rainforests (*Philoria knowlesi*) was described and is likely to be listed as Endangered. NSW acquired a new endemic legless lizard, the Hunter Valley delma (*Delma vescolineata*). Other discoveries included an earthworm, four orchids, two lava cave weevils, eleven jumping spiders, seven pseudo-scorpions, and a shark.

Recently discovered mountain frog (Philoria knowlesi)



About this report

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

On the website (www.ausenv.online) you can 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

Production of this report was made possible by the National Computational Infrastructure (NCI) and data published by Geoscience Australia, Bureau of Meteorology, European Centre for Medium-Range Weather Forecasts, NASA, Japan Meteorological Agency, US National Oceanic and Atmospheric Administration, US National Snow and Ice Data Center, Australian Bureau of Statistics, Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), CSIRO, NSW Department of Planning, Industry and Environment, Atlas of Living Australia (ALA), Terrestrial Ecosystem Research Network (TERN), and Australian Bureau of Agricultural and Resource Economics.

About the data

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

Weather data were derived by combining stationary satellite and weather forecast model data. Data on land cover, inundation, fire, soil condition and vegetation leaf area were derived by automated interpretation of satellite imagery.

'Biodiversity analysis' was based on the TERN-managed Threatened Species Index (TSX), providing measures of change in the relative abundance of Australia's threatened and near-threatened species at national and regional levels.

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 the data, visit the website (www.ausenv.online).

About Us

Australia's Environment is produced annually by TERN and the Australian National University (ANU).

ANU's Centre for Water and Landscape Dynamics develop new methods to measure, monitor and forecast climate, water availability and landscape conditions by combining satellite and field measurements using biophysical modelling and machine learning.

TERN is Australia's land ecosystem observatory, an NCRIS-enabled National Research Infrastructure that provides long-term preservation and access to analysis-ready ecosystem data for researchers and decision-makers to help Australia prepare for the future.



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

www.ausenv.online

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