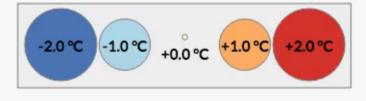






# TEMPERATURE CHANGE Years 1900–2018 & Projections 2020s–2090s





Afghanistan	Albania	Algeria	Andorra	Angola	Argentina	Armenia	Australia	Austria	Azerbaljan	Bahamas	Ba <mark>hr</mark> ain	Bangladesh	Barbados	Belarus	Belgium
Belize	Benin	Bhutan	Bolivia	Bosnia and Herzegovina	Botswana	Brazil	Brunei	Bulgaria	Burkina Faso	Burundi	Cabo Verde	Cambodia	Cameroon	Canada	Central African Republic
Chad	Chile	China	Colombia	Comoros	Congo Dem. Rep.	Congo Rep.	Costa Rica	Côte d'Ivoire	Croatia	Cuba	Cyprus	Czechia	Denmark	Djibouti	Dominica
Dominican Republic	Ecuador	Egypt	Salvador	Equatorial Guinea	Eritrea	Estonia	Eswatini	Ethiopia	Fiji	Finland	France	Gabon	Gambia	Georgia	Germany
Ghana	Greece	Grenada	Guatemala	Guinea	Gulnea- Bissau	Gu <mark>ya</mark> na	Halti	Honduras	Hungary	Iceland	Indla	Indonesia	Iran	(rag	Ireland
Israel	Italy	Ja <mark>mal</mark> ca	Japan	Jordan	Kazakhstan	Kenya	Kiribati	North Korea	South Korea	Kosovo	Kuwait	Kyrgyz Republic	Lao PDR	Latvia	Lebanon
Lesotho	Liberia	Libya	Liechtenstein	Lithuania	Luxembourg	Macedonia FYR	Madagascar	Malawi	Malaysia	Maldives	Mali	Malta	Marshall Islands	Mauritania	Mauritius
Mexico	Micronesia	Moldova	Monaco	Mongolia	Montenegro	Morocco	Mozambique	My <mark>an</mark> mar	Nambia	Nauru	Nepal	Nether lands	New Zealand	Nicaragua	Niger
Nigeria	Norway	Oman	Pakistan	Palau	Panama	Papua New Guinea	Paraguay	Peru	Philippines	Poland	Portugal	Qatar	Romania	Russian Federation	Rwanda
Samoa	San Marino	Sao Tome and Principe	Saud <mark>i A</mark> rabia	Senegal	Seychelles	Sierra Leone	Singapore	Slovak Republic	Slovenia	Solomon Islands	Somalia	South Africa	South Sudan	Spain	Sri Lanka
St. Kitts and Nevis	St. Lucia	St. Vincent	Sudan	Suriname	Sweden	Switzerland	Syrian Arab Republic	Talwan	Tajikistan	Thalland	Timor- Leste	Togo	Tonga	Trinidad and Tobago	Tu <mark>ni</mark> sia
Turkey	Turkmenistan	Uganda	Ukraine	United Arab Emirates	United Kingdom	Uruguay	USA	Uzbekistan	Vanuatu	Venezuela	Vietnam	Yemen	Zambia	Zimbabwe	

#### Data sources:

Berkeley Earth temperature analysis (1900-2018) The 'rcp45' experiment of the CMIP5 (2020-2100) Base period 1951-1980.

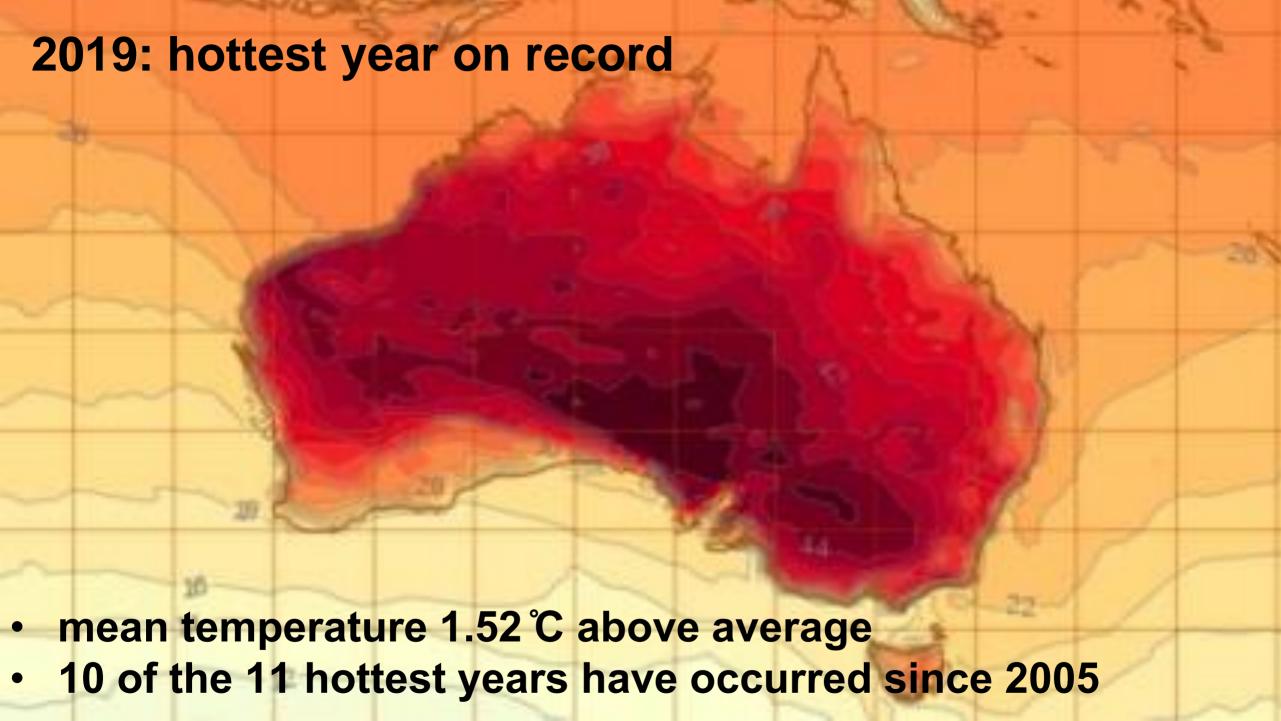


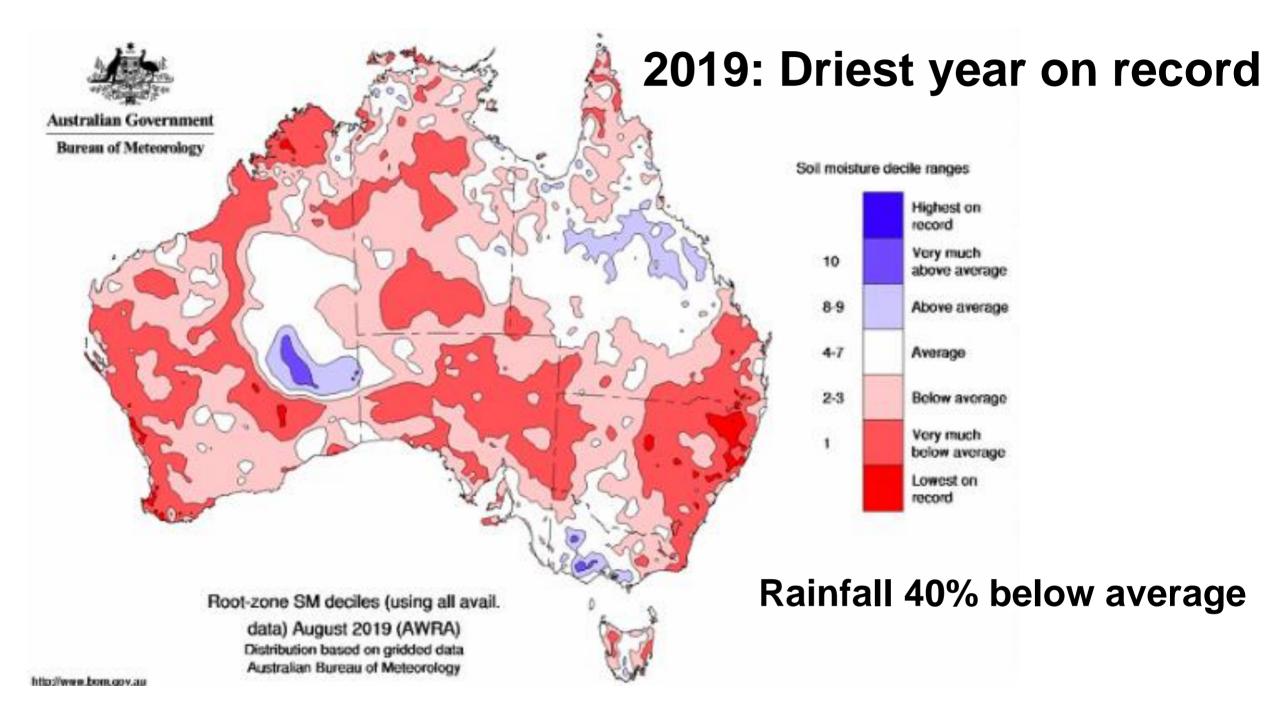


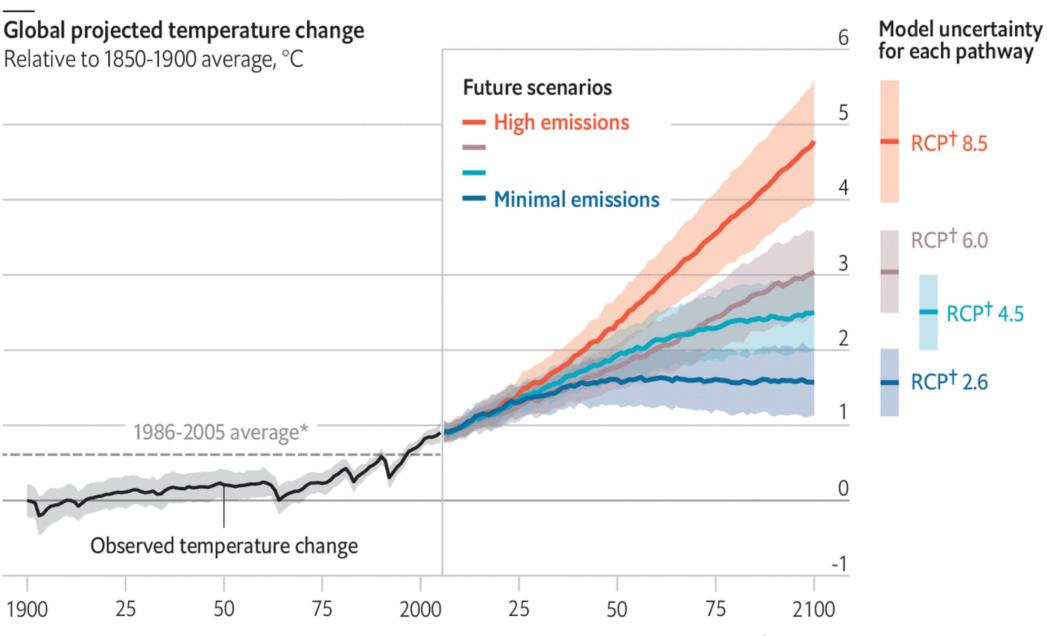
## State of the Climate 2020

State of the Climate draws on the latest climate research, encompassing observations, analyses and projections to describe year-to-year variability and longer-term changes in Australia's climate.









Source: IPCC AR5, adjusted to an 1850-1900 baseline
The Economist

\*Uncertainties calibrated to 1986-2005, as shown †Representative Concentration Pathway

## **WARMING FROM PARIS ACTIONS**

"The Paris climate agreement voluntary emission reduction commitments, if implemented, would result in warming by 3°C with a 50% chance of exceeding that amount"

Extract from Disaster Allev report, Download - breakthroughonline.org.au



"INCOMPATIBLE WITH AN ORGANISED GLOBAL COMMUNITY"

PARIS EMISSIONS PATH ACTUAL WARMING

COUTRIGHT CHAOS"

- 2° PARIS UPPER LIMIT TARGET
- 1.5° WARMING ALREADY IN THE CLIMATE SYSTEM

"VERY DANGEROUS" BOUNDARY

WARMING FROM 1880-1900 BASE

ARCTIC SEA ICE & WEST ANTARCTIC ICE TIPPING POINTS

BREAK THROUGH National Centre for Climate Restoration





The context.....our ecosystems are transforming





River red gums affected by drought & salinity



# Massive fish mortality in Menindee Lakes



# Saltwater intruding into freshwater ecosystems



# Fires penetrating into new ecosystems



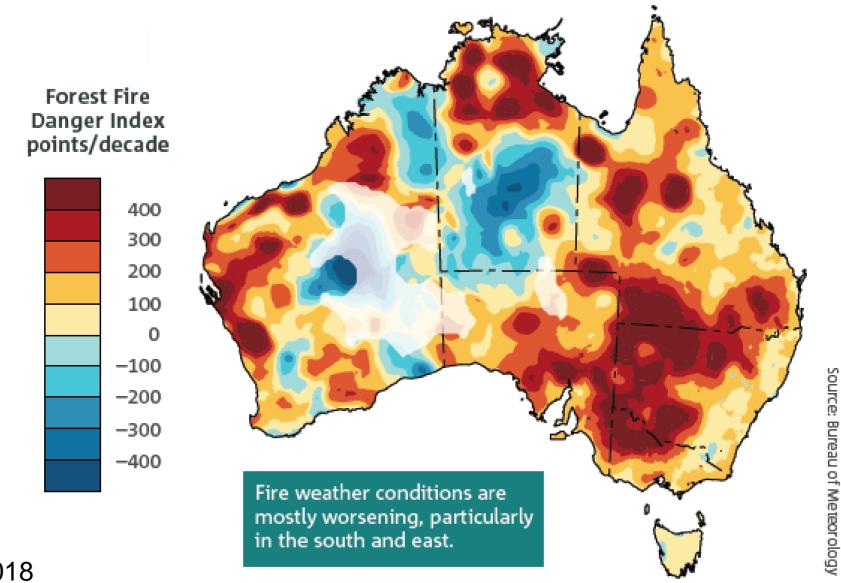
# Jarrah forest dieback due to heat and drought





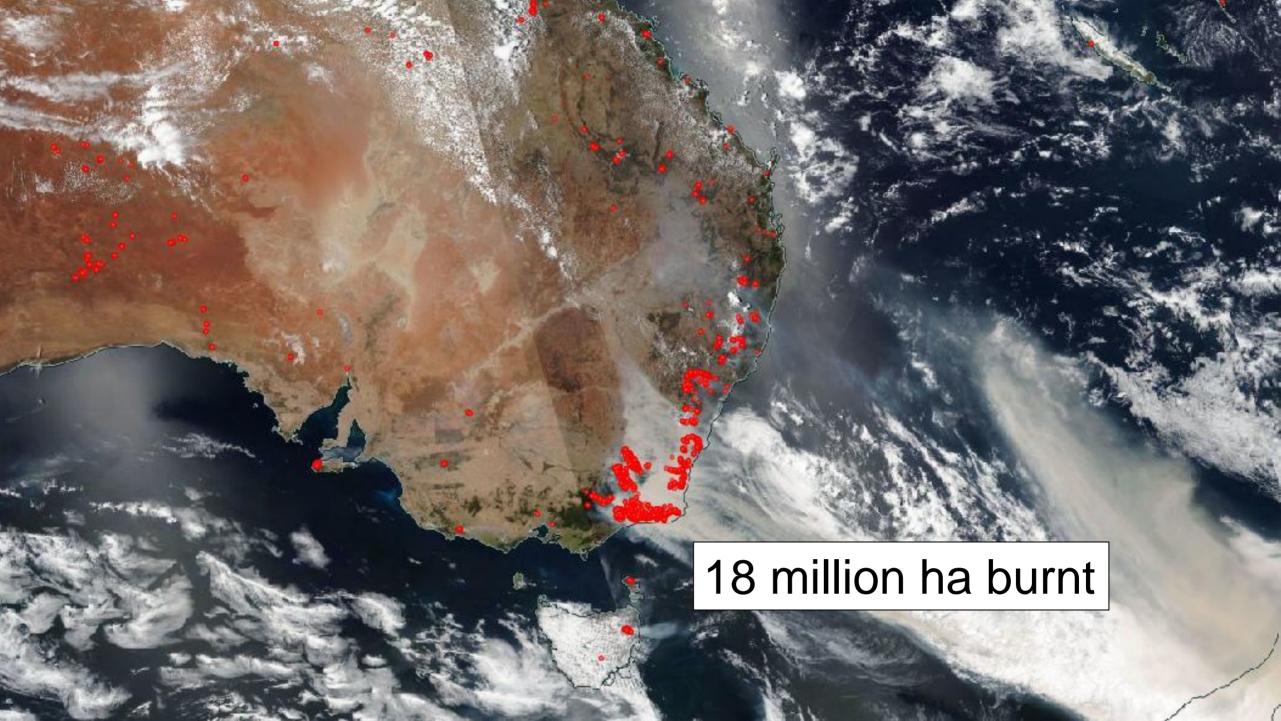


## Observed trends in Forest Fire Danger Index (1978 – 2017)



**CSIRO & BoM 2018** 





- ~3 billion vertebrates killed (mammals, birds & reptiles)
- Death from smoke inhalation recorded for wildlife 50 km from fire front
- Many threatened species lost most or all of their habitat





- Up to 10,000 koalas died in NSW (1/3 population)
- 25,000 died on Kangaroo Island (1/2 population)
- Post fire conditions: further mortality due to lack of food and shelter
- Animals brought into hospitals and rehabilitation centres subject to stress during handling, transport & housing





#### **Extreme events**

Mortality

#### **Heat stress**

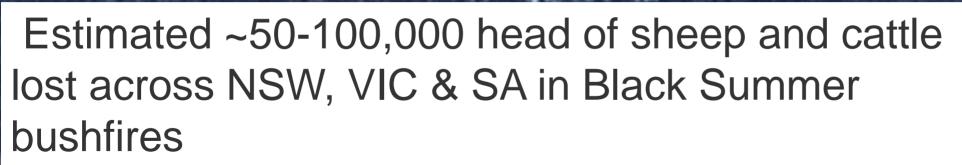
- Metabolic disruption
- Oxidative stress
- Immune suppression

### **Indirect impacts**

- Quality & quantity of food & drinking water
- Distribution, transmission & virulence of pests & pathogens









#### **Heat stress**

 Rapidly growing, high-producing stock most at risk as they already tend to have higher internal heat loads

 Heat stress reduces appetite via several mechanisms including the expression of ghrelin; subsequent decreased food intake can cause weight loss, lethargy and malaise



#### **Heat stress**

 Ruminants: increased ambient temperature increases risk of lameness, metabolic disorders, acidosis, respiratory alkalosis and altered energy balance

 Indoor farm animals at risk from failure of ventilation and air conditioning systems





#### **Nutrition**

- Affected positively and negatively via effects on pasture growth, quality & variability
- Decreased pasture growth in marginal areas increases risk of hunger and starvation
- Higher temperatures also associated with increased incidence of fungal toxins in feed
- If supplementary concentrates are fed routinely (such as in feedlots) or as compensation for low pasture, protein digestion may be elevated & body temperature increased, increasing risk of heat-related illness

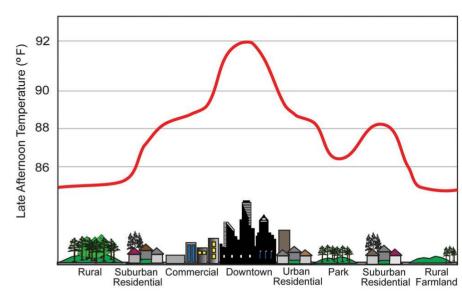
#### Parasites & vector- borne disease

- Hotter & more humid conditions more conducive to spread of parasites and vectors including mosquitoes, flies, lice, ticks and mites
- Implications for pets eg for heartworm spread by mosquitoes
- Implications for livestock as tropical parasites spread into more southerly areas eg. cattle ticks
- Direct impacts of temperature increase on pest physiology e.g. 3°C increase associated with 2x increased incidence of fly strike in lambs and 4x increase in ewes



#### **Pets**

- Rising average temperatures and more extreme hot days →TNZs will be exceeded more often and for longer periods, especially in urban areas which may be several degrees hotter on a given day than surrounds (Urban Heat Island Effect); ambient temperatures of 25°C can mean footpath temperatures of >50°C
- Thermal Neutral zone (TNZ) of dogs is 20-30°C; guinea pigs 18-26°C, heat stress at >28°C
- Heat stress vulnerability affected by age, preexisting conditions, breed, reproductive status
- Behaviour also affected: disruption of social dynamics, sleep, increased stress, foraging times



 Pets also at risk of being displaced during evacuations in extreme events

Many evacuation centres do not allow pets

Pet owners may delay evacuation action and increase own risk



## **Sport**

- Thoroughbreds: body temperature increases 1°C per minute of racing
- Greyhounds increase by over 2°C in less than 1 minute



#### **Useful references**

- Lacetera N (2019) Impact of climate change on animal health and welfare. Animal Frontiers 9(1): 26–31.
   <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6951873/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6951873/</a>
- https://vetpracticemag.com.au/globalwarming-rising-cost-australias-livestockindustries/
- https://kb.rspca.org.au/wpcontent/uploads/2020/05/Climate-Changeand-Animal-Welfare-RSPCA-Australia-Research-Report-May-2020.pdf



RESEARCH REPORT:
The impact of climate change on the welfare of animals in Australia

**APRIL 2020** 





GIGA-WHAT?
EXPLAINING
AUSTRALIA'S
RENEWABLE
ENERGY
TARGET

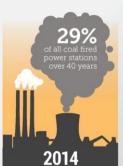


THE US-CHINA JOINT ANNOUNCEMENT ON CLIMATE CHANGE AND CLEAN ENERGY COOPERATION:
WHAT'S THE BIG DEAL?





BY 2030 65% OF AUSTRALIA'S
COAL-FIRED POWER STATIONS WILL
BE OVER 40 YEARS OLD



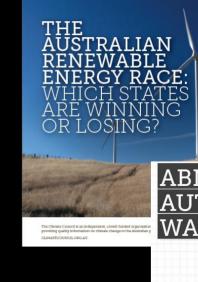




climatecouncil



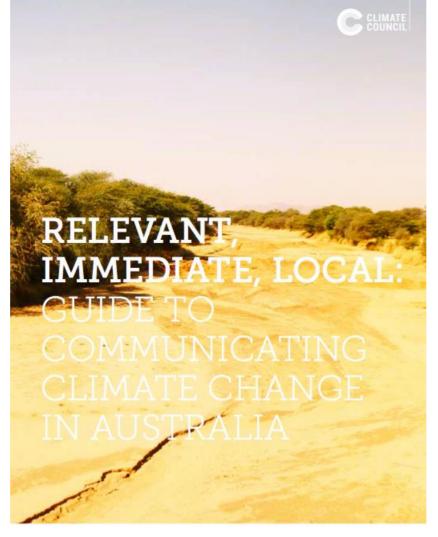
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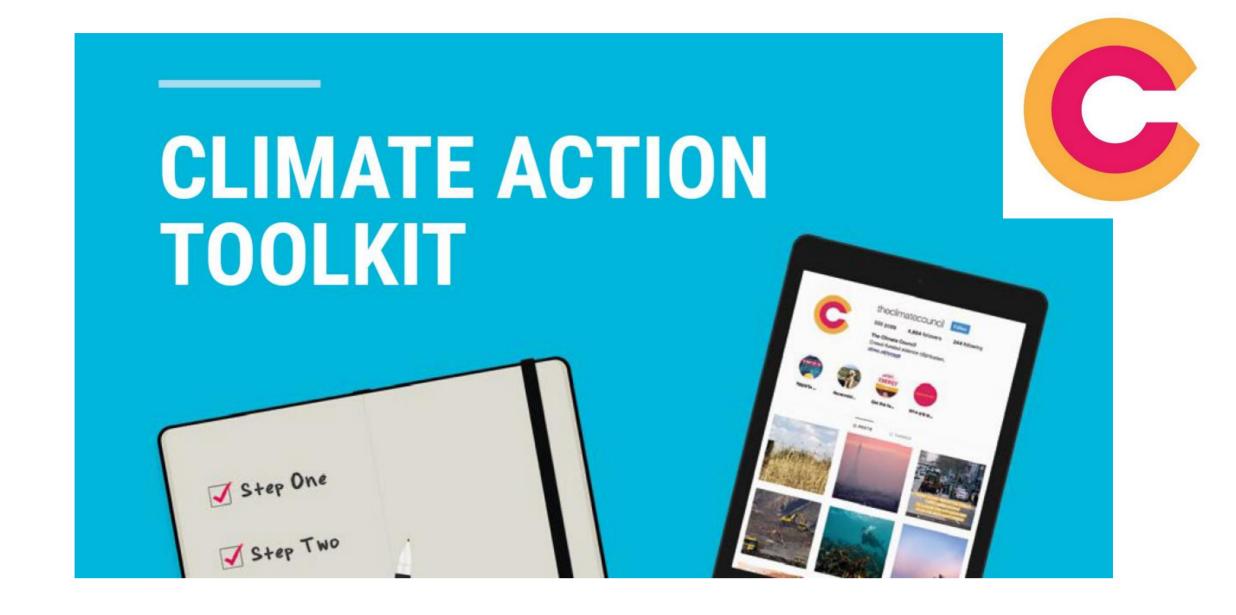
ABNORMAL
AUTUMN
WARMING
Hottest two year period on
Hottest two year period on
Feored (March 2012-April 2014)
Feored (March 2014-April 2014-April 2014)
Feored (March 2014-April 2014-April 2014)
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www.climatecouncil.org.au www.facebook.com/climatecouncil



The Climate Council is an independent, crowd-funded organisation providing quality information on climate change to the Australian public.

https://www.climatecouncil.org.au/resources/relevant-immediate-local-guide-to-communicating-climate-change-in-australia/



https://www.climatecouncil.org.au/actions/download-your-climate-action-toolkit/