

Climate and Communi-es: Adap-ng to the new normal

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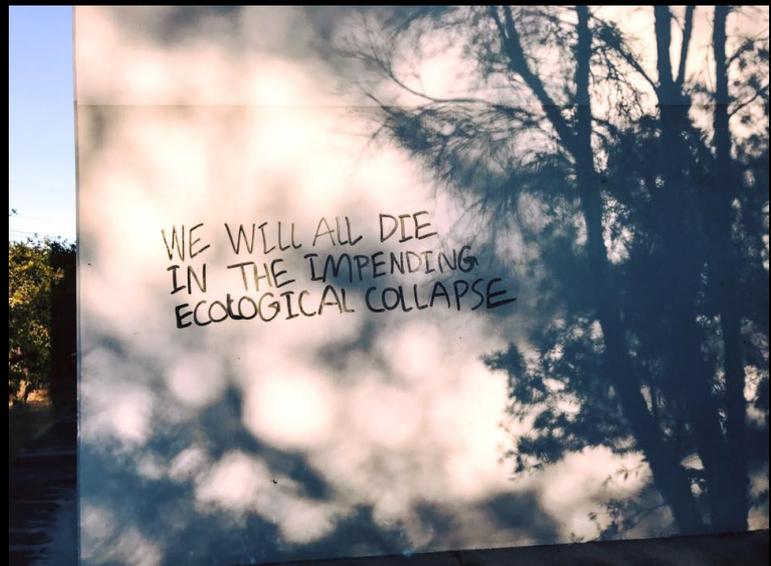
Twitter@hilarybambrick



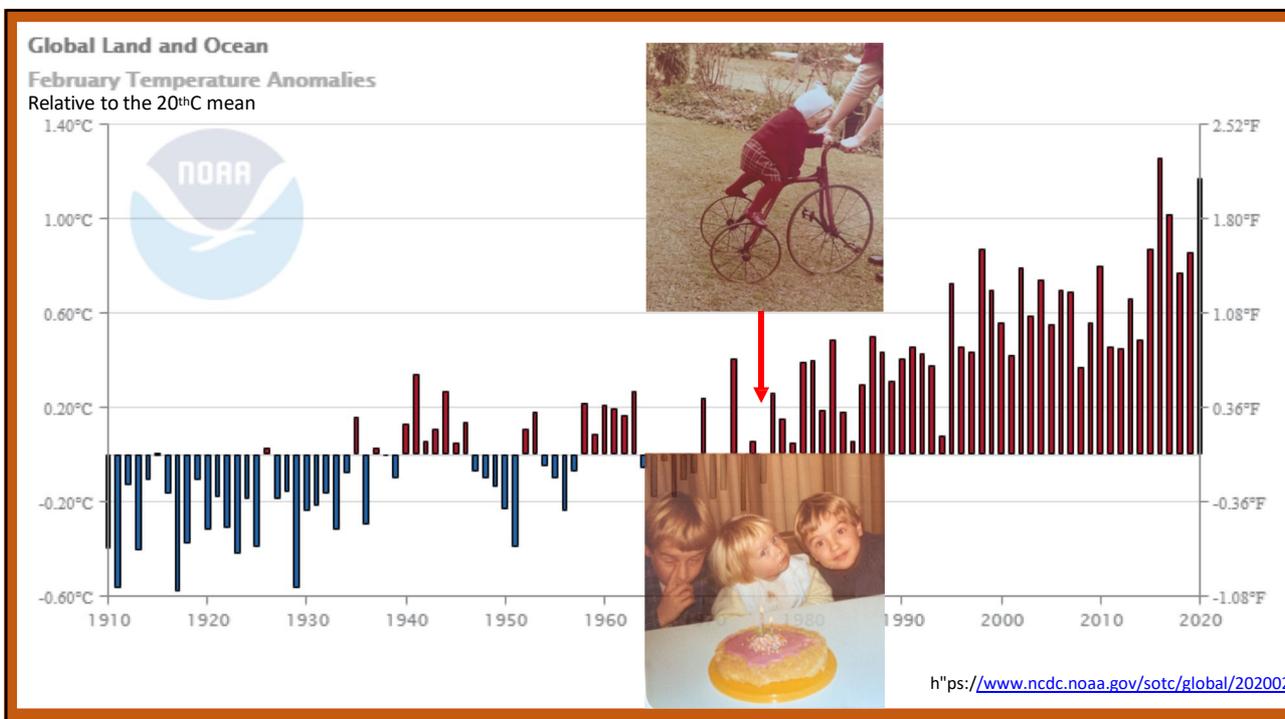
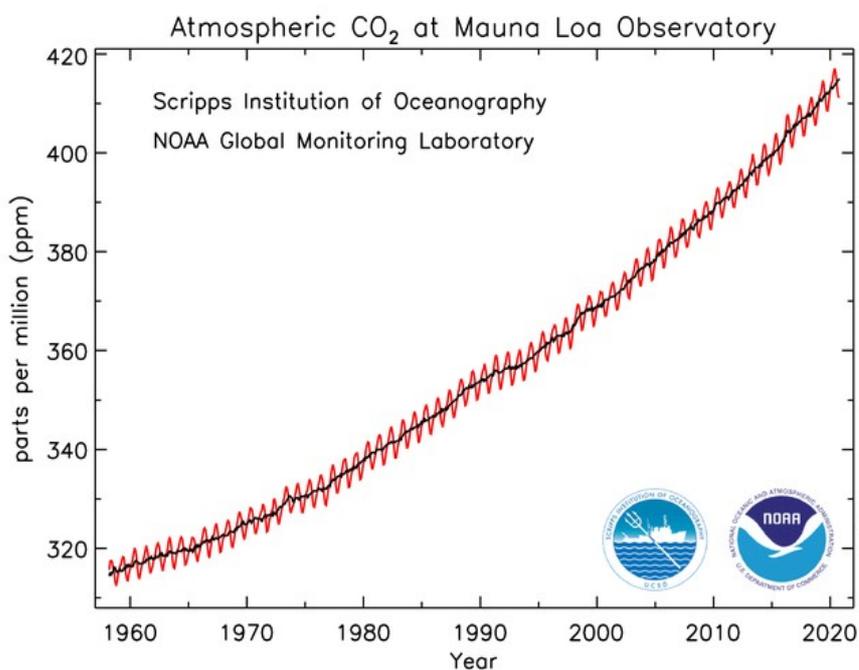
Is there a new normal?

- What climate change looks like, now and in the future
 - Global and Australian trends and events
 - Impacts on health and communities

Can we adapt?

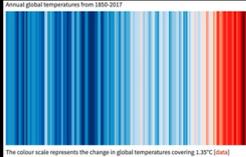


- Trends in atmospheric CO₂
 - Not the only GHG
- Methane
 - more potent
 - shorter lived

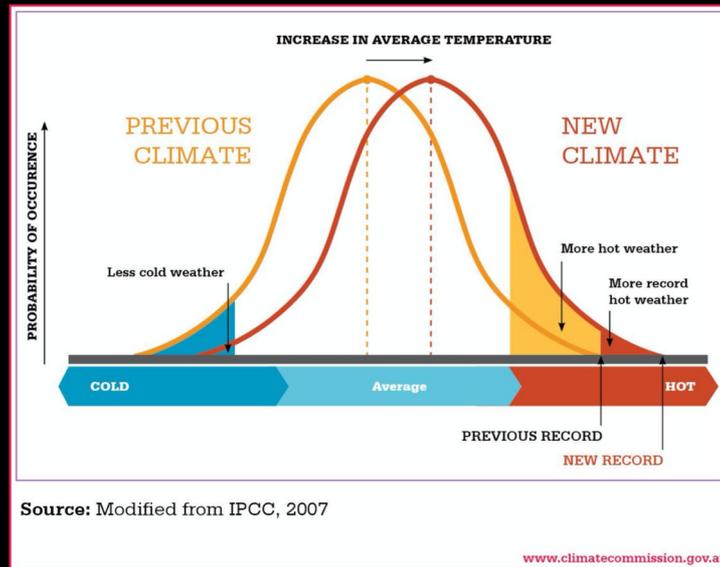
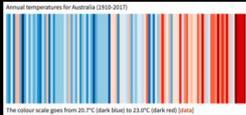


Temperature trends

>1°C increase
in global
mean since
1900



>1.44°C for
Australia



Changes both
averages &
extremes

- Increasing temperatures
- More variable rainfall

Increasing frequency, duration and intensity of extreme events

- Extreme heat waves
- Extended droughts
- Catastrophic bushfires
- Severe storms and cyclones
- Sea level rise and storm surges

**More
energy in
the system**

Changed seasons

Changed geographical distribution

Breaking records - repeatedly



Some recent notable heat events

- **'Middle East heat dome'**, Bandar Mahshahr, Iran, July-August 2015: 50°C + high humidity = 'feels like' temperature of 74°C (heat index)
- US **'year without winter'** 2015-2016: Dec-Feb 5°C above 20thC average
- Australia's **'endless summer'** October 2015 to May 2016. Early March was 12°C above average in the southeast. Hottest April day on record for Sydney, at 34°C (mid-autumn)
- Unprecedented **heatwave duration** in Moree, NSW, February 2017. Over 50 consecutive days above 35°C. Previous record was 19, in 1957.
- **'Lucifer'**, Mediterranean August 2017, 40-45 °C, sea temperatures above 30 °C
- Record 47.3°C in Penrith, NSW, January 2018
- Temperatures 30°C above average in the Arctic, January 2018

2016: Cyclone Winston, Pacific Islands



August 2017

- Deadly monsoon in India, Nepal and Bangladesh: ~1200 dead
- Hurricane Harvey, Texas: 127cm rainfall (up to 15cm/hr): ~50 dead

What would 9 trillion gallons of water look like?

As of noon on Aug. 27, about 9 trillion gallons of rain had already fallen across the greater Houston area and Southeast Texas.



Source: Capital Weather Gang; Google Street View

THE WASHINGTON POST

California wildfires 2019 ... and 'gigafires' in 2020



Situation in Oct 2019

Power cut to 10s of '000s in anticipation of catastrophic fire weather

Northern Los Angeles: 100,000 evacuated



<https://www.abcnews.com/news/ires-in-california-saddled-jac-wildfire-ex-...-noting-mandatory-evacuations-amid-power-out-...-11/>

<https://www.theguardian.com/us-news/2019/oct/22/california-fire-evacuations> >ons-live-latest-news-power-outages-today

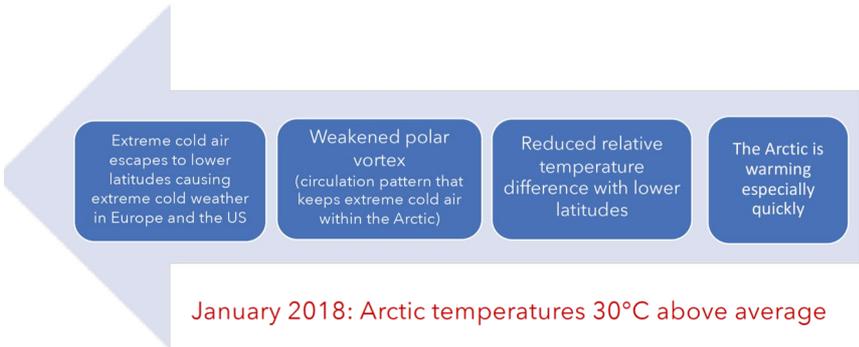
But what about the record cold?

Arctic warming: scientists alarmed by 'crazy' temperature rises

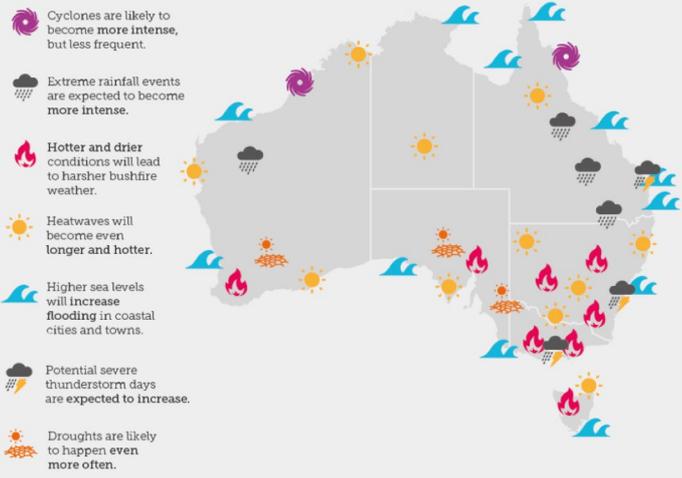
Record warmth in the Arctic this month could yet prove to be a freak occurrence, but experts warn the warming event is unprecedented



▲ This is an anomaly among anomalies; temperatures in parts of the Arctic have recently risen well above average
Photograph: Ralph Lee Hopkins/National Geographic/Getty Creative/Getty Images



HOW WILL CLIMATE CHANGE AFFECT AUSTRALIA?



Cyclones are likely to become **more intense**, but less frequent.

Extreme rainfall events are expected to become **more intense**.

Hotter and drier conditions will lead to harsher bushfire weather.

Heatwaves will become even **longer and hotter**.

Higher sea levels will increase **flooding** in coastal cities and towns.

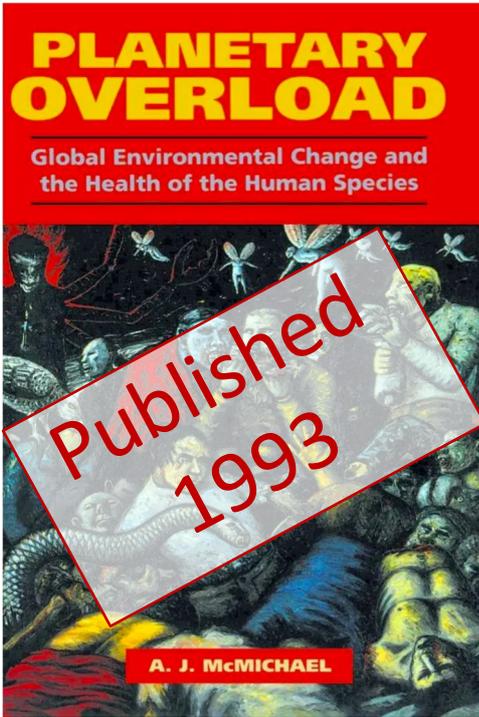
Potential severe thunderstorm days are expected to **increase**.

Droughts are likely to happen **even more often**.

CLIMATE COUNCIL.ORG.AU

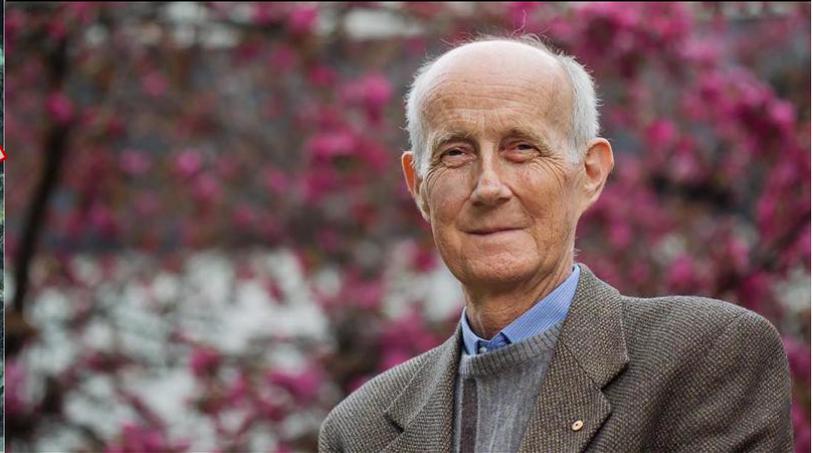
crowd-funded science information

We humans have so fundamentally altered the Earth's life support system that we are now in the **Anthropocene**



Tony McMichael

Environmental epidemiologist and pioneer in linking climate change to human health



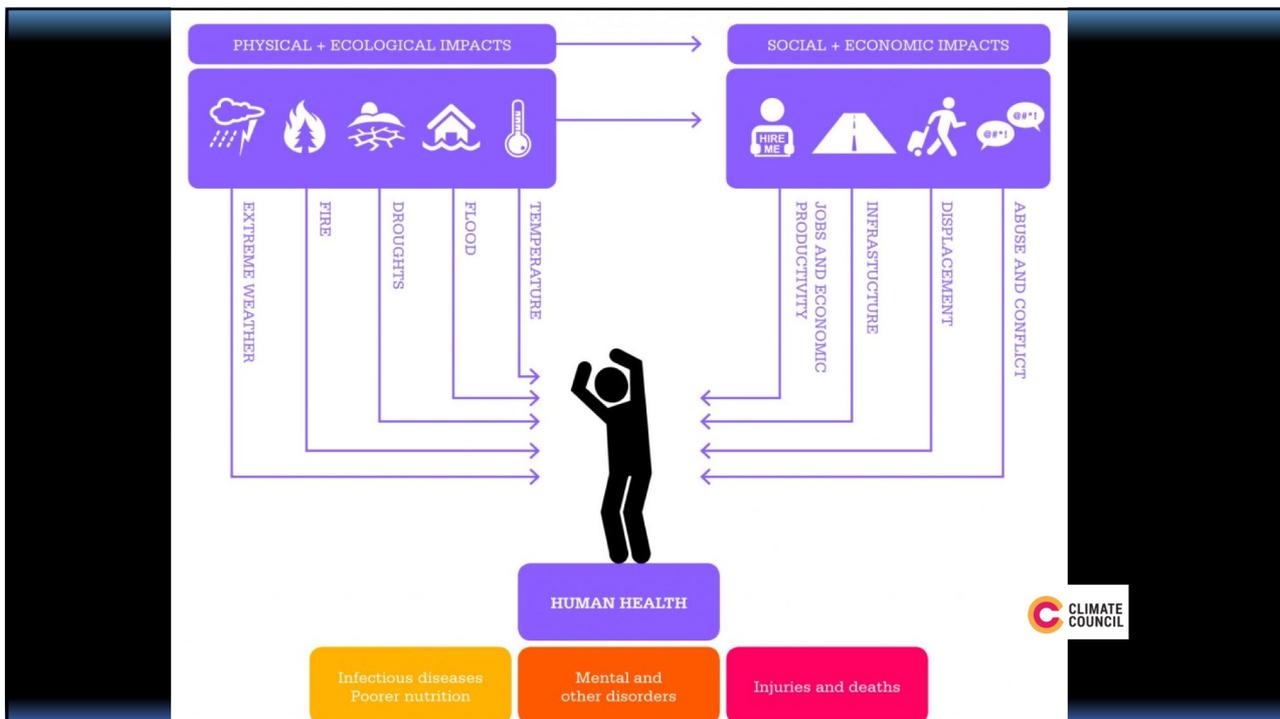
Direct (primary):

- Extreme heat
- Bushfires
- Severe storms

Less direct (secondary and tertiary):

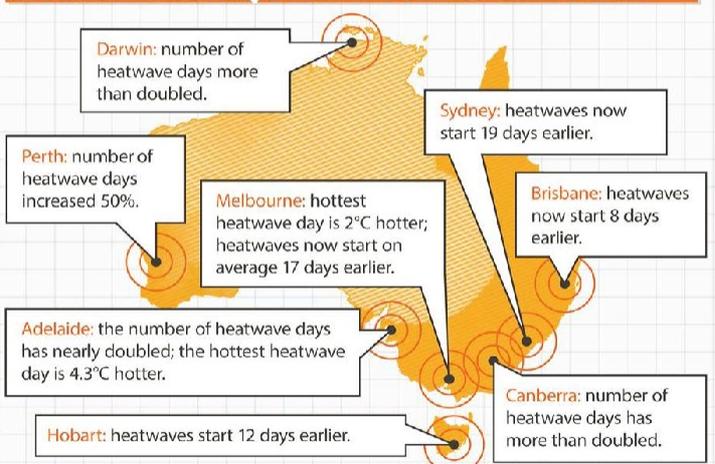
- Vector-borne disease (dengue, RRV, etc)
- Respiratory disease (asthma & allergy)
- Gastroenteric disease (food- and water-borne)
- Mental health (depression, suicide)
- Obesity and chronic disease
- Food security





Extreme heat is increasing

AUSTRALIA'S CAPITAL CITIES ARE EXPERIENCING HOTTER, LONGER, MORE FREQUENT HEATWAVES.



Compares heatwaves between 1950-1980 and 1981-2011. Source: Data from Perkins and Alexander 2013

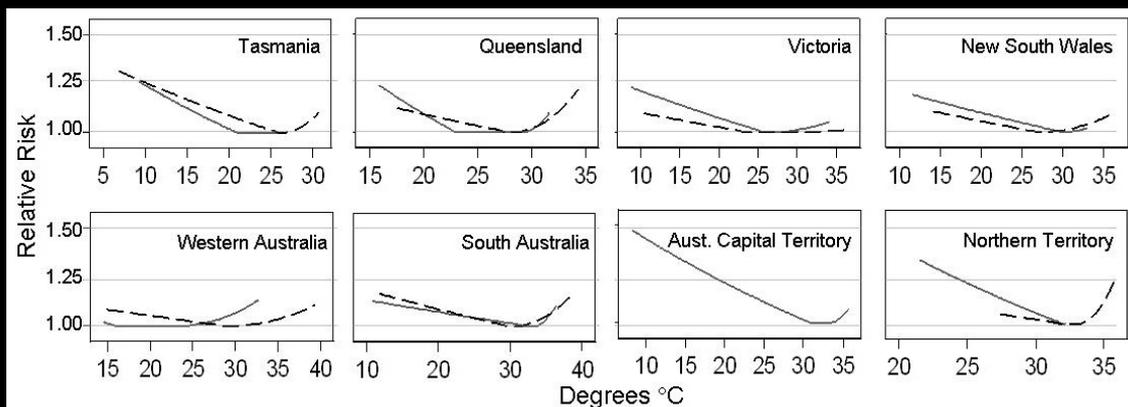
Not everyone is equally affected

- Older
- Indigenous
- Homeless
- Migrant
- Socially isolated
- Chronically ill
- Less mobile
- Highly dependent
- Low income
- Outdoor workers
- Emergency service workers

Risks also vary by location:

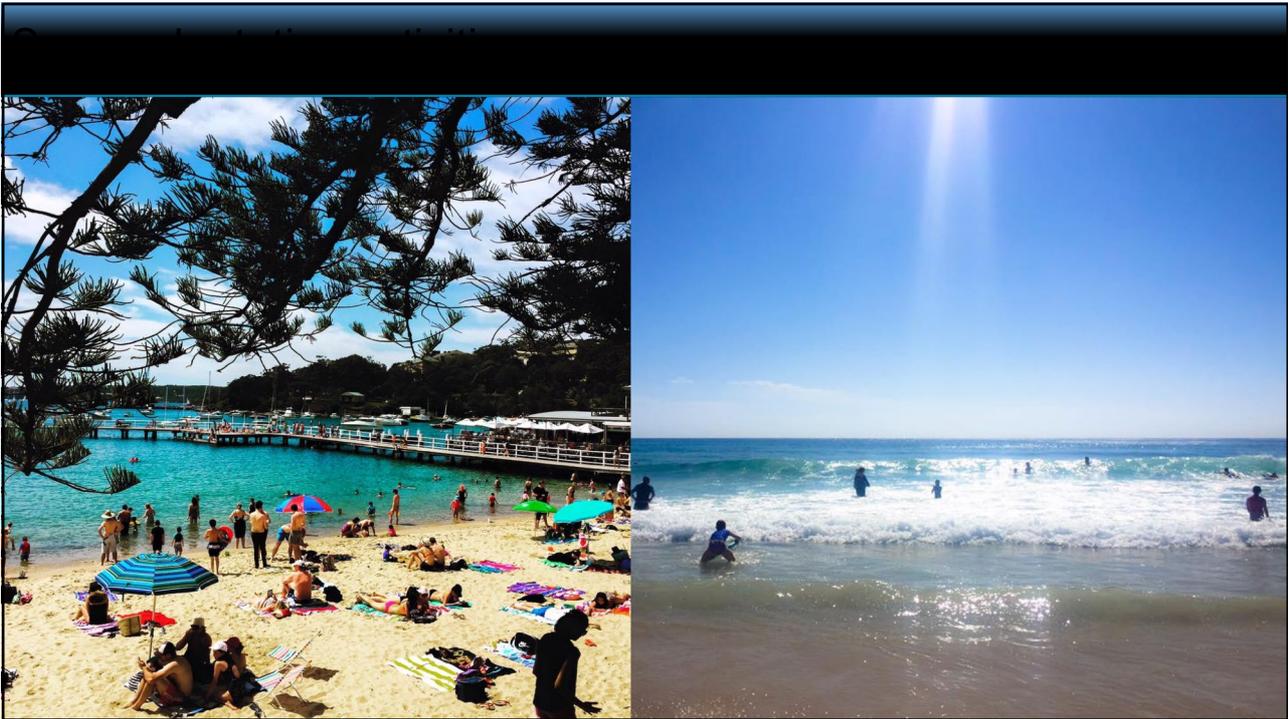
- Urban
- Rural
- Remote
- Coastal

Relationship between temperature and mortality



Relationships between maximum daily temperature and all-cause mortality calculated as relative risk across different Australian states. Solid lines represent state capitals, dashed lines are for the rest of each state. Relative risk of dying at any given daily maximum temperature varies across different states of Australia. Bambrick et al 2008.

... some level of physiological, behavioural and structural adaptation



2009: Extreme heat, Melbourne Victoria

January

- 48.8°C highest state max
- Records broken for number of days, highest max and highest min
- Melbourne: Reached 45.1°C, with 3 consecutive days over 43°C
 - Power outages and low voltage (increased load)
 - Evacuations
 - Transport shutdown
 - Heat buckled railway tracks
 - Loss of power for light rail
 - Air-conditioning failure
 - Lift rescues
 - Sporting events cancelled
 - Thousands treated by paramedics and in hospital
 - > 200 deaths; 45% increase
 - Morgues filled 'to capacity', temporary storage of bodies

Estimated cost: \$100 million

2009: Black Saturday bushfires, Victoria

7 February

- Followed January's extreme heatwave
- Australia's worst bushfire disaster with 173 killed, 414 injured
- >3500 structures, including >2000 homes destroyed
- 7562 people displaced
- Extreme fire danger conditions had been forecast and firefighters were deployed
- Winds 100km/hour; Melbourne reached 46.4°C
- Most people who died were inside their houses
- Power blackout for 60,000 people
- Estimated cost: \$4.5 billion



- Other impacts: 12,000 livestock, food crops, animal feed, national parks and reserves, cultural sites, communication infrastructure

2009: dengue outbreak, Far North Queensland

- Average around 200 cases per year during summer
- 1200 cases in 2008-2009 summer
- \$? Cost
 - Lost productivity, tourism, health service use, medication, surveillance and control
- Broader impacts
 - Reduced the national supply of donated blood as donations from the outbreak region (two major cities) were put on hold
- Fueled by climate adaptation?
 - Domestic water tanks

The Millennium Drought: Australia

- 1995-2012: worst on record
- Rainfall around 60% below average
- Decreased agricultural areas
- Reduced food crops and livestock
 - Broader impacts on communities, rural mental health: depression and suicide; food availability and prices
- \$4.5 billion provided in drought assistance
- Permanent water restrictions and alternative water sources sought to 'drought-proof' cities
 - Recycling, desalination
- Expected ongoing decrease in rainfall in the south-east make drought more normal than not

2011: Floods, Queensland

- Dec 2010-Jan 2011: Evacuations and preparations, dam management
- 10 January: 3 days of heavy rain --> sudden surge of 7m floodwater: "inland tsunami" hit the town of Grantham
- 38 people died
- 75% of local councils declared disaster zones
- 90 towns and 200,000 people affected
- Transport cut
- Food price increase
- Estimated direct cost \$2.4 billion
- Reduced national GDP \$40 billion
- Recovery costs included in a national income tax levy



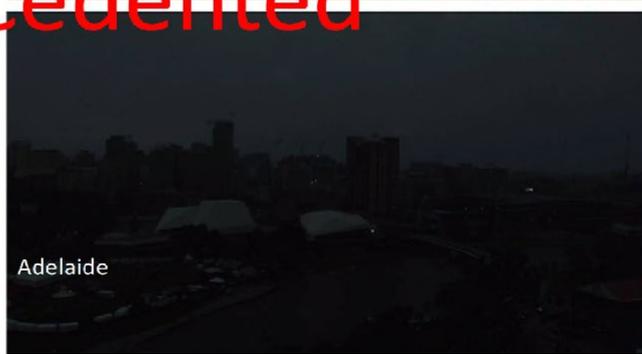
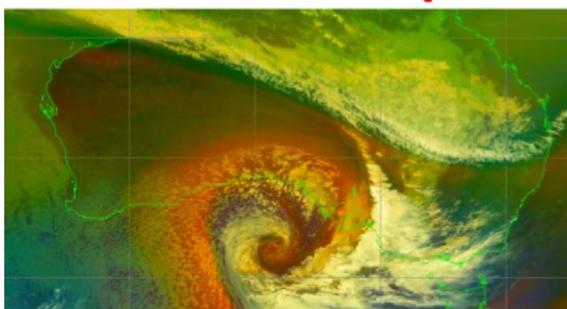
2016: Severe Storms, South Australia

28 September

“Unremarkable...just a storm”:
Deputy PM Barnaby Joyce

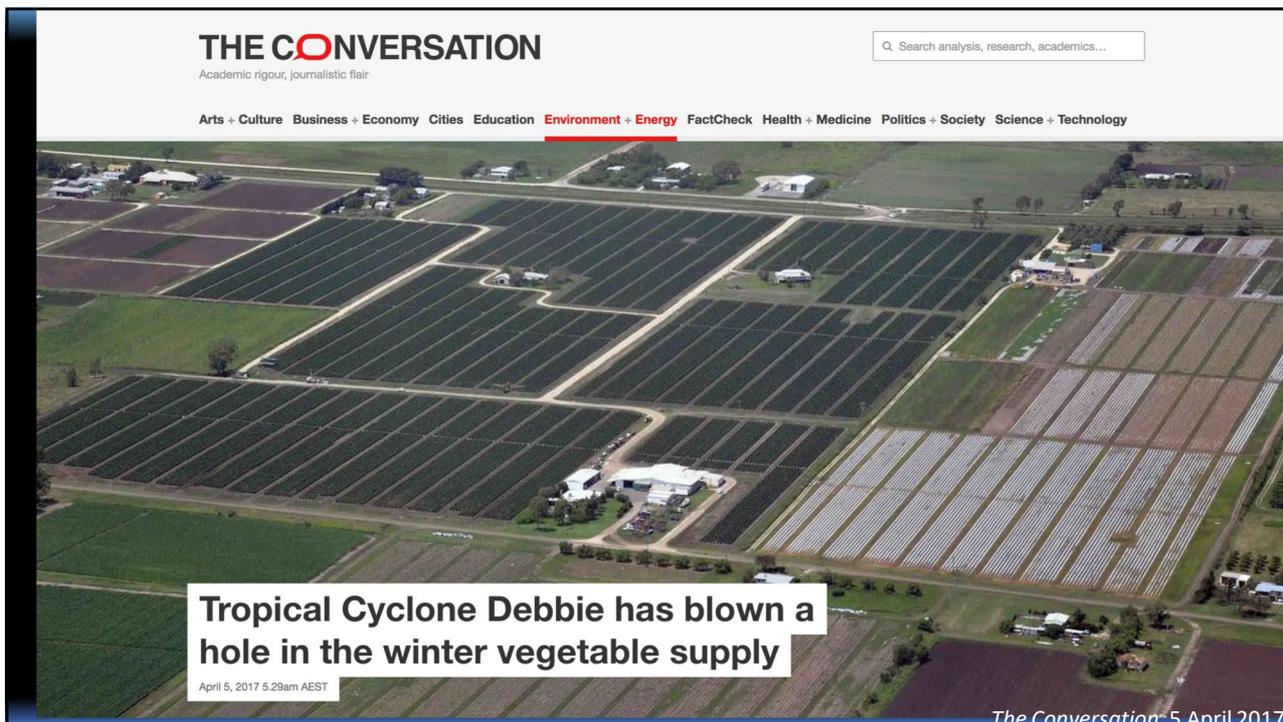
“Unprecedented” weather event:
140km winds

Unprecedented



Ex-Tropical
Cyclone Debbie,
Brisbane,
Thursday 30
March 2017





Australia's black summer bushfires 2019-2020



On arrival at Canberra Airport, 17 December 2019. Photo: Hilary Bambrick

22 APR 2015 - 10:43AM

Australians Recovering From Their Fifteenth 'Once In A Lifetime' Disaster.





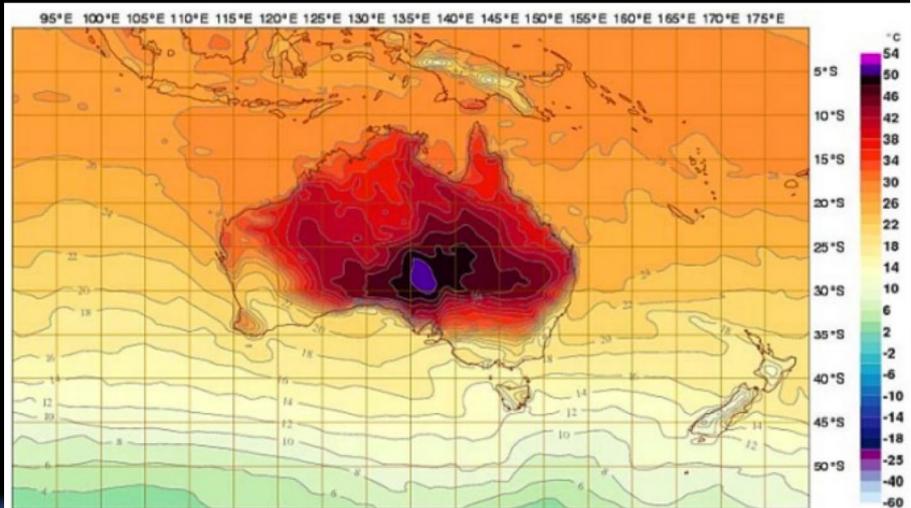
QUEENSLAND FIRE & EMERGENCY SERVICES
THU MAR 30 18:52:28 EST 2017

PHOTO
A bull shark washed up in Ayr

Authorities have warned people not to swim in floodwaters.

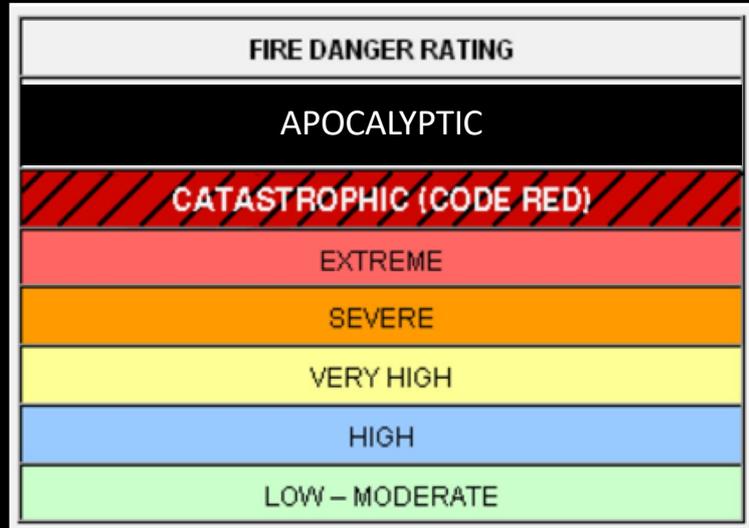
The way we represent risk has already had to change

In 2013, two new colours were added to Australian weather maps to be able to show where temperatures exceed 50°C

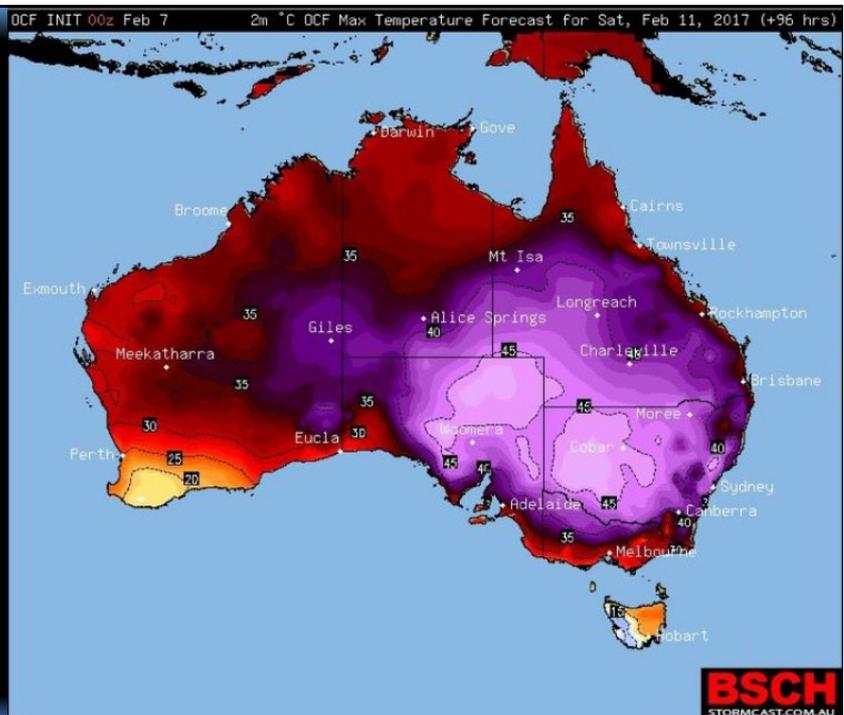


Following the 2009 Victorian bushfires, "Catastrophic" rating added to Australia's system of fire danger ratings

...what next?



Forecast map for Australia, Saturday 11 February 2017



NSW,
February
2017:

'As bad
as it gets'

Records broken across NSW

48°C

"If you are caught out in the open,
under these sorts of conditions, you
are likely to die"

Shane Fitzsimmons, Rural Fire Service
Commissioner, 11 Feb 2017

in city above 35°
(previous record
was nine days)

0°

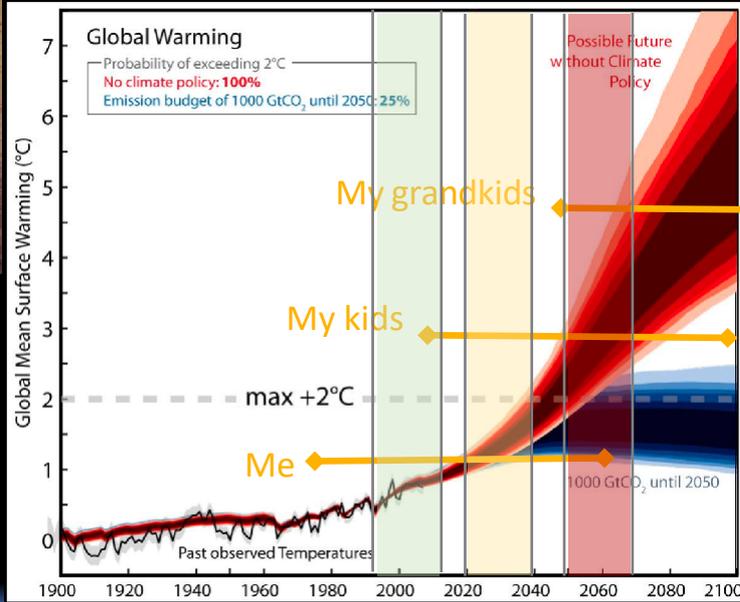
SOURCE: BOM.GOV.AU

Is this the "new normal"?

Peregian Beach, Sunshine Coast. Photo: Above Photography, 10 Sept 2019



Original image from Raper and Wrigley 2012
<http://www.cate.mmu.ac.uk/projects/assessment-of-greenhouse-gas-emission-pathways-for-climate-change-miBgaBon/> with additions of general context aDer Lesley Hughes, Macquarie University



Runaway climate change

If all pledges to reduce emissions are honoured, still heading for 3°C average warming

Paris agreement was to limit warming to 2°C, with aspiration to limit to 1.5°C

Evidence that some tipping points are being reached at lower average temperatures, between 1-2°C

- Ice sheet collapse – sea rise and reduced albedo (reflection)
- Changed ocean currents
- Methane release from melting permafrost

COMMENT · 27 NOVEMBER 2019 · CORRECTION 09 APRIL 2020

nature

Climate tipping points – too risky to bet against

The growing threat of abrupt and irreversible climate changes must compel political and economic action on emissions.

Timothy M. Lenton, Johan Rockström, Owen Gaffney, Stefan Rahmstorf, Katherine Richardson, Will Steffen & Hans Joachim Schellnhuber



An aeroplane flies over a glacier in the Wrangell St Elias National Park in Alaska. Credit: Frans Lanting/Nat Geo Image Collection

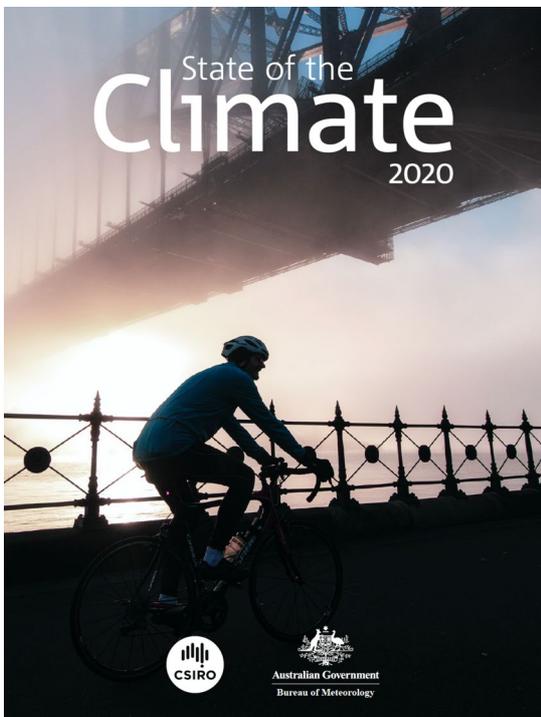
Adaptation? Yes, but...

Limits to how much we can adapt-
biophysical, economic, geographic

e.g. early warning systems; health
systems; care for family, friends,
neighbours; drought relief; flood relief;
bushfire relief

**Unsustainable tweaking
around the edges
No match for what is to
come**

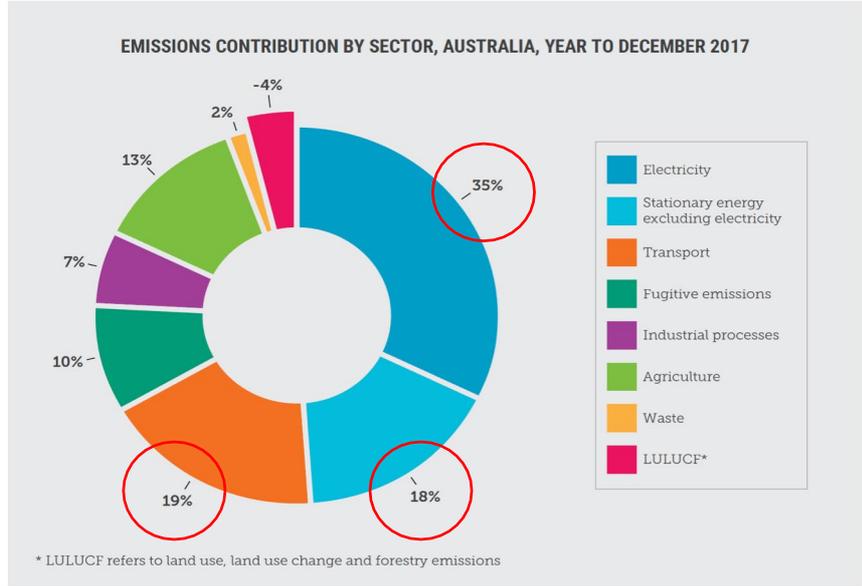
**Without urgent
emissions cuts, the
future looks not only
uninsurable, but
uninhabitable**



**“we think of this
decade being hot, but
this decade will be one
of the coolest in the
next hundred years”**

**-Dr Jaci Brown, CSIRO, 13 Nov
2020**

Figure 1: There are eight sectors that are responsible for Australia's greenhouse gas emissions. Note that the land use (LULUCF) sector was classified as a carbon sink in 2017. Due to uncertainties around the calculation of LULUCF emissions, it is not certain that the LULUCF sector actually constituted a carbon sink.



Source: Adapted from Australian Government (2018).

Where do Australia's emissions come from?

Contribution by sector

To have just a break-even, 50:50 chance of staying below 2°C of global warming, we must keep most of the world's fossil fuel reserves in the ground.



Carbon budget

Australia's emissions reduction policy

- 26%-28% by 2030
 - Relative to 2005
- Coal mining expansion in Queensland's Galilee Basin approved
 - to supply India
 - billion \$ subsidy
- 'Clean coal'
 - 20% reduction in emissions
 - Very expensive: twice the cost of wind and solar
- **Coal is increasingly unsellable**



Map from Waratah Coal <https://www.waratahcoal.com/galilee-coal-project-northern-export-facility-coal-project/>, accessed 2 Oct 2020.

Coal creates air pollution at every stage: mining, transport, burning

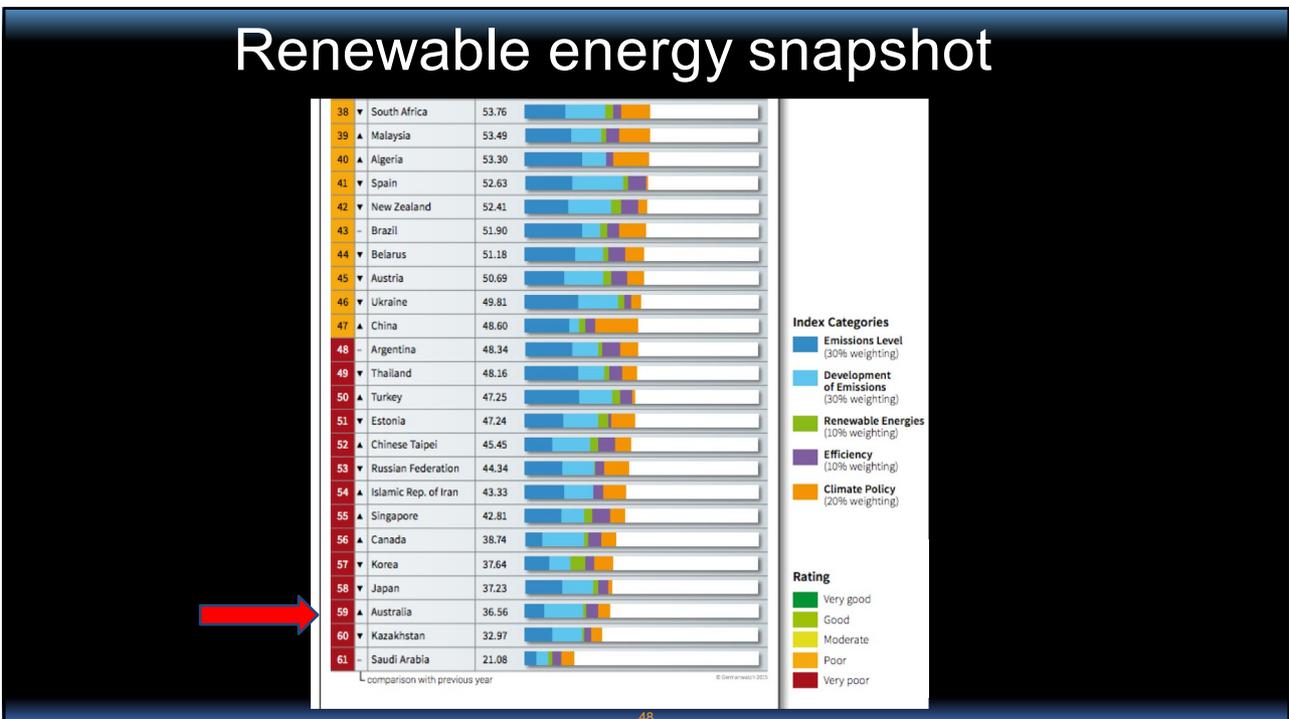
- Climate change drivers are themselves a health hazard
- 2014 Hazelwood coal mine fire: 45 days, 11 direct deaths, widespread symptoms
- Black lung disease: re-emergence in Australia, 25,000 deaths globally p.a.
- Air pollution in Australia: 3000 deaths per year, mostly particulates, mostly coal
- Hunter Valley: 42 million kg dust through transportation



Maisie likes fingerprinting.
Here is a self-portrait she did using the coal dust that covers her house.



Self-portrait by Maisie, aged 6.
Maisie lives in the Illawarra. Trains in the Illawarra pull uncovered coal trucks.
The dust blows all over Maisie's house.



What sort of society do we want to live in?

- Not only energy source, but how we organise ourselves
 - Urban planning
 - Transport
 - Social capital and cohesion
- A **just** transition
 - From mining jobs to renewable jobs

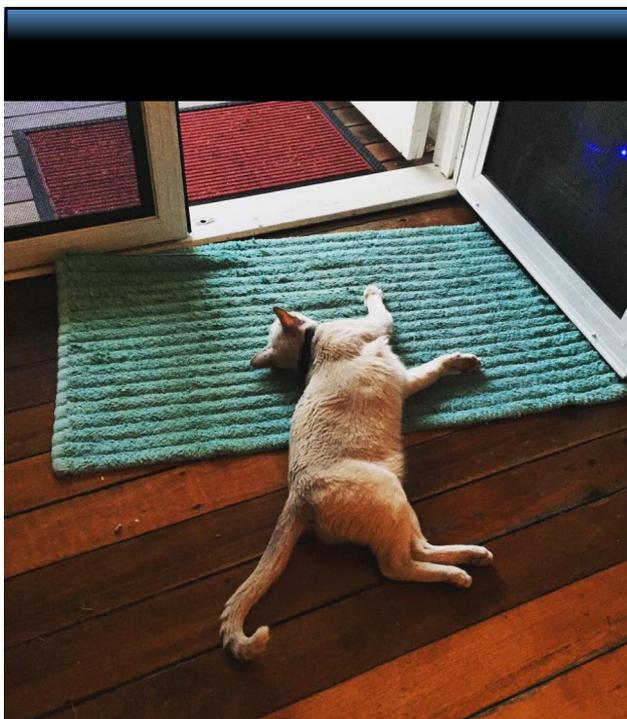


COAL VS WIND?

WHAT DO YOU CALL A BLIGHT ON THE LANDSCAPE?



- Many 'co-benefits' for climate change**
Benefits health (short-term and long-term) and mitigates climate change
- Immediate benefits for population health (cleaner air, decr obesity)
 - Decreased carbon emissions



Not just human health at risk from climate change

- Wildlife
- Companion animals
- Working animals
- Livestock
- Consideration needed in emergency planning and response, e.g. bushfires

Cultural and environmental loss

Mass coral bleaching: Australia's Great Barrier Reef



Loss of nations



The decisions we make today matter

A child born today in Australia is likely to live to the end of the century

No time to waste: 20 years and another half a degree of warming 'in the pipeline'

Who will make it happen?

- Elected officials and law makers
 - Sometimes, some places
 - Cities Power Partnership
- Power of civil society
 - NGO activities, e.g. info sharing
 - Fossil fuel divestment
 - Individuals: big banks
 - Institutions: universities
 - Civil disobedience
 - Rise of XR
- Courts



Australia's response to COVID-19: Parallels?

- Swift, decisive and based on evidence and expert opinion
- Required spending up front and rapid action seemingly at odds with ideology
 - Free child care
 - Eliminating poverty overnight
- Largely avoided (in Australia) a public health catastrophe (so far)

Shows government can enact changes in the public interest quickly – if they choose to

COVID recovery is a perfect opportunity to re-set our emissions trajectory

Chance to choose which industries to support

Opportunity to build a more equitable society and to boost investment in renewable energy

And yet...

Instead we're promised a 'gas led recovery'

