Australia's Environment | 2020 REPORT

Australian National University

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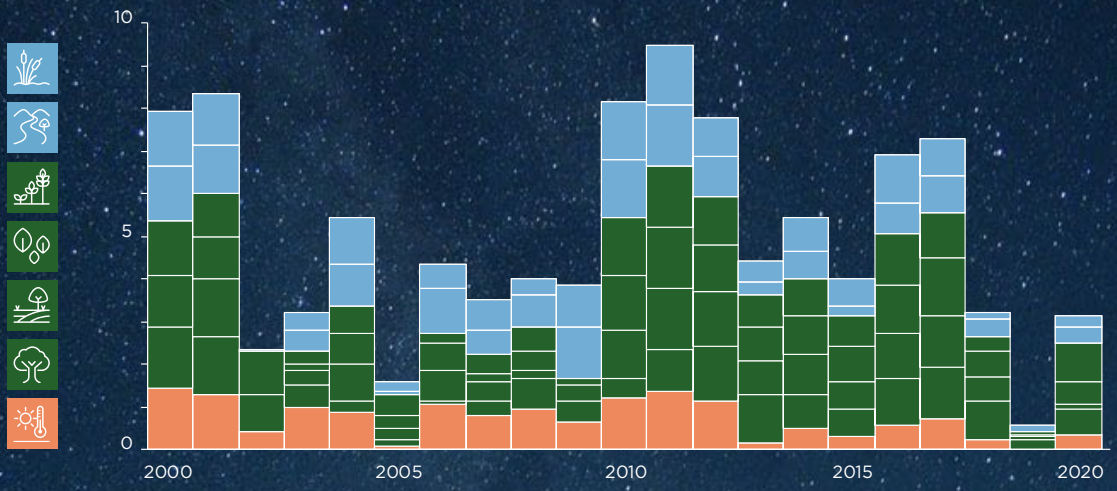
Summary Indicators

The first months of 2020 continued the extreme conditions of the previous year, but after good rains from February onwards there were signs of recovery. Overall environmental condition remained well below average.



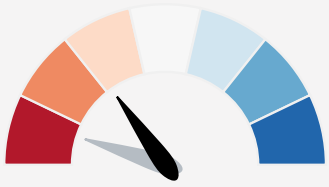
National ECS and its components for 2000–2020

The National Environmental Condition Score (ECS) improved 2.6 points out of ten to reach 3.2 points. Scores improved in all states and territories except Tasmania (TAS).

The poorest conditions occurred in the Northern Territory (NT) and Western Australia (WA) due to continued dry conditions. The largest improvements occurred in New South Wales (NSW) and Victoria (VIC) thanks to good rains, reaching above average conditions. Conditions in the Australian Capital Territory (ACT) were affected by large fires in early 2020.

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).

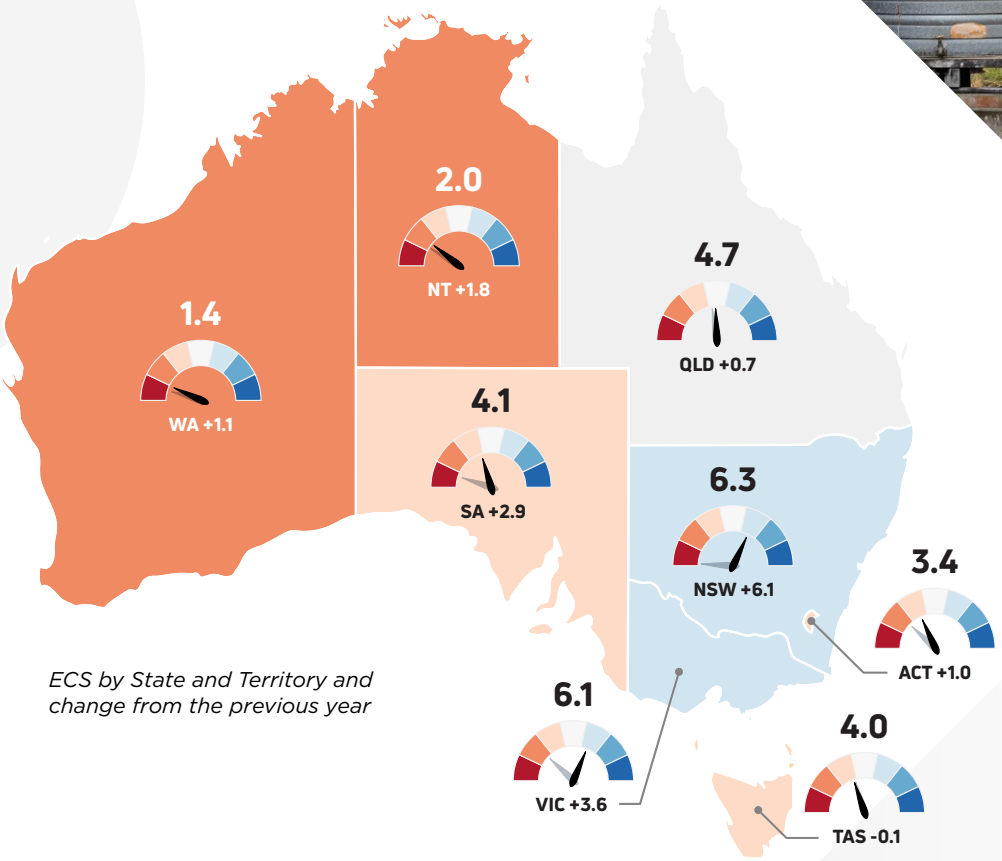
3.1



AUS +2.6

National Environmental Condition Score

2020



ECS by State and Territory and change from the previous year

National Environment Indicators at a glance

+1% Ozone hole	+0.19°C Ocean temperature	+17% Population	0.43°C Mean temperature	+11% Days over 35°
+9% Rainfall	-43% Biomass burnt	-27% River flows	-21% Wetlands	-3% Soil moisture
-11% Soil protection	-4% Leaf area	+1% Plant growth	-1% Tree cover	+16% Threatened species

Numbers represent the relative change from 2000-2019 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

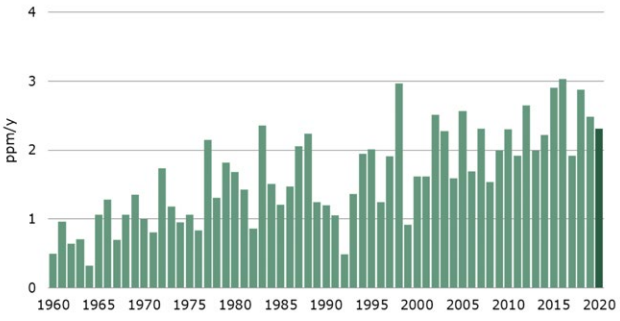
Greenhouse gas pollution and warming slowed down slightly. The ozone hole expanded to normal size.

Atmospheric CO_2 continued to increase rapidly by 2.3 ppm, 7% slower than the previous year but 5% faster than the average 2000–2019 rate. This was likely partly due to reduced energy use during the COVID-19 pandemic. Average CO_2 concentration reached 414 ppm; a 31% increase from 1960.

Global air temperature increased by 0.03°C in 2020, reaching 0.85°C above the 1961-1990 mean. This is the second highest in the historical record, only 0.01°C short of 2016 record temperature.

The ozone hole returned to normal size (1% greater than the 2000-2019 average) after being very small the previous year due to an unusual polar air circulation pattern.

Sea ice extent increased slightly. Ice extent on both hemispheres combined was 3% greater than previous year but still 4% lower than the 2000–2019 average.



Annual growth in average atmospheric CO_2 concentration (NOAA)

Oceans

A marine heat wave caused another bleaching event in the Great Barrier Reef.

Oceans absorb 93% of excess heat from climate change. Unlike atmospheric heat content, global ocean heat content was slightly (1%) less than in 2019.

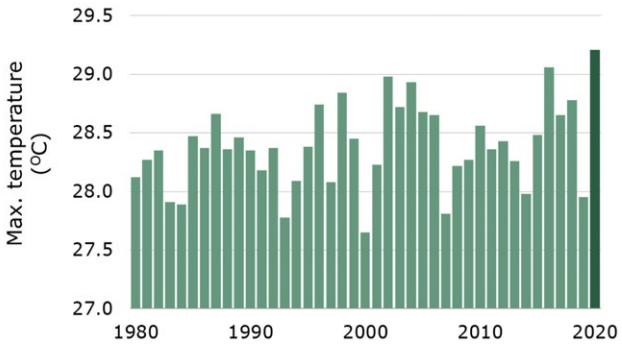
Global sea level rose by 4.3 mm, marking an increase of 76 mm since 2000 and 98 mm since 1993.

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 increased and was the equal fourth warmest year on record. Mean temperature was 0.17°C above the 2000– 2019 average and 0.32°C above the 1961- 1990 average.

High temperatures in the tropical seas culminated in a marine heatwave in the Great Barrier Reef in February-March, which experienced the hottest temperatures since at least 1955.

The marine heatwave caused the third mass bleaching event in the Great Barrier Reef in five years, following events in 2016 and 2017. There was severe bleaching of 25% of reefs and unlike previous events the southern reef was also affected. Overall reef condition was already poor and did not change substantially from 2019.

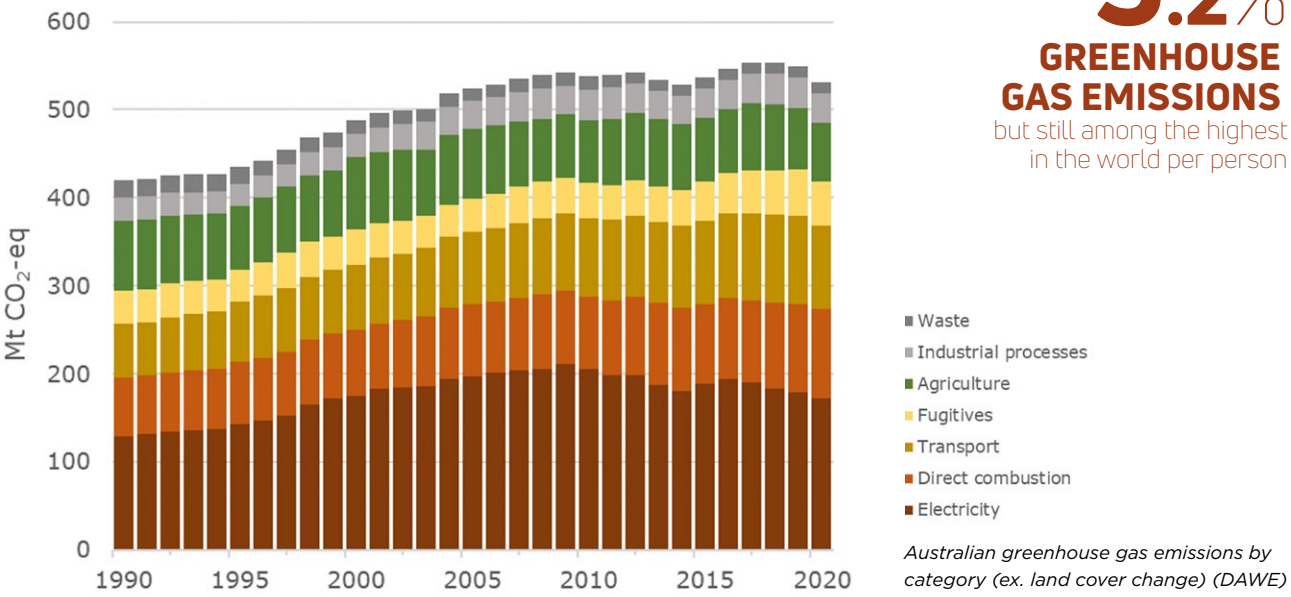


Maximum monthly sea surface temperature across the GBR (BoM)

People

Population growth and carbon emissions were less than previous years, largely due to the COVID-19 pandemic.

-3.2%
GREENHOUSE GAS EMISSIONS
but still among the highest in the world per person



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

Australia's population reached 25.7 million, 17% above the 2000–2019 average.

Population growth slowed down considerably in 2020. The population grew by 188,000; 43% below the average 2000-2019 growth rate, This reduction was due to the effect of COVID-19 border closures on net immigration.

Demand for space and materials increased. The number of building approvals increased for the first time since 2015, increasing by 6% from previous year.

Greenhouse gas emissions decreased 3.2% from the previous year, due mainly to the impact of COVID-19. Emissions were close to the 2000–2019 average.

Emissions decreased most strongly in transport (-6.7% from the previous year), from waste (-6.7%) from fugitive gases (-4.4%) and electricity generation (4.3%). The only increase was in direct combustion (+3.1%).

According to Government statistics, new forests exceeded forest removals, resulting in a net uptake of 17 Mt CO_2-eq. However, this number only accounts for a small part of the landscape carbon balance, and does not include emissions from vegetation decline and bushfires, for example.

Emissions per person fell 3.9% from the previous year and were 14% below the 2000–2019 average. Per capita emissions remain among the highest in the world, at 20.6 t CO_2-eq in 2020; greater than for the US (>1.3 times), EU (2.5 times) and world-average (>4 times). Reasons include the high per-capita energy use, the use of polluting coal, and high non-CO_2 emissions.

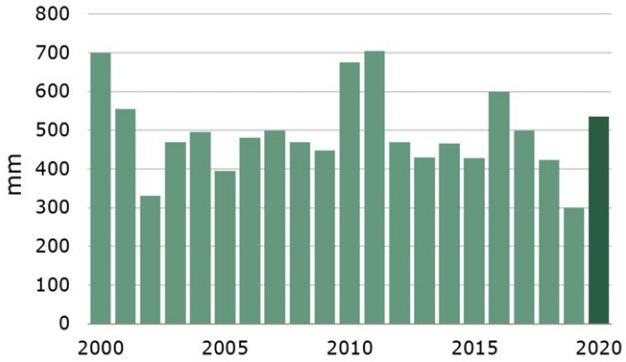
Weather

Hot and dry conditions continued until February but returned to normal thereafter.

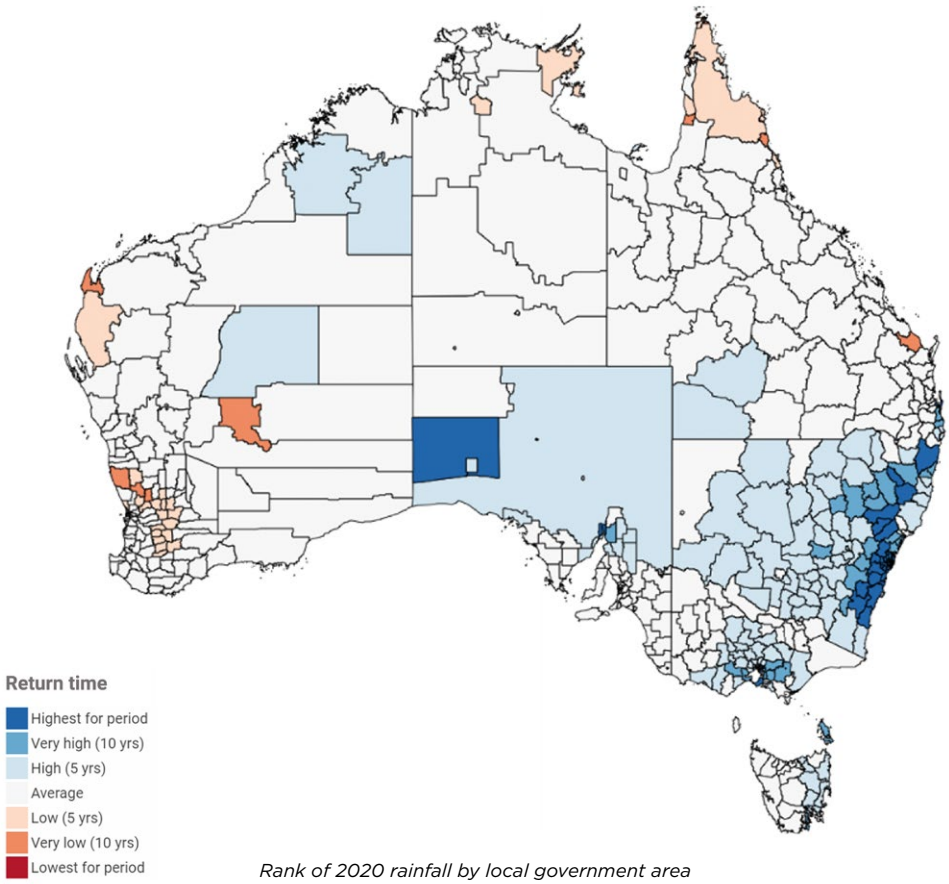
National average rainfall was slightly above average after a record dry 2019. Average rainfall was 536 mm: 79% more than the previous year and 10% above the 2000–2019 average.

Above-average rainfall occurred over most of NSW, Victoria and South Australia as well as parts of inland WA and Queensland. Rainfall was highest since at least 2000 along the coast of NSW.

Parts of coastal northern and Western Australia received below average rainfall.



Annual rainfall across Australia



Rank of 2020 rainfall by local government area

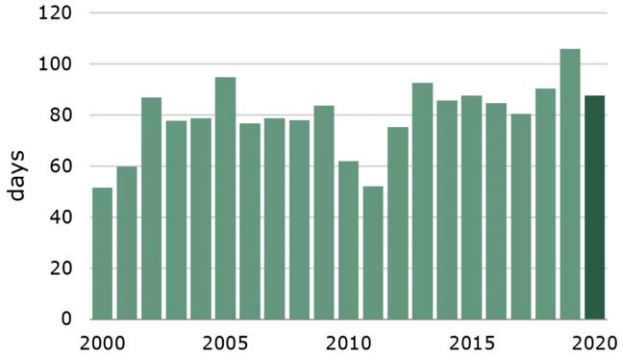
+79%
MORE RAINFALL
than in 2019.

Temperatures were also lower than in the record hot year 2019, but remained well above average in line with global warming. National average temperature was 0.43°C above the 2000– 2019 average and 1.15°C above the 1961-1990 average.

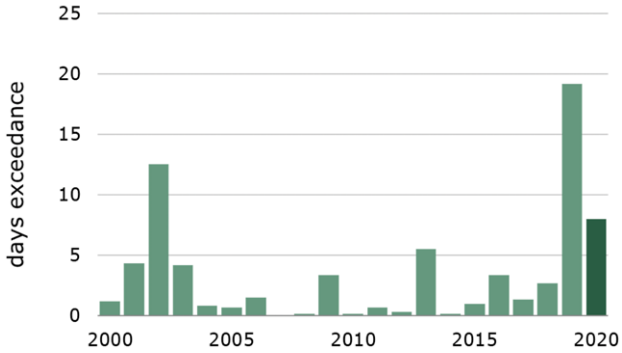
Maximum temperatures were also lower than those of the previous year but well above average: the average maximum temperature was 42.6 °C or 0.66 °C above the 2000–2019 average.

Annual maximum temperatures were the highest since at least 2000 in southern NSW, the ACT and parts of WA and Tasmania in early 2020. Western Sydney experienced a new record of 48.9 °C on January 4. August and November were also unseasonally warm.

The number of days exceeding 35°C was lower than previous year. Nationally there were an average 88 hot days: 11% or 9 days more than the 2000–2019 average.



National average number of days above 35 °C



Average number of days with PM2.5 exceeding threshold at 52 NSW locations (NSW Dept. of Planning, Industry and Environment)

Nights were the warmest since 2013 and higher than the previous year as greater cloud cover and wetter soils enhanced the underlying warming trend. The national average minimum temperature was 0.81°C above the 2000–2019 average.

In contrast to the warmer nights overall, the SA-Victoria border region experienced the largest number of frosty nights since at least 2016.

Snow cover was below average, for the third year in a row, and was 24% below the 2000-2019 average.

Smoke caused major air quality problems that had begun with bushfires in late 2019, with especially poor conditions in southern NSW and the ACT in January and February. Canberra was ranked as the city with the most dangerous air quality in the world for several days.

Flash flooding at a Gold Coast zoo, January 2020

Water

River flows and wetland extent improved but remained below average in most catchments.

National river inflows remained below average at 66 mm or 504,000 GL; 27% below the 2000–2019 average but 26% more than the previous year.

Very to extremely low river flows occurred in several catchments in the Top End and Capricornia.

River flows were above average across much of NSW and in the Nullarbor catchments. There were no large algal blooms or fish kills in the Murray-Darling Basin.

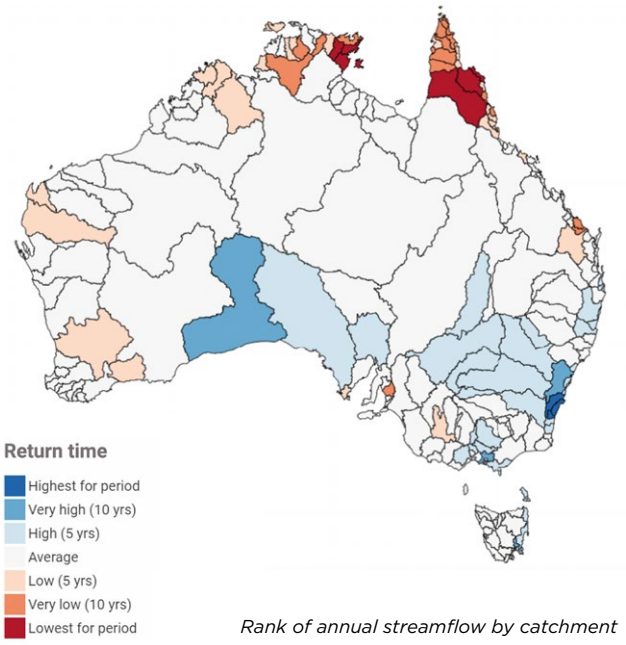
Major floods occurred on the southern NSW coast in August. The Shoalhaven River and surrounding areas experienced the highest flood levels since 1991.

Very intense rainfall caused flash flooding in southeast Queensland in January and again in December.

Storage in the Murray-Darling storages increased, with combined storage in the five largest storages increasing from 35% to 57% of capacity, reaching levels last seen in 2018.

Reservoir storage in the Ord system in the Kimberly region declined for a third year, from 34% to 29% of capacity.

Urban water supplies increased for all cities. The Sydney and Canberra supply systems increased from around half to near full capacity. Smaller improvements occurred in Melbourne (+12%) and Adelaide (+7%) whereas supplies for Brisbane and Perth remained stable.

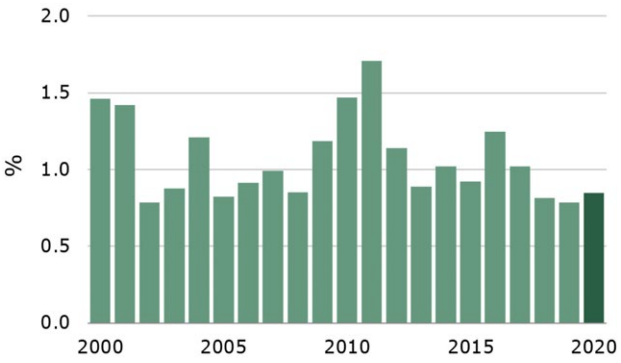


Rank of annual streamflow by catchment

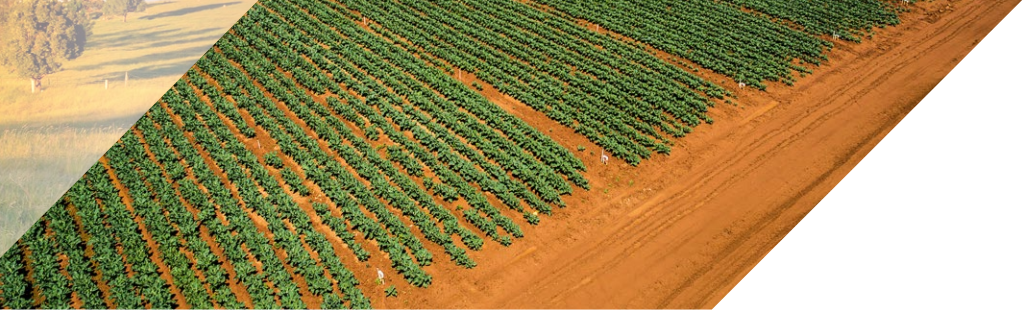
The national extent of wetland flooding increased by 8% on 2019 but remained at similarly low levels as the previous two years. Total inundation was 21% below the 2000–2019 average.

Wetland extent was the lowest since at least 2000 in the Ord, Murchison and Albany catchments in WA as well as several catchments in eastern Victoria.

The greatest wetland extents were observed in several smaller coastal catchments in southwest WA, along the East coast and in western Tasmania.



National annual inundated area



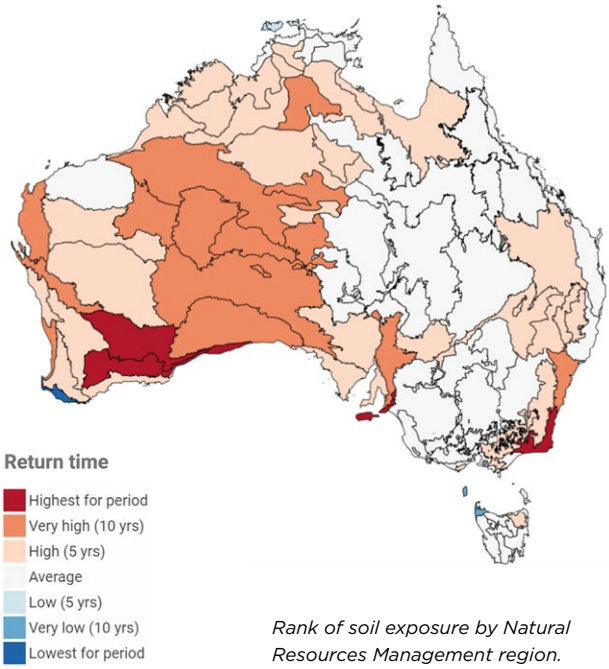
+9%
SOIL MOISTURE
An increase of 31mm

Soils

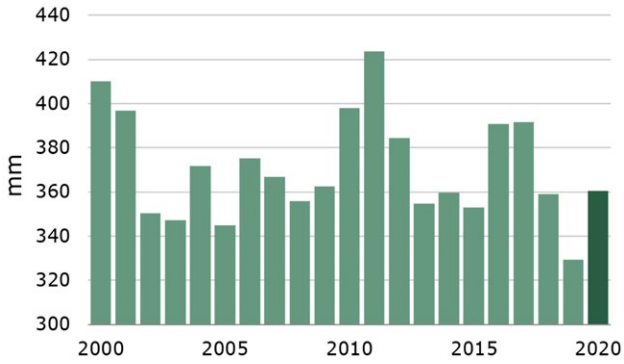
Soil moisture rose back to normal levels, however soil protective cover mostly remained poor.

National average top 6m moisture availability increased by 31 mm to reach values close to 2018. Values were 9% more than the previous year and 3% below the 2000–2019 average.

Soil moisture increased or remained stable in most regions, with the strongest increases along the NSW coast and in the NT and Kimberley region. Soil moisture fell to more typical levels along the North Queensland coast after a wet 2019 and decreased to below average in some arid inland regions.



Rank of soil exposure by Natural Resources Management region.



National average soil moisture content.

Soil moisture changes on the Southeast Coast compared to the previous year.

Soils across southeast Australia were extremely dry at the start of the year but rose to normal levels after rains in February and March. Moisture levels were sustained by regular rainfall during the remainder of 2020.

Northern Australia saw good rains in the later part of the 2019/20 monsoon from January to March and again at the early 2020/21 monsoon in December.

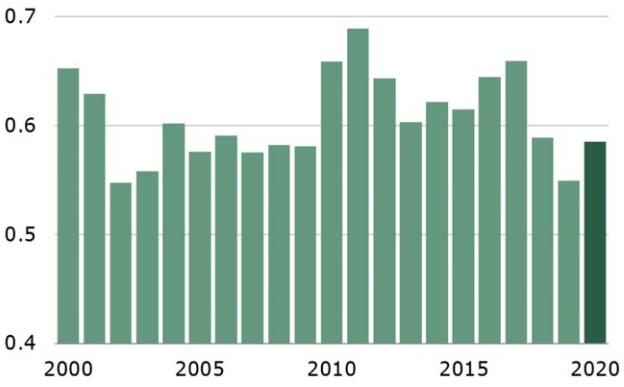
National average soil protection by vegetation and leaf litter remained poor. Soil exposure was 1% less than the previous year but still 11% worse than the 2000–2019 average.

Extremely poor soil surface condition occurred in inland southwest WA, Kangaroo Island and the southeast corner of Australia due to a combination of bushfires and drought.

Vegetation

Nationally vegetation condition returned to normal, but with strong regional differences.

+13%
TREE COVER
increase from 2019



National average leaf area index

National vegetation condition returned closer to average values: 7% more than the previous year and 4% below the 2000–2010 average.

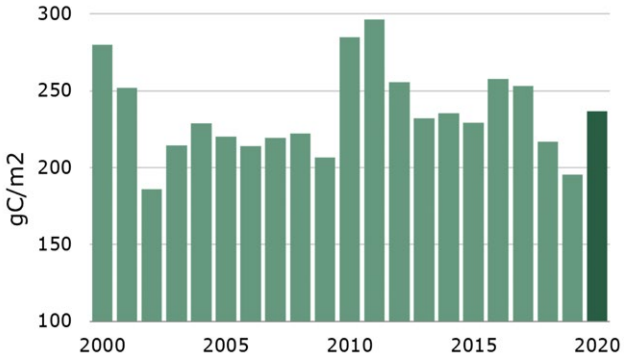
There were strong regional differences: vegetation condition was poorest since at least 2000 in large parts of inland WA and fire-affected areas in southeast Australia. The strongest improvements occurred in the NSW tablelands.

Vegetation growth rates, estimated from weather and satellite data, also returned to normal. Nationally, growth was 21% greater than the previous year and within 1% of the 2000–2019 average.

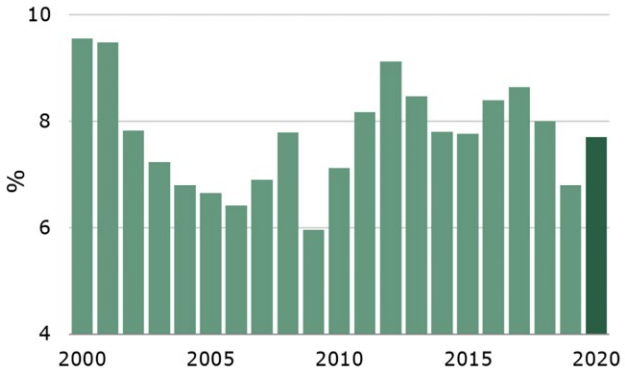
Growth conditions were the best since at least 2000 in the NSW wheat belt. Growth conditions were the worst in two decades in parts of inland WA.

Farming conditions improved considerably compared to the previous year, mainly due to improved conditions in southeast Australia. Vegetation productivity was above average 2000–2019 levels in dryland cropping (+25%) and irrigation (+24%) and close to normal in grazing (+3%).

In contrast, growth conditions were only slightly better than previous year in native and plantation forestry (-9%) and natural environments (-6%) and remained below average 2000-2019 conditions.



National average vegetation carbon uptake

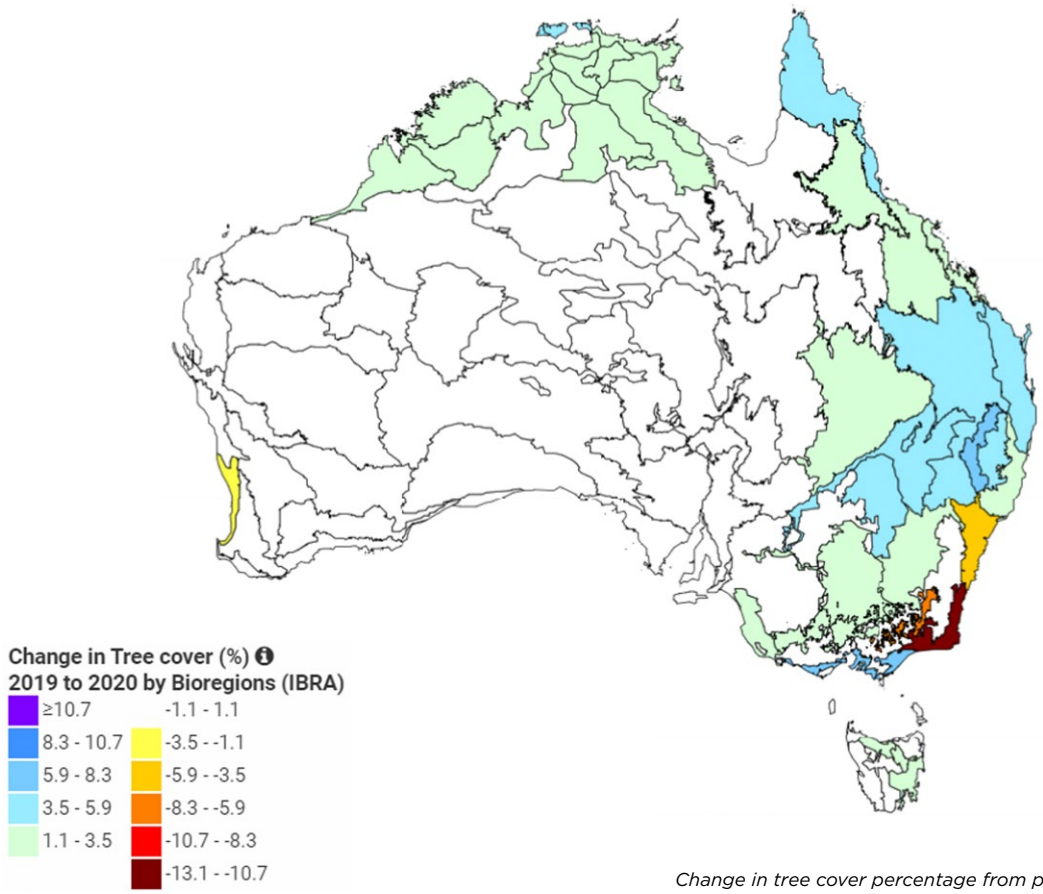


National average woody vegetation cover faction

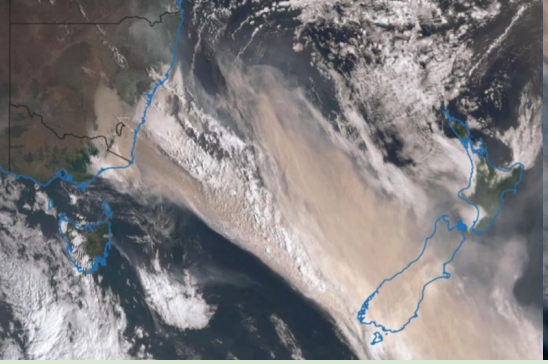
Increased water availability led to expanded tree cover. Tree cover, the canopy fraction of vegetation >2 m tall, increased by 13% or 7 Mha from 2019, to 1% below the 2000–2019 average.

Tree cover increases occurred in northern and most of eastern Australia, except for the coastal forests affected by bushfires.

Nationally, net increases occurred on grazing land (+4.9 Mha), in natural environments (+1.1 Mha) and on cropland (+0.7 Mha). Plantation forests suffered a loss of canopy cover equivalent to 46,000 ha.



Change in tree cover percentage from previous year by bioregion.



Smoke blankets southeast Australia and travels to New Zealand

Regrowth from fire-tolerant eucalyptus trunks after the Black Summer fires

Fire

The severe 2019/20 bushfires continued until February, but fire activity was very low otherwise.

The 2019/20 fire season saw unprecedented fire activity in southeast Australia, with new fires in southern NSW, Eastern Victoria and the ACT in January and February.

The area burnt in NSW, ACT and Victoria in 2020 was less than in 2019, but still 2.2 times the 2000-2019 average. Continued very dry fuel and hot weather explain the high fire activity in southeast Australia.

Nationally the area burnt was unusually small. This was mainly due to very low fire activity in inland Australia, which could be attributed to low fuel availability after prolonged dry conditions.

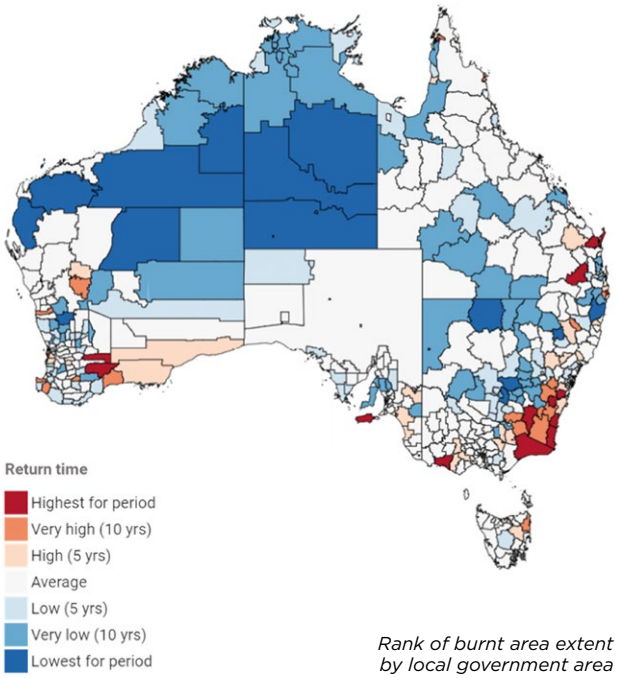
Total area burnt was 17 Mha, 90% below the 2000–2019 average and 88% less than the previous year.

Remotely sensed fuel moisture content provides a measure of landscape flammability. Nationally, the minimum value during 2020 remained close to the record low levels observed the previous year.

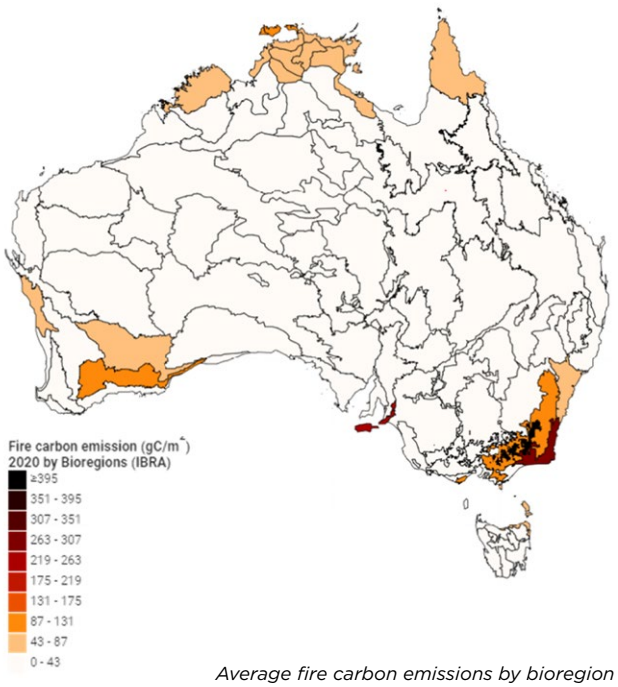
Record low fuel moisture was observed along the East coast in early 2020. Values increased after February.

Total fire carbon emissions were below average at 80 Mt carbon: 43% below the 2000–2019 average and 53% less than in the previous year.

Unusually, but for a second year, the largest part of emissions originated from forest fires in southern Australia. Smoke and ash produced by bushfires in southeast Australia were observed as far as New Zealand.



Rank of burnt area extent by local government area



Average fire carbon emissions by bioregion

Common mist frog (Litoria rheocola), one of the species recovering from chytrid fungus disease.

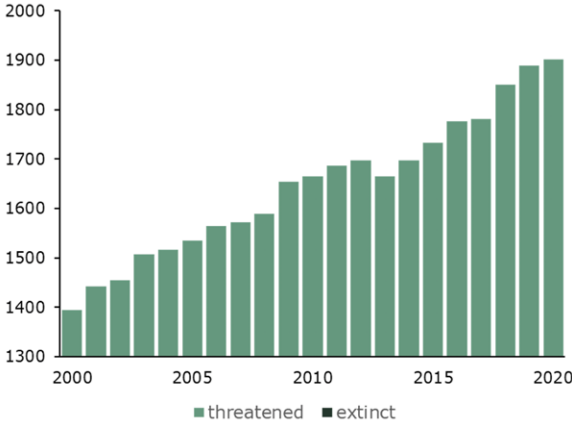
The endangered Mt Kaputar pink slug survived the fires

Biodiversity

Biodiversity continued to decline, with fire, drought and heat all impacting on ecosystems.

Another 15 species were added to the Threatened Species List and 3 removed. This represents a 0.6% increase from the previous year and a 36% increase from 2000.

A total of 1902 species are now listed. Plants make up 72% of threatened species, and have declined on average by 70% since 2000.

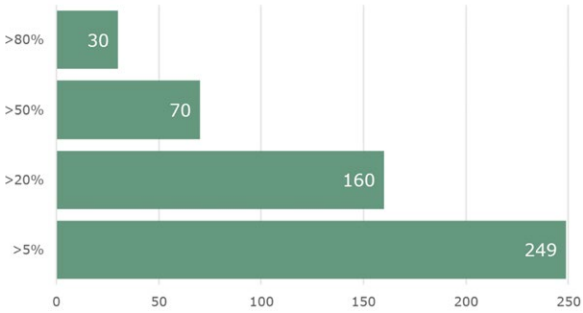


Number of species on Threatened Species List (Commonmwealth Dept. of Agriculture, Water and the Environment, DAWE)

The 2019/20 Black Summer bushfire season had a major impact on southeast Australian ecosystems. Many species already listed as threatened were pushed closer to extinction, and other species have become threatened as a result of the fires. The immediate impact of the fires and the food shortage afterwards were compounded by predators, especially feral cats.

The fires burnt through more than 5% of the habitat of 249 threatened species, and through more than 80% for 30 species.

Three species were down-listed, 15 added and four up-listed. Among the downlisted species were



Number of threatened species impacted and percentage of their habitat burnt (DAWE)

two tropical tree frog species that appear to have rebounded from the global chytrid fungus disease.

No species were declared extinct, however the impacts of the bushfires is expected to result in new extinctions being declared in 2021.

Two species thought extinct were rediscovered and taxonomic changes created two new mammal species. Another 30 new marine species were described following exploration in deep sea canyons off West Australia.

Arid zone bird species such as the budgerigar were found moving across NSW and South Australia following good rains in those areas.

The full impacts of the fires on biodiversity will not be known for some time. The COVID-19 pandemic has further hampered monitoring efforts. In some cases, there are encouraging signs. Citizen scientists found all 33 summer-breeding frogs in the fire-affected areas, including several threatened species. The endangered Mt Kaputar pink slug also survived.

Waterbird numbers in inland southeastern Australia showed a decrease from the previous year and remained lower than the long-term average for the eighth year in a row. This is consistent with continued low levels of wetland inundation.

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

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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 station 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.

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

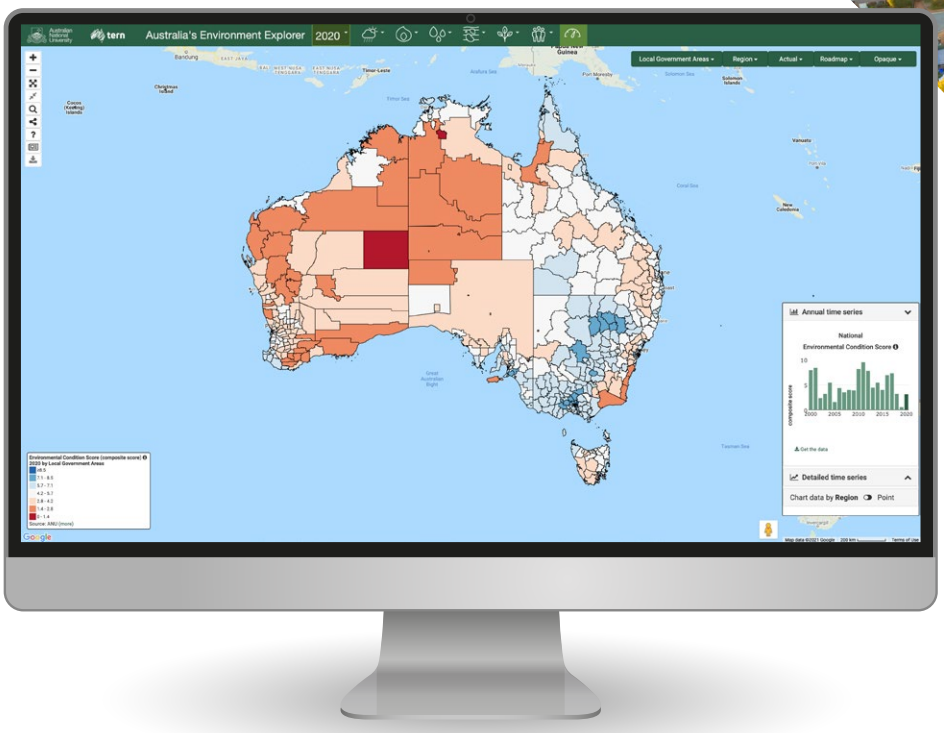
For further details on data and methods or to download any of the data shown here visit the web site (www.ausenv.online).

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 our 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.

*Image credit: Heiko Otto on Unsplash @heiko_otto_fotograaf (Snowy Mountains, Kosciuszko National Park, Australia. Inside front cover), David Clode on Unsplash @davidclode (*Eucalyptus platyphylla, *Cairns, Australia. p1 + back cover), Harry Cunningham on Unsplash @harry.digital (Water tank,Albany, Western Australia. p1), Rose Lamond on Unsplash @roselamond (Market Street, Sydney. p3). Himawari-8, (1 January 2020 p10),* Eucalyptus: *Nathan Rott/NPR (p10), Mt Kaputar pink slug: Michael Murphy / NPWS (p11)*



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

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