Climate Change 2020:
Why we are facing an emergency

Will Steffen
Emeritus Professor, Australian National University
Senior Fellow, Stockholm Resilience Centre

Australia, January 2020 – Start of a new decade

ABC News

Canberra, January 2020

Photo: Brook Mitchell/Stringer/Getty Images

Photo: Kelly-ann Oosterbeek/Facebook

Photo: ABC News: Jonathan Hair


Midday, Central Canberra, 5 Jan 2020
Photo: Chu Chen/Xinhua via Getty Images

Estimates of ~12 million ha burnt

33 people killed
Bushfire smoke responsible for 417 excess deaths

Nearly 3,000 dwellings and other structures destroyed

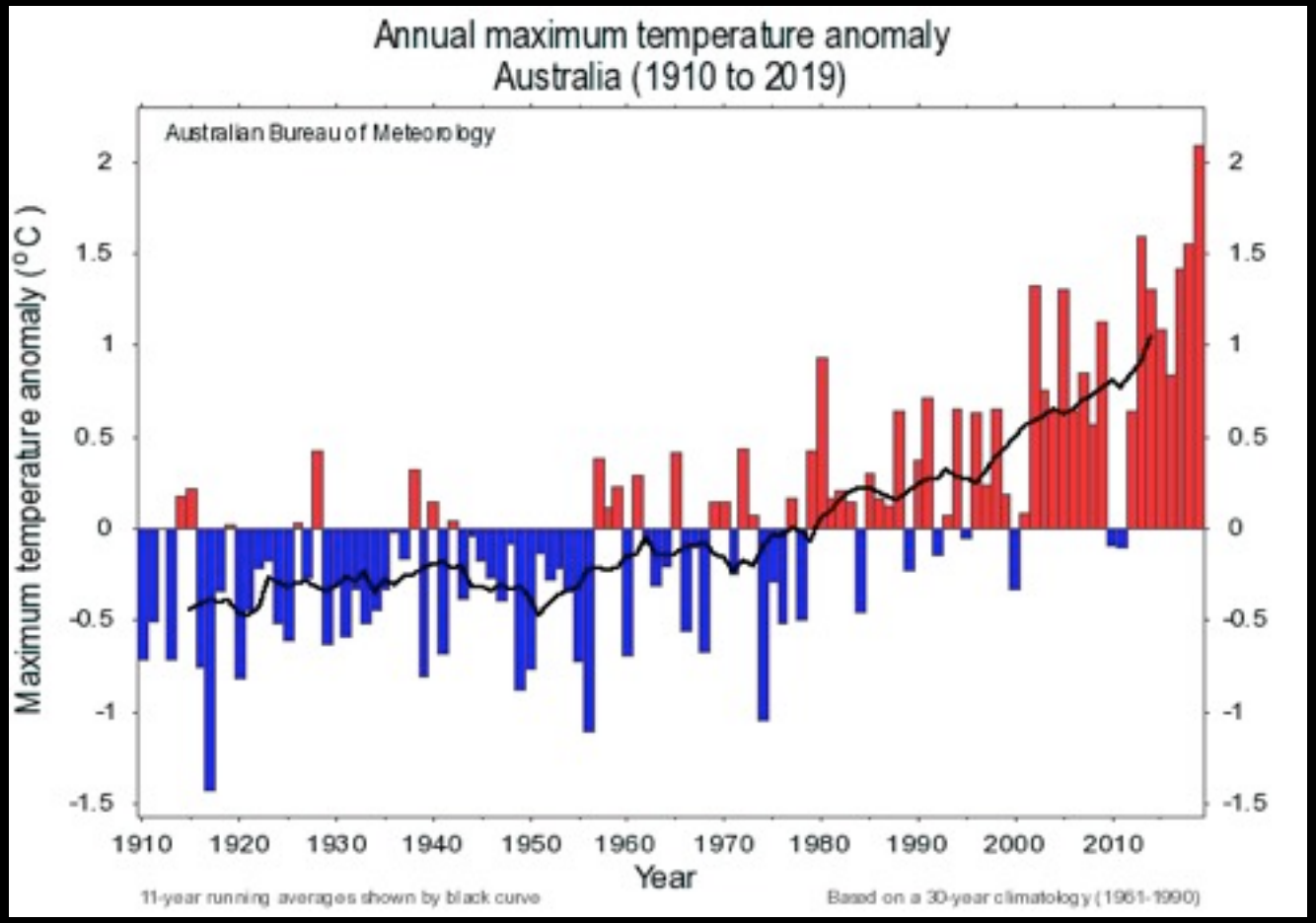
Several villages destroyed

About 1 billion animals (mammals, birds, reptiles) burnt to death

Fires doubled Australia's annual CO_2 emissions

Photo: Chu Chen/Xinhua via Getty Images

Climate Change and Australian Disasters



Source: Bureau of Meteorology 2020

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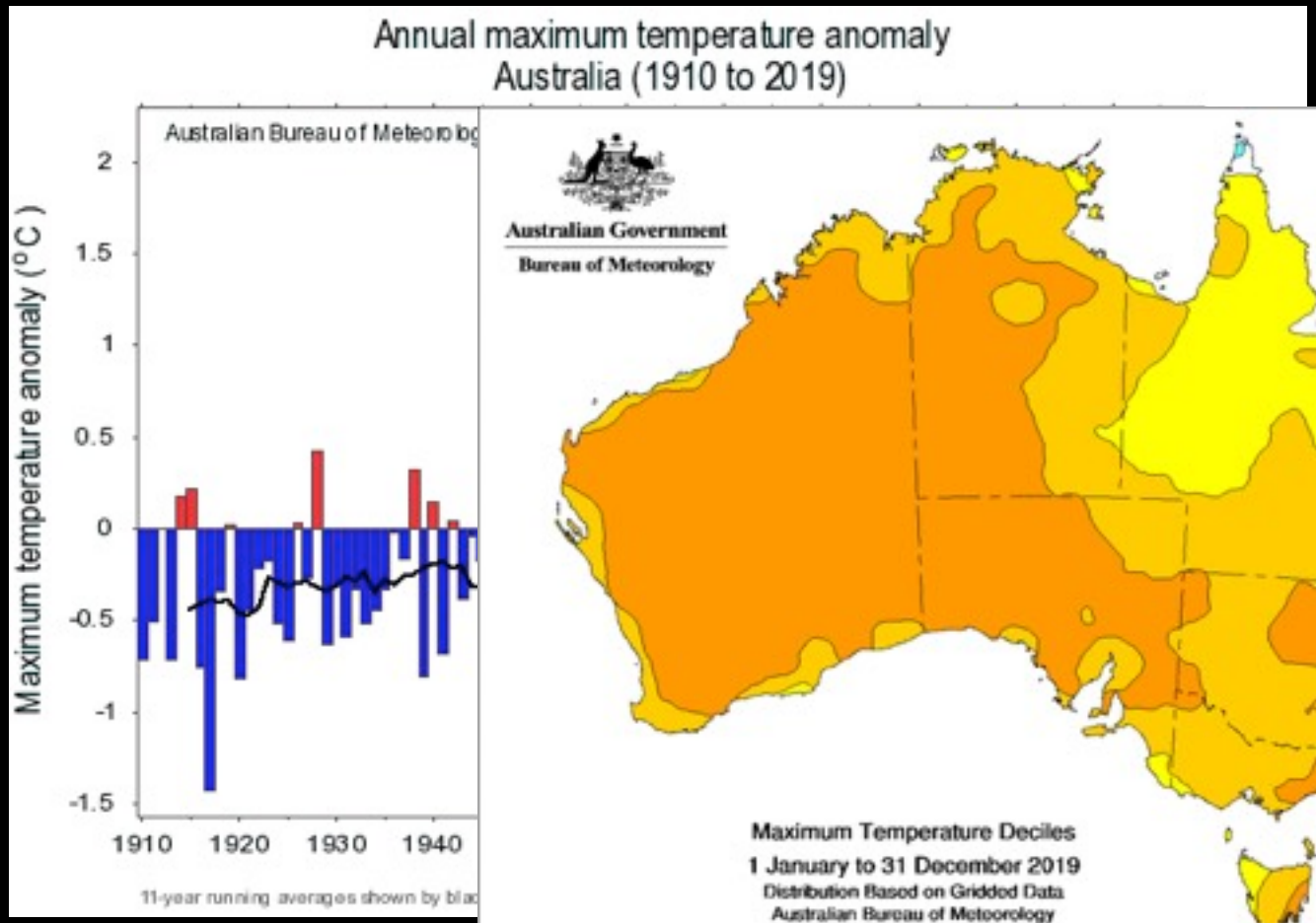

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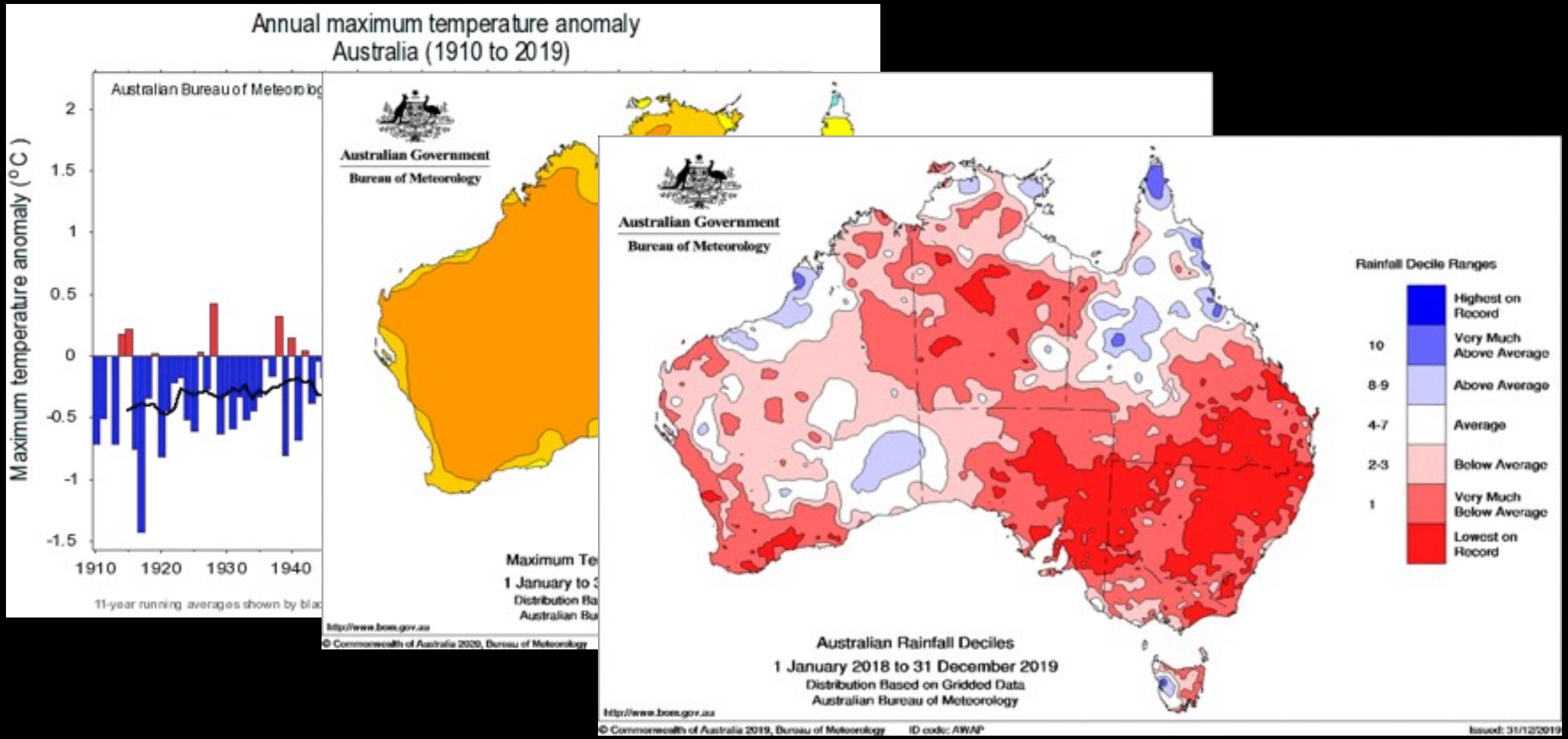

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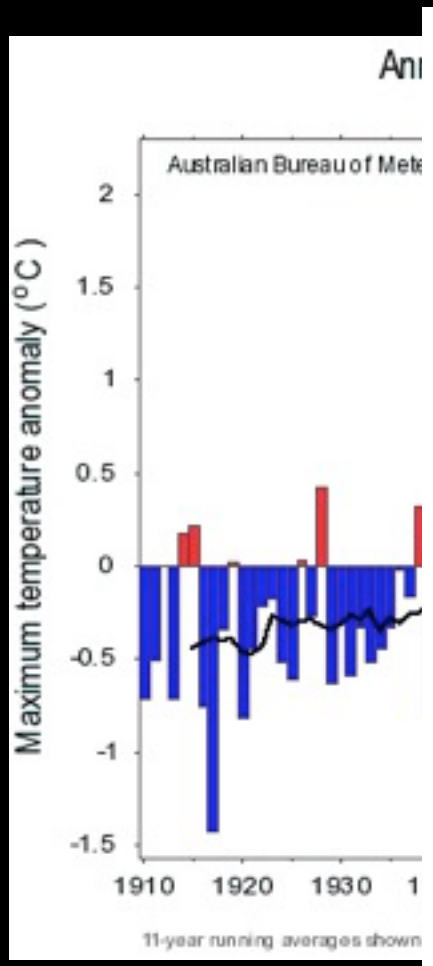
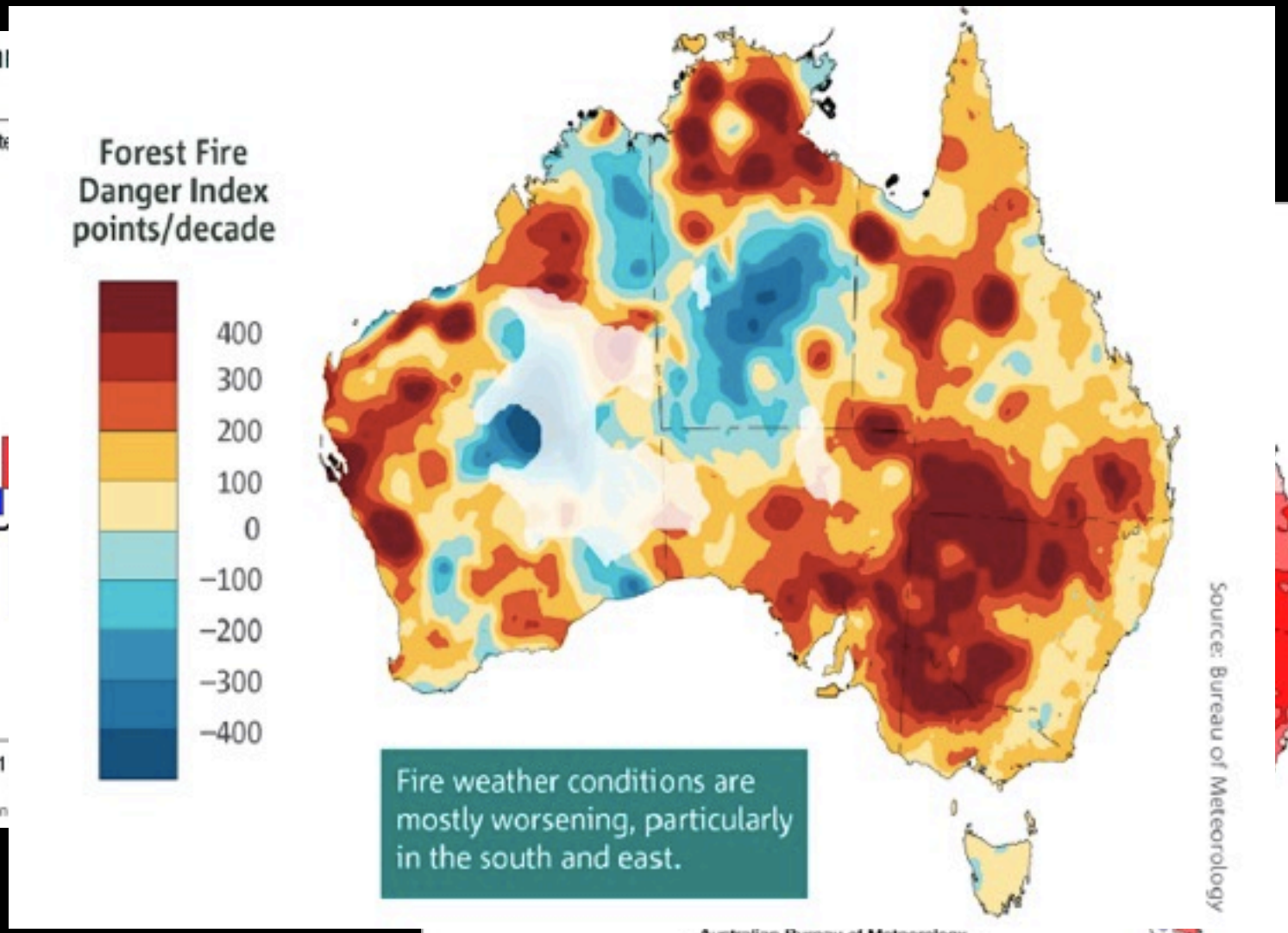
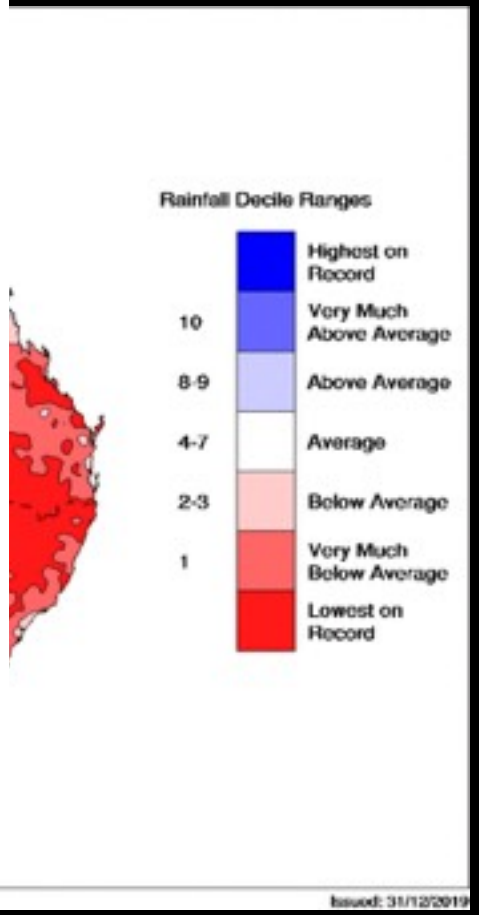






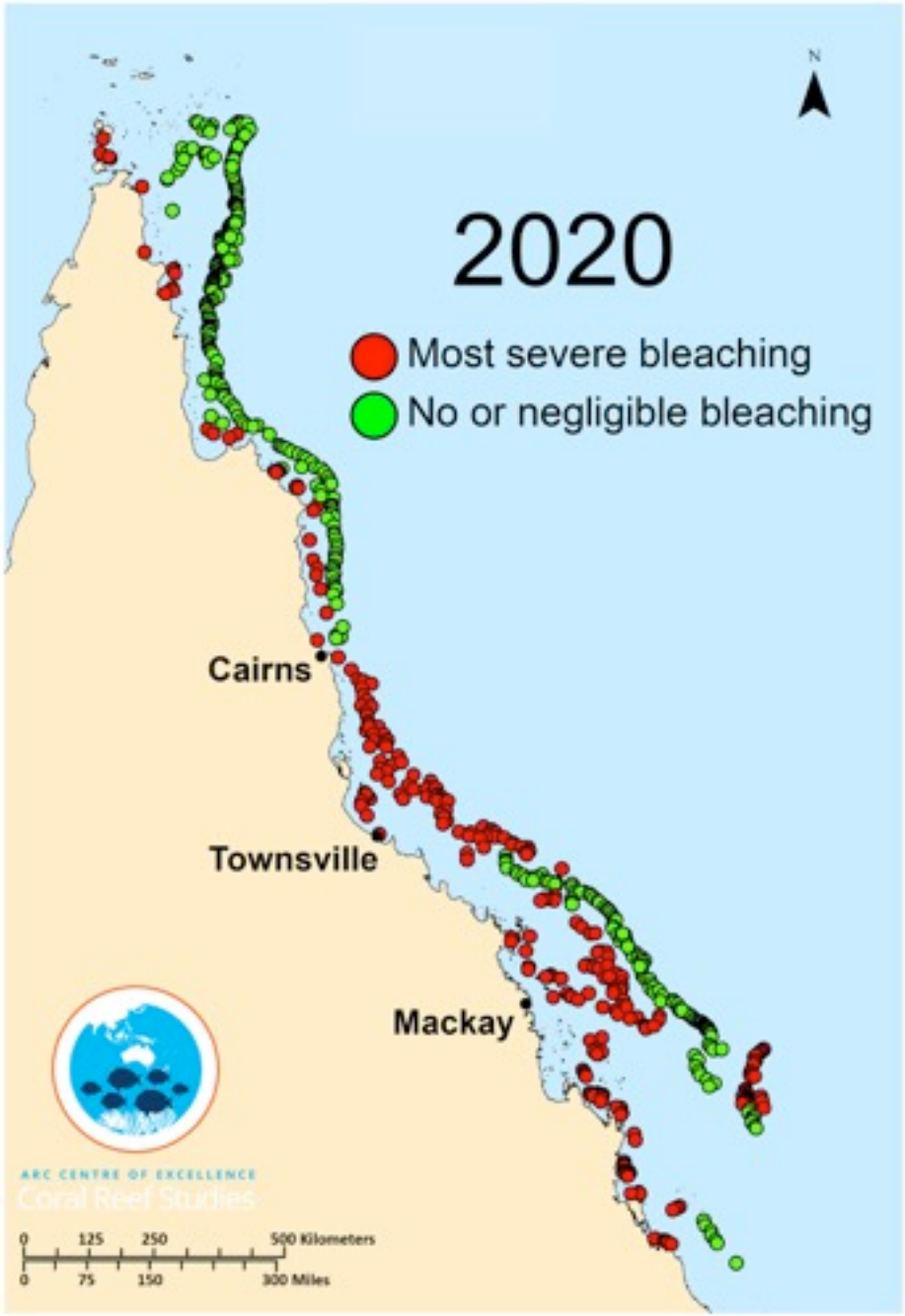
Source: Bureau of Meteorology 2020

Feb 2020: Highest monthly SSTs ever recorded on the GBR

For the first time, bleaching has occurred on all sections of the GBR, north to south

GBR has suffered mass bleaching events in 3 of the last 5 years: 2016, 2017, 2020

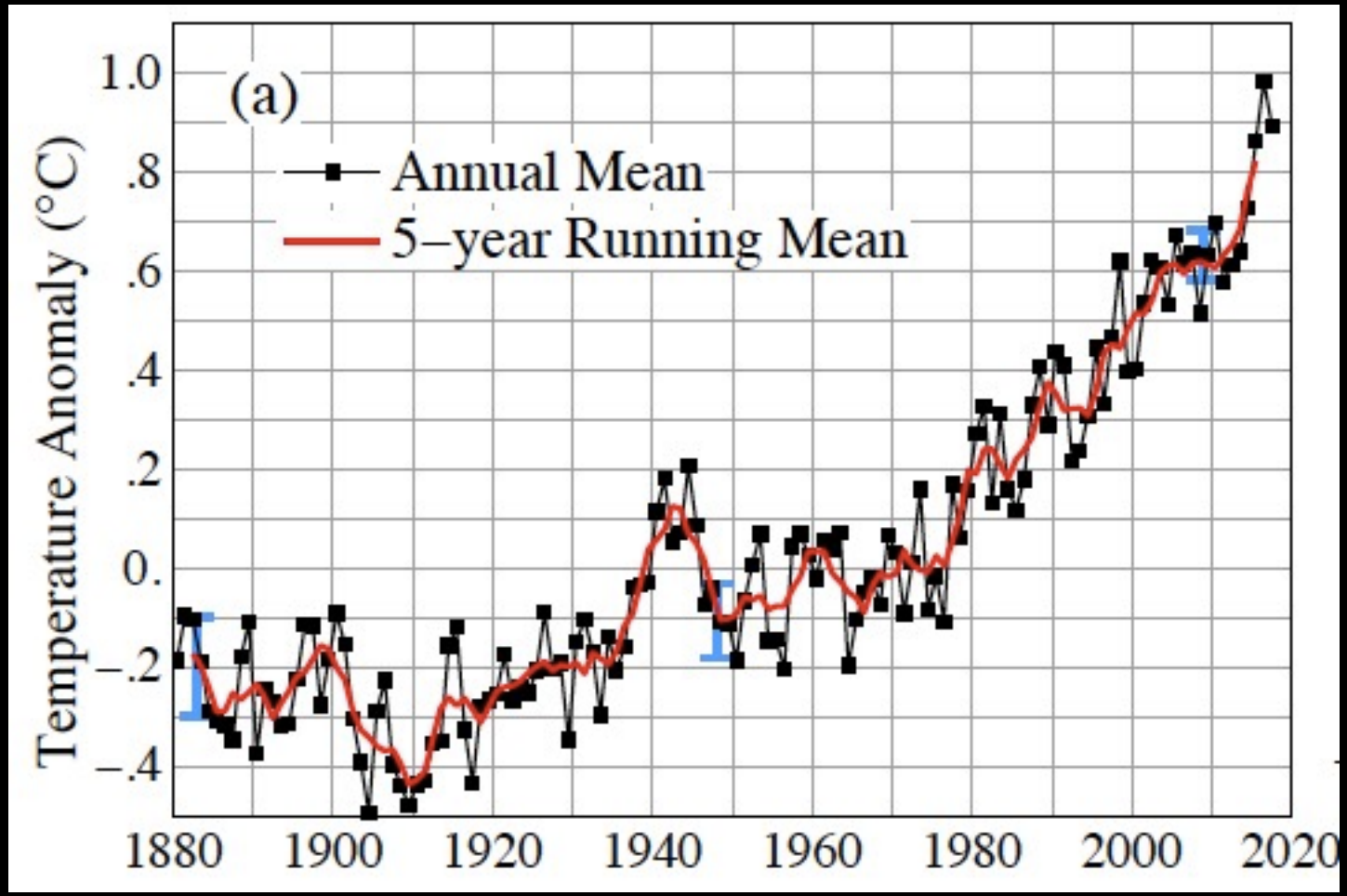
Gap between recurrent bleaching events is shrinking, hindering recovery



Source: ARC CoE Coral Reef Studies, Townsville

The climate is warming rapidly

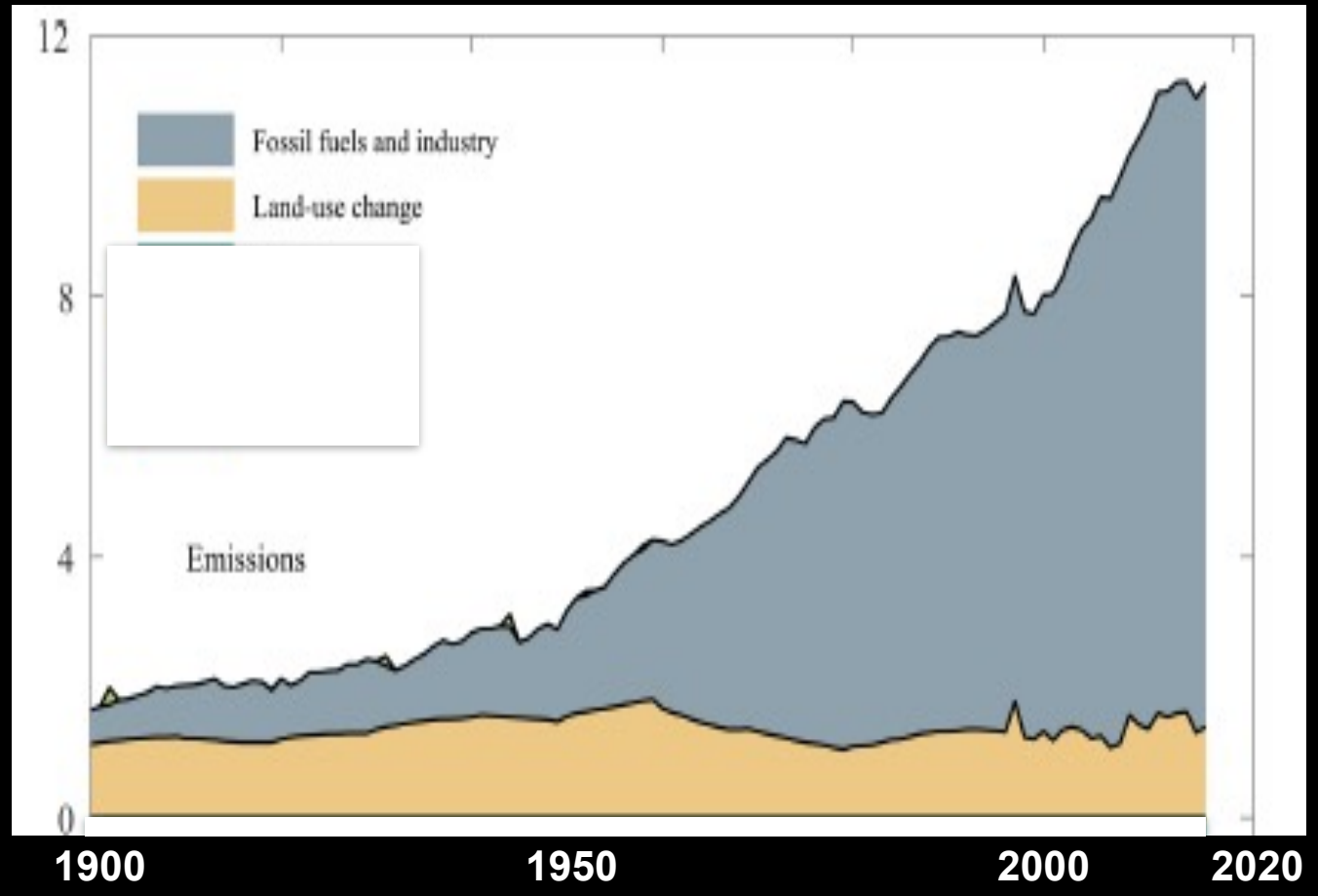
Global Average Temperature Anomaly, 1880-2017



Baseline is 1951-1980

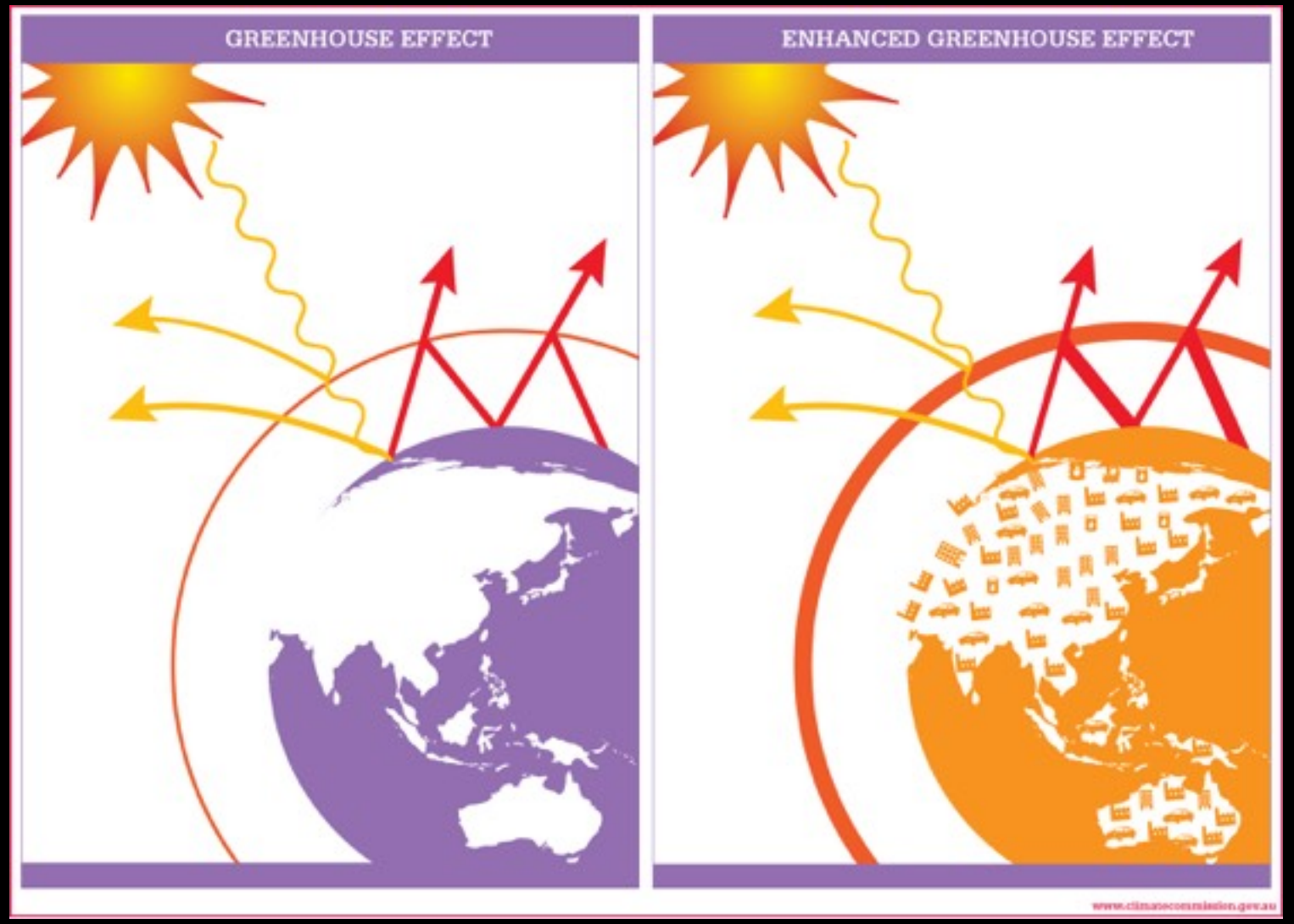
NASA 2018

Global Carbon Dioxide Emissions



Source: Le Quere et al. 2018

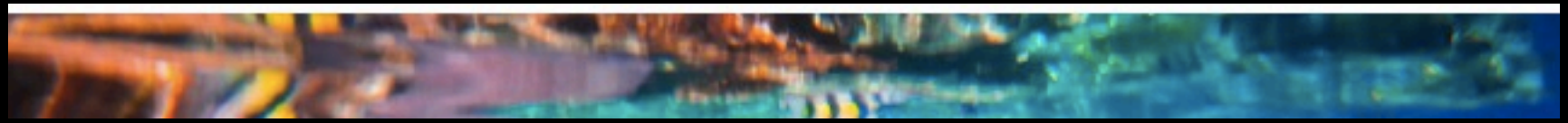
Enhanced Greenhouse Effect



Nature’s Dangerous Decline

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019

Nature’s Dangerous Decline



Nature is declining globally at rates unprecedented In human history

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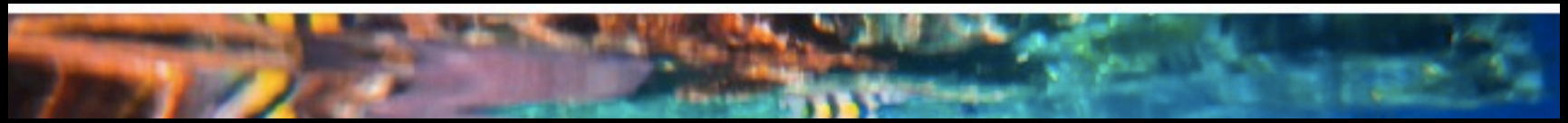

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Around 1 million animal and plant species are now threatened with extinction, many within decades.

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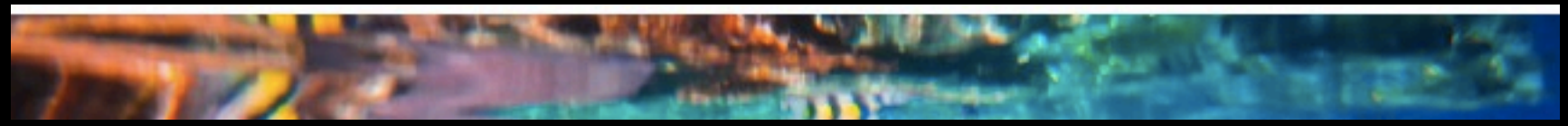

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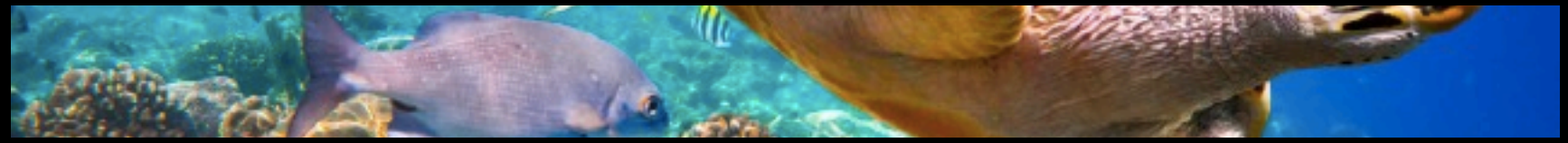
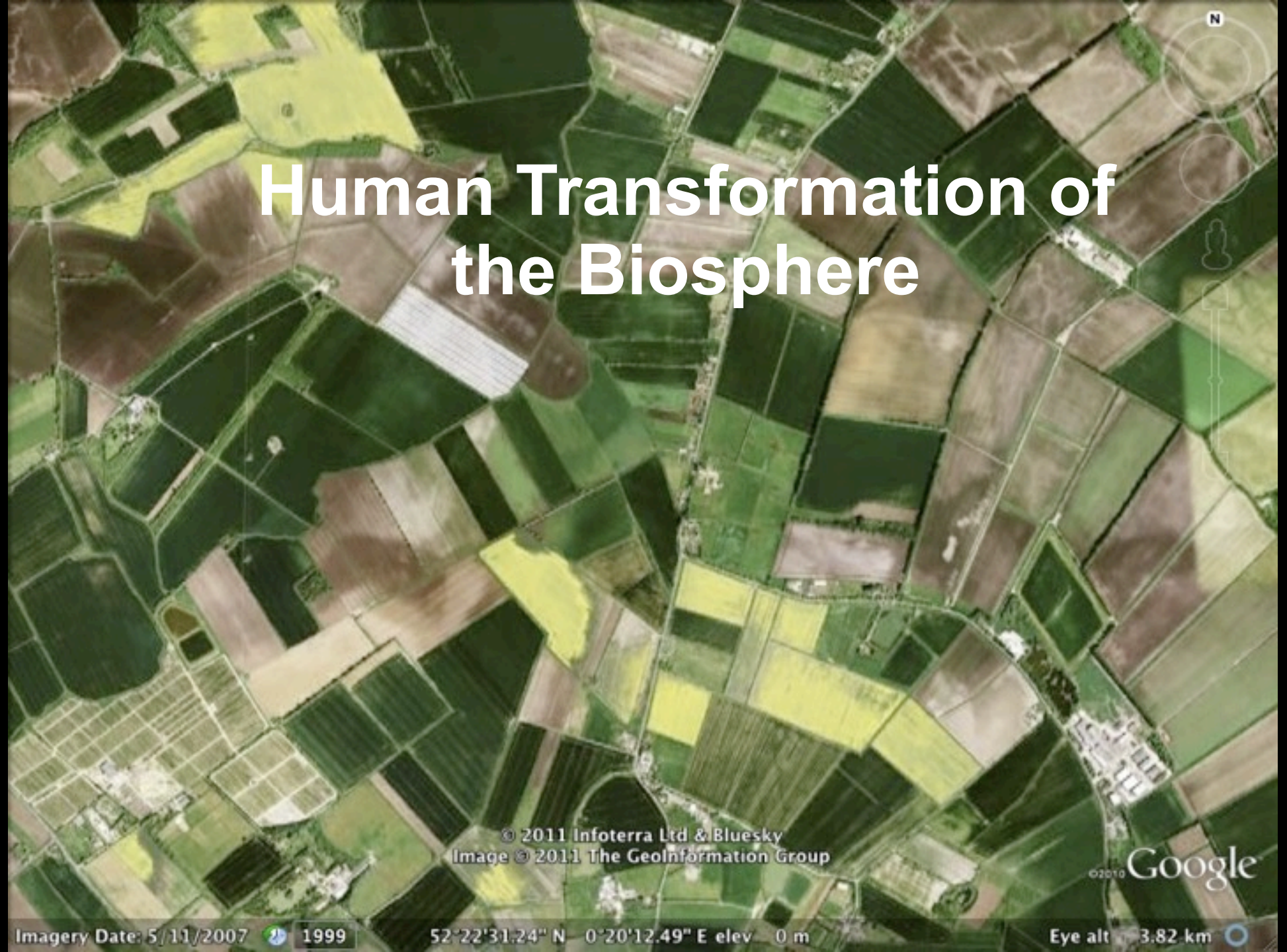


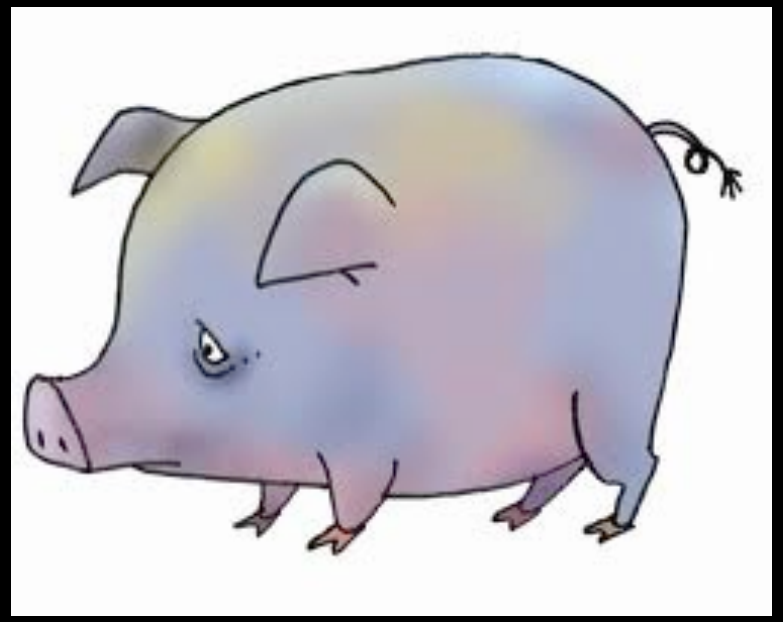
The web of life on Earth is getting smaller and increasingly frayed.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019

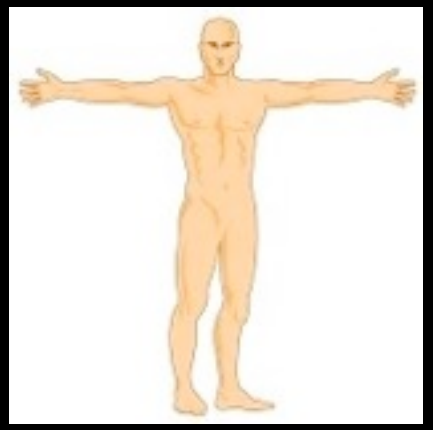
An Earth System Perspective


Human Transformation of the Biosphere
© 2011 Infoterra Ltd & Bluesky
Image © 2011 The GeoInformation Group
©2010 Google
Imagery Date: 5/11/2007
1999
52°22'31.24" N 0°20'12.49" E elev 0 m
Eye alt 3.82 km

Terrestrial vertebrate biomass



Domesticated animals
67%



Humans
30%

Vertebrate
wildlife
3%

Smil 2011

Review

THE ANTHROPOC
REVIEW

The Anthropoce

The Anthropocene biosphere

DOI: 10.1177/2053019

Mark Williams,[1] Jan Zalasiewicz,[1] PK Haff,[2] Christian Schwägerl,[3] Anthony D Barnosky[4,5,6] and Erle C Ellis[7]

Abstract

The geological record preserves evidence for two fundamental stages in the evolution of biosphere, a microbial stage from ~3.5 to 0.65 Ga, and a metazoan stage evident by c. 650 M suggest that the modern biosphere differs significantly from these previous stages and show signs of a new, third stage of biosphere evolution characterised by: (1) global homogen of flora and fauna; (2) a single species (*Homo sapiens*) commandeering 25–40% of net p production and also mining fossil net primary production (fossil fuels) to break through the photosynthetic energy barrier; (3) human-directed evolution of other species; and (4) increasing interaction of the biosphere with the technosphere (the global emergent system that includes humans, technological artefacts, and associated social and technological networks). These unique features of today's biosphere may herald a new era in the planet's history that could persist over geological timescales.

Keywords

biosphere, evolution, global ecosystem, neobiotic species, planetary state, production and consumption, technosphere

Introduction

Humans transport organisms around the globe (McNeely, 2001 and references therein), construct unique agricultural and urban 'anthromes' for organisms to live in (e.g. Ellis, 2013; Ellis et al., 2012, 2013a, 2013b), and have concentrated biomass into a particular set of plants and animals (e.g. Smil, 2011). Ecosystem fragmentation, intensive farming, climate change and pollution threaten the biodiversity of many organism groups with a greatly increased risk of

[1]University of Leicester, UK
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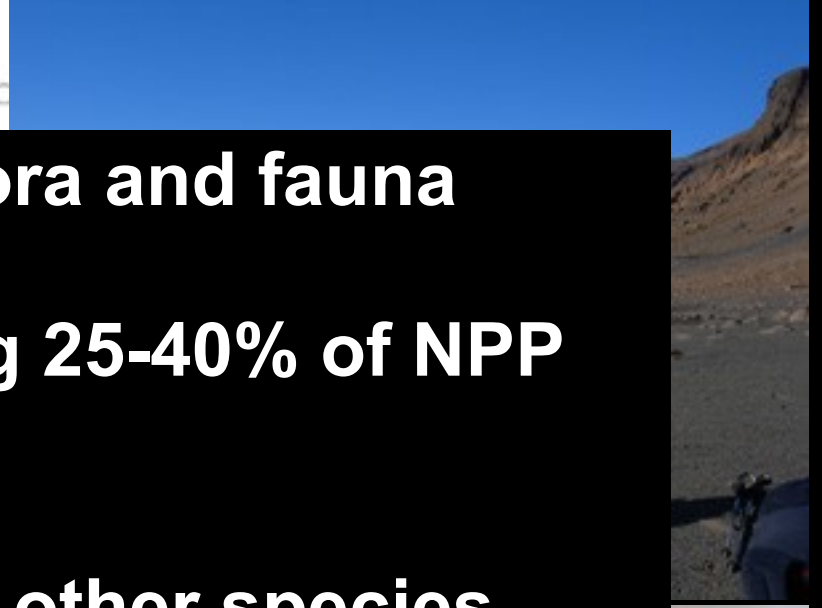
Corresponding author:
Mark Williams, Department of Geology, University of Leicester, Leicester LE1 7RH, UK.
Email: mrs@le.ac.uk

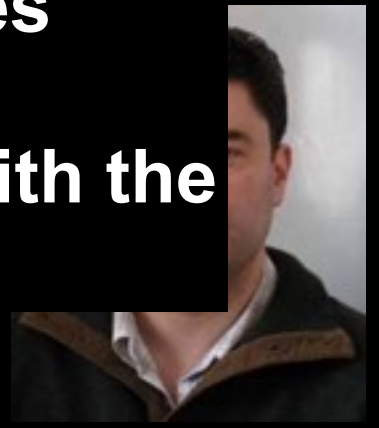


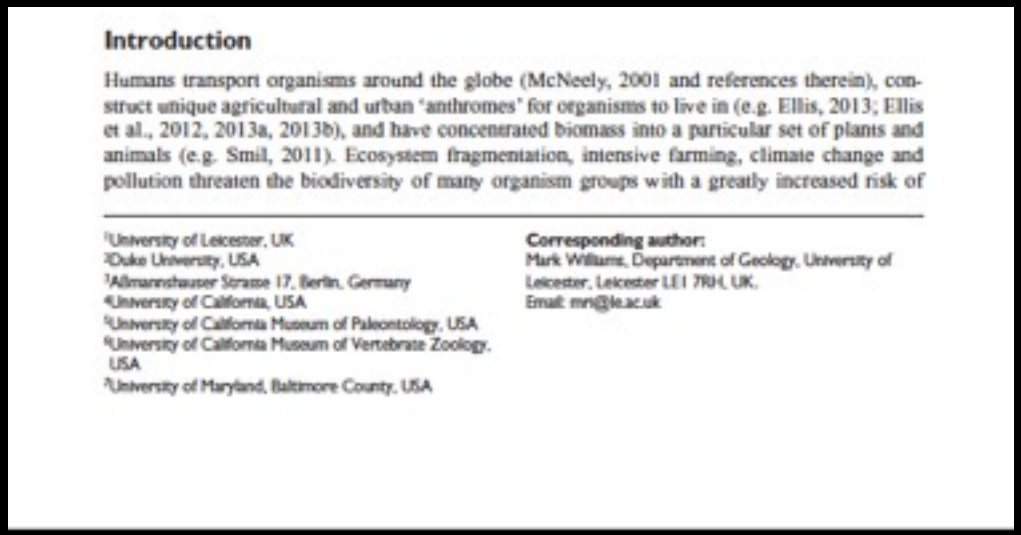
Global homogenisation of flora and fauna

Homo sapiens comandeering 25-40% of NPP and mining fossil NPP

Human-directed evolution of other species

Increasing interaction of the biosphere with the technosphere





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THE
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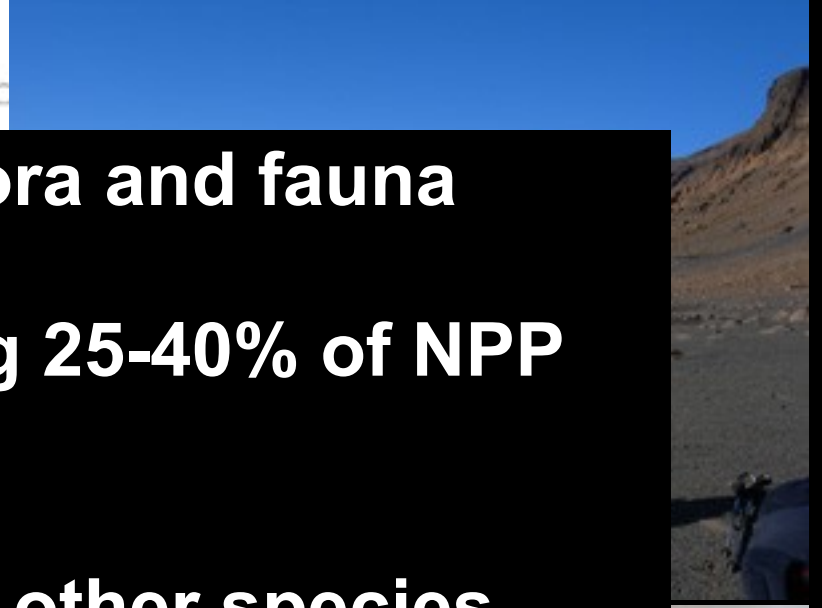

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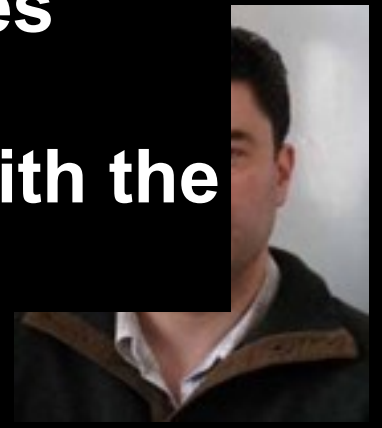

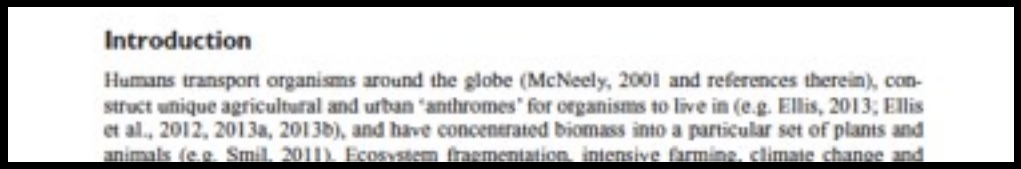
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Signs of a New, Third Stage of Biosphere Evolution

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Research

Cite this article: Johnson CK, Hitchens PL, Pandit PS, Rushmore J, Evans TS, Young CCW, Doyle MM. 2020 Global shifts in mammalian population trends reveal key predictors of virus spillover risk. *Proc. R. Soc. B* **287**: 20192736. http://dx.doi.org/10.1098/rspb.2019.2736

Received: 22 November 2019
Accepted: 13 March 2020

Subject Category:
Global change and conservation

Subject Areas:
ecology, health and disease and epidemiology

Keywords:
zoonotic disease, virus, spillover, threatened species, exploitation, habitat loss

Global shifts in mammalian population trends reveal key predictors of virus spillover risk

Christine K. Johnson[1], Peta L. Hitchens[2], Pranav S. Pandit[1], Julie Rushmore[1], Tierra Smiley Evans[1], Cristin C. W. Young[1] and Megan M. Doyle[1]

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Emerging infectious diseases in humans are frequently caused by pathogens originating from animal hosts, and zoonotic disease outbreaks present a major challenge to global health. To investigate drivers of virus spillover, we evaluated the number of viruses mammalian species have shared with humans. We discovered that the number of zoonotic viruses detected in mammalian species scales positively with global species abundance, suggesting that virus transmission risk has been highest from animal species that have increased in abundance and even expanded their range by adapting to human-dominated landscapes. Domesticated species, primates and bats were identified as having more zoonotic viruses than other species. Among threatened wildlife species, those with population reductions owing to exploitation and loss of habitat shared more viruses with humans. Exploitation of wildlife through hunting and trade facilitates close contact between wildlife and humans, and our findings provide further evidence that exploitation, as well as anthropogenic activities that have caused losses in wildlife habitat quality, have increased opportunities for animal–human interactions and facilitated zoonotic disease transmission. Our study provides new evidence for assessing spillover risk from mammalian species and highlights convergent processes whereby the causes of wildlife population declines have facilitated the transmission of animal viruses to humans.

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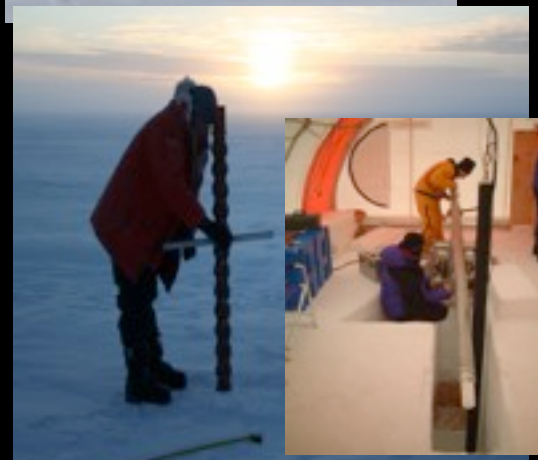
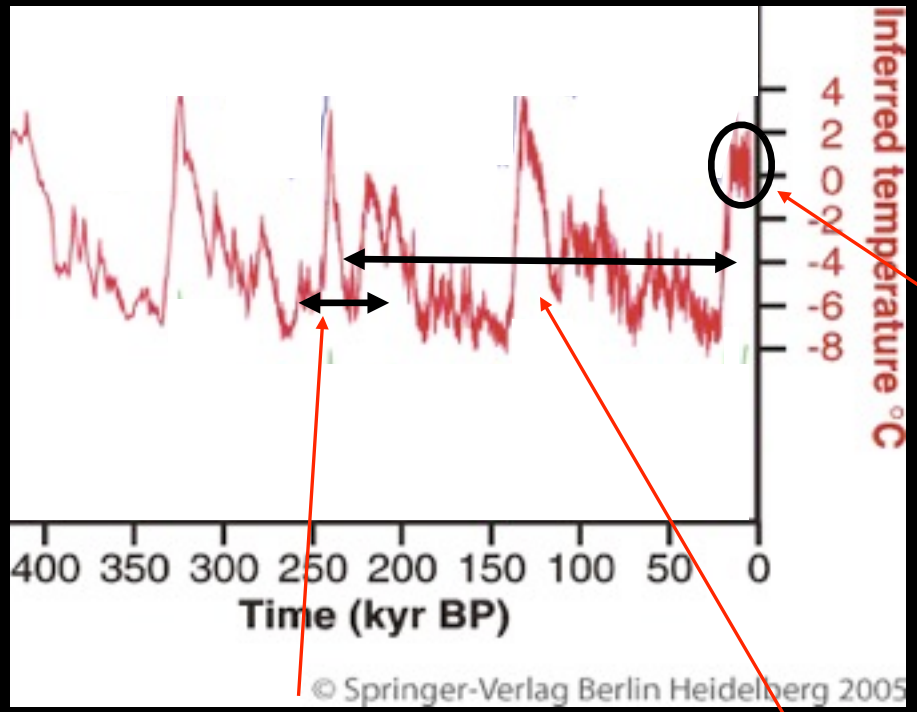


Human Development
and
the Earth System



Beginning of agriculture

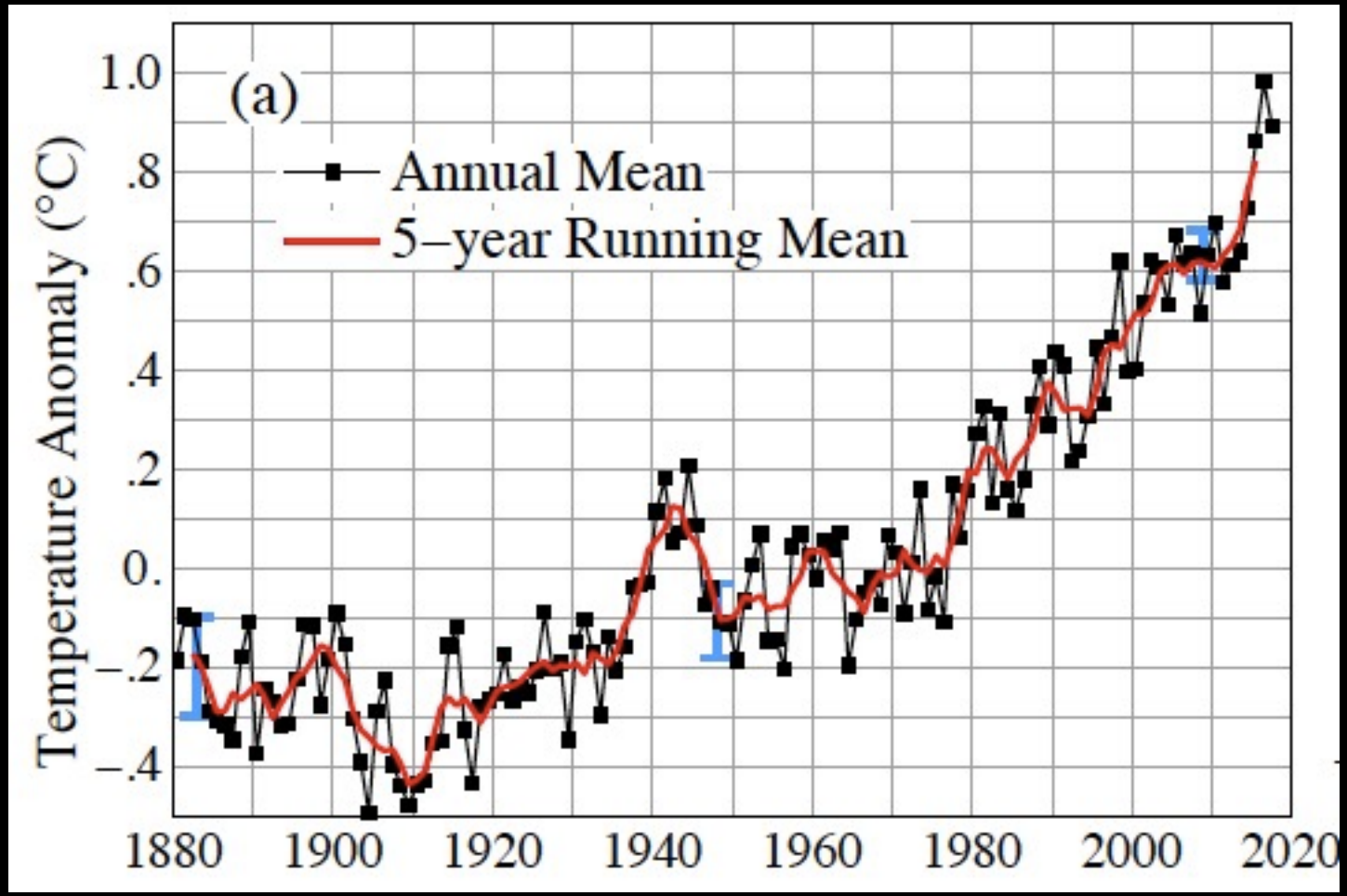
Evolution of fully modern humans in Africa

Hunter-gatherer societies only

Adapted from Steffen et al. 2004; ice core data from Petit et al. 1999

Climate Change

Global Average Temperature Anomaly, 1880-2017



Baseline is 1951-1980

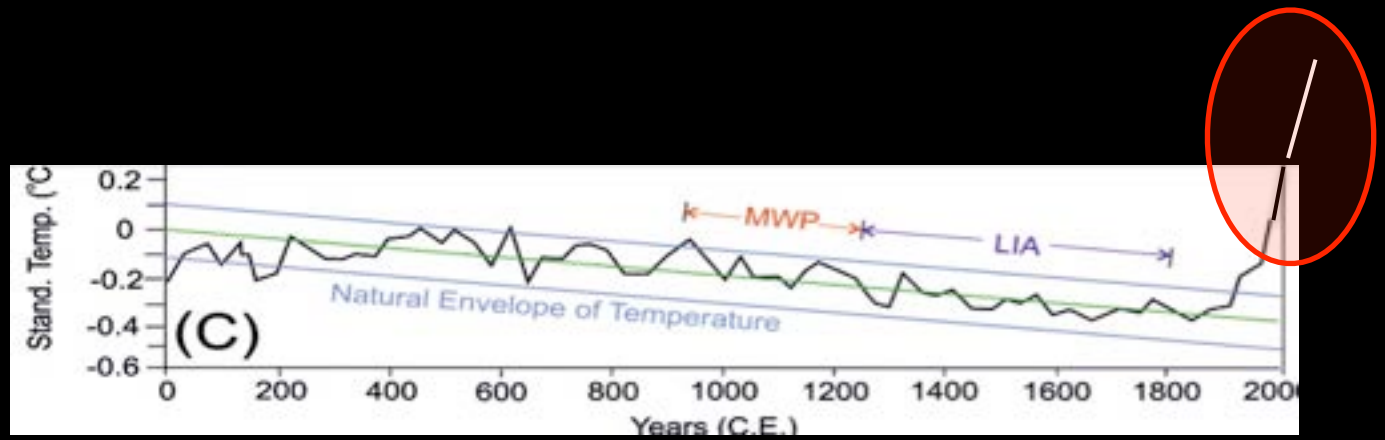
NASA 2018

An Earth System Perspective

Temperature rise:

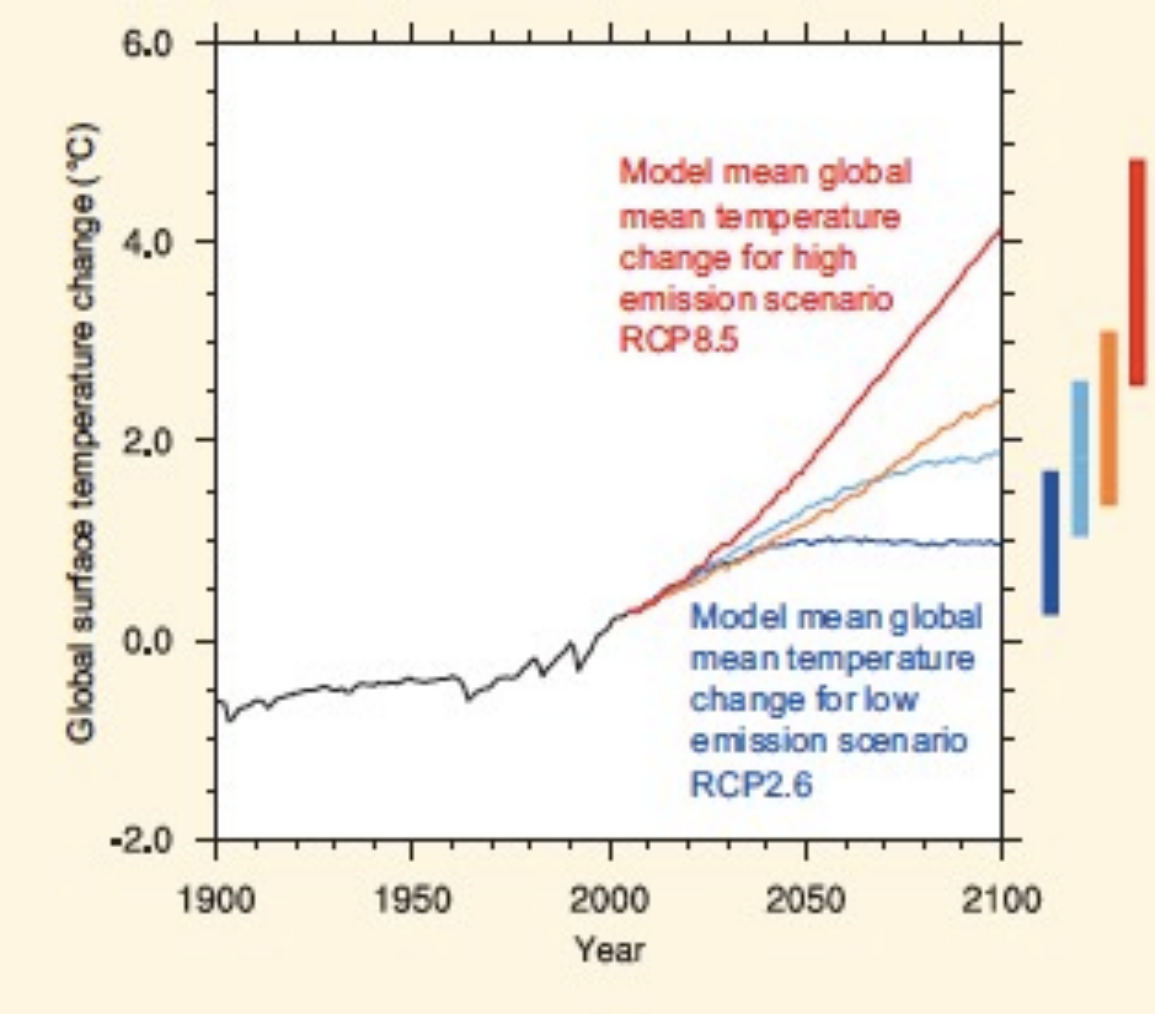
Beyond the envelope of natural variability!

Human influence

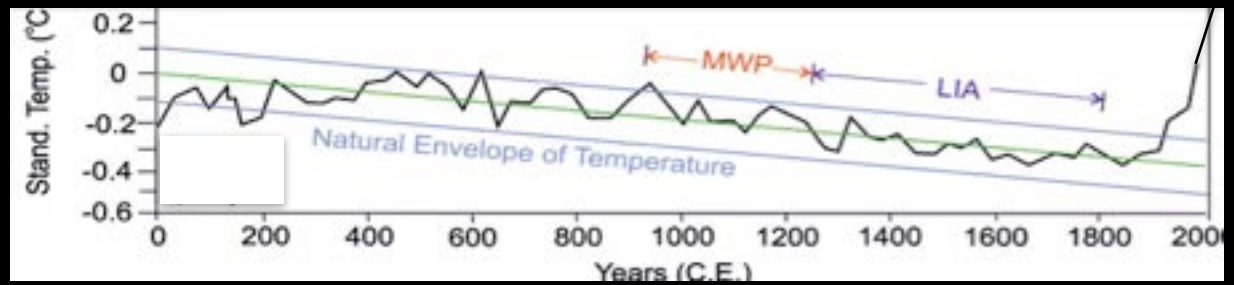


Summerhayes 2015

IPCC temperature projections



IPCC 2013



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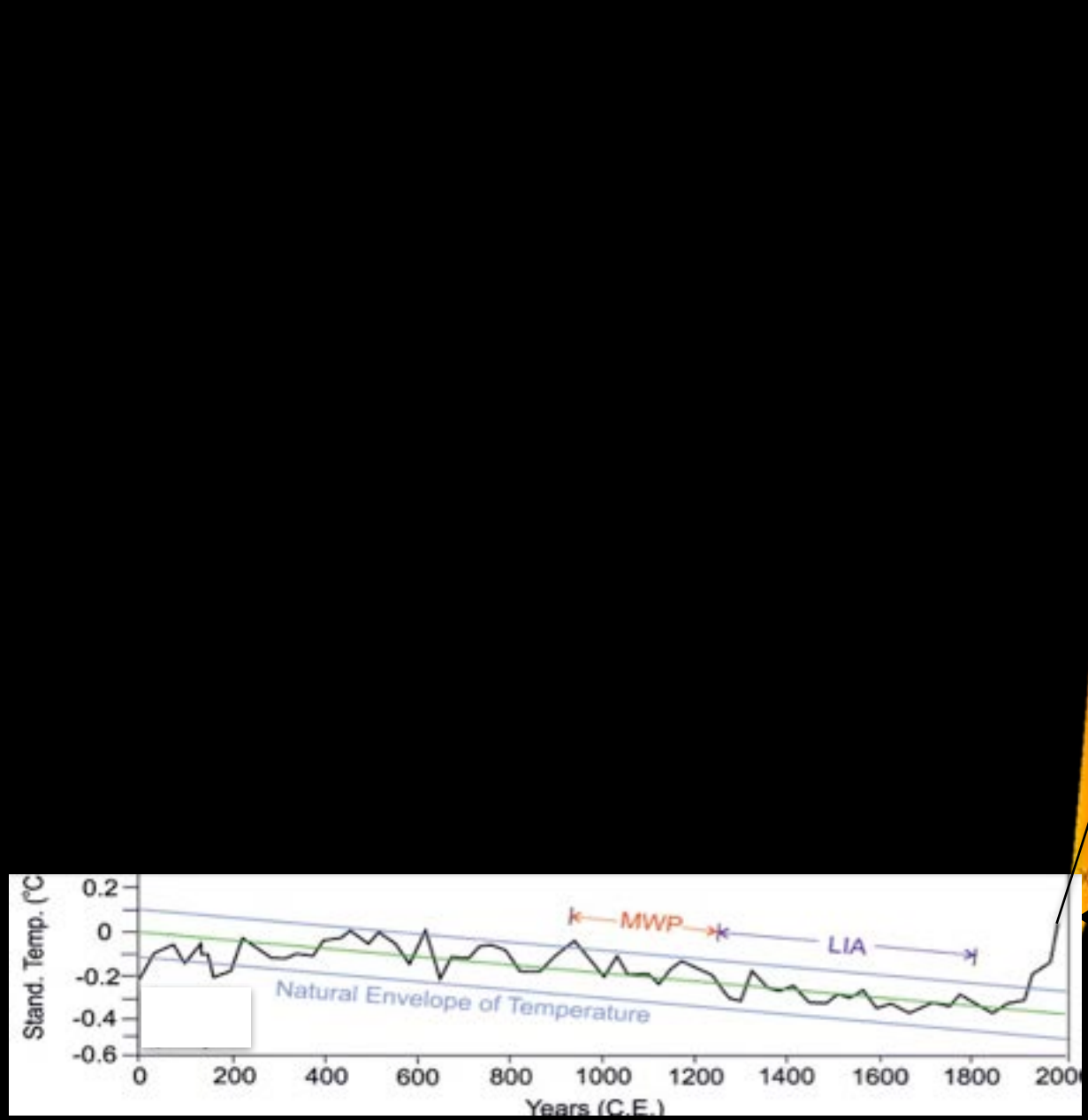

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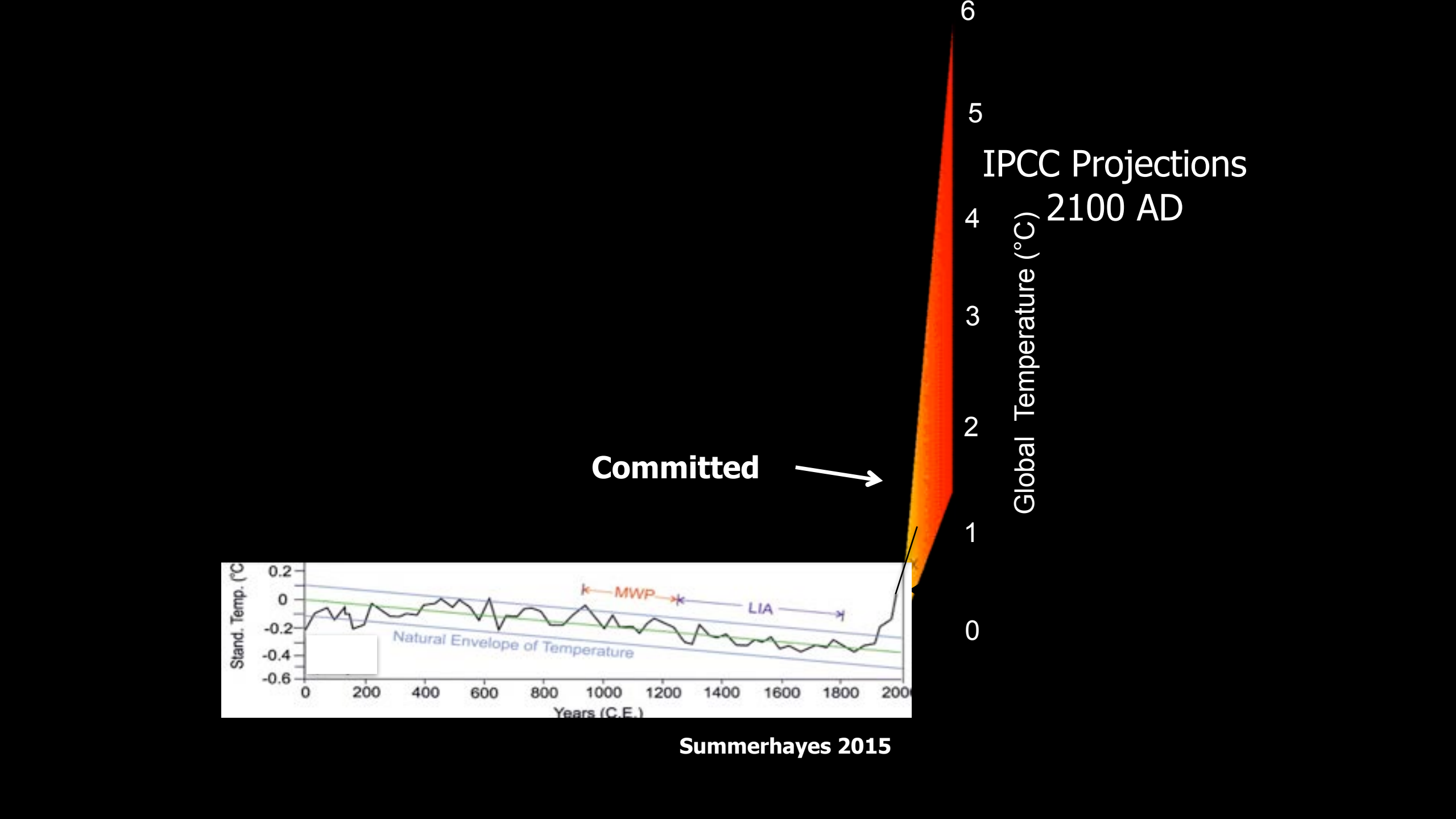
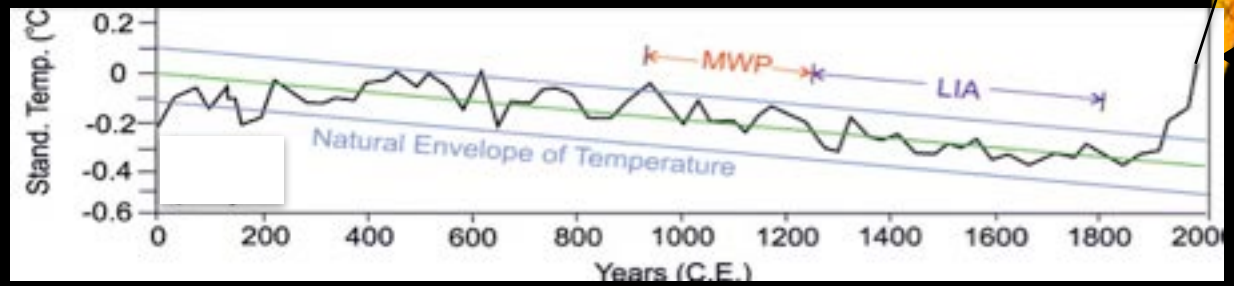
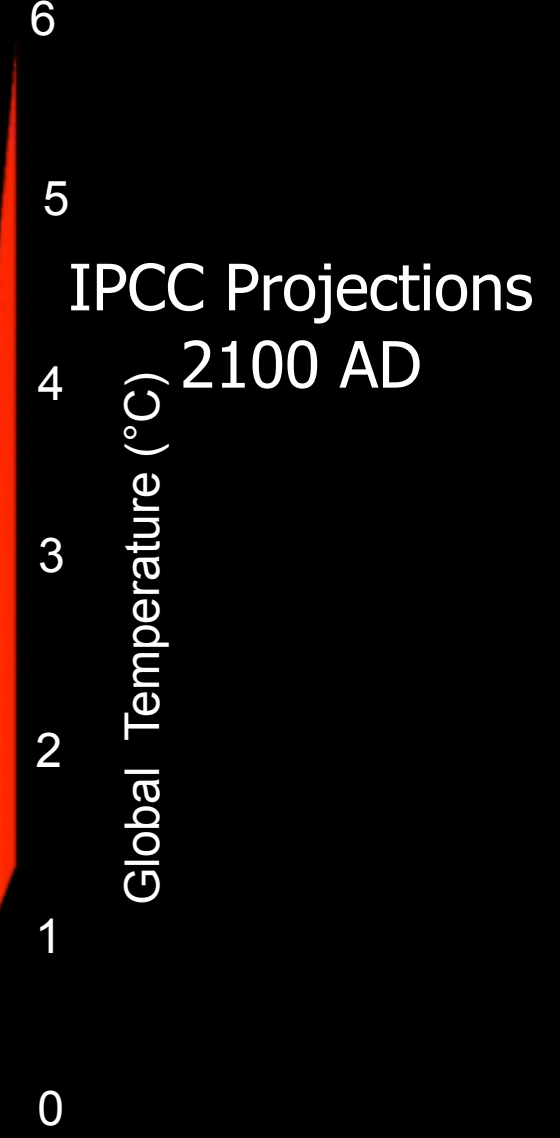


Summerhayes 2015

Earth System moves to a new state? Severe challenge to contemporary civilisation. Possible collapse?

Committed





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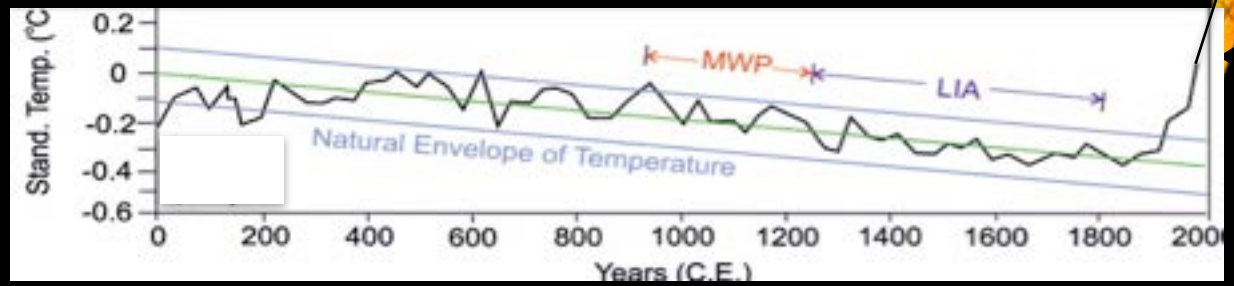
IPCC Projections 2100 AD

Global Temperature (°C)

6
5
4
3
2
1
0

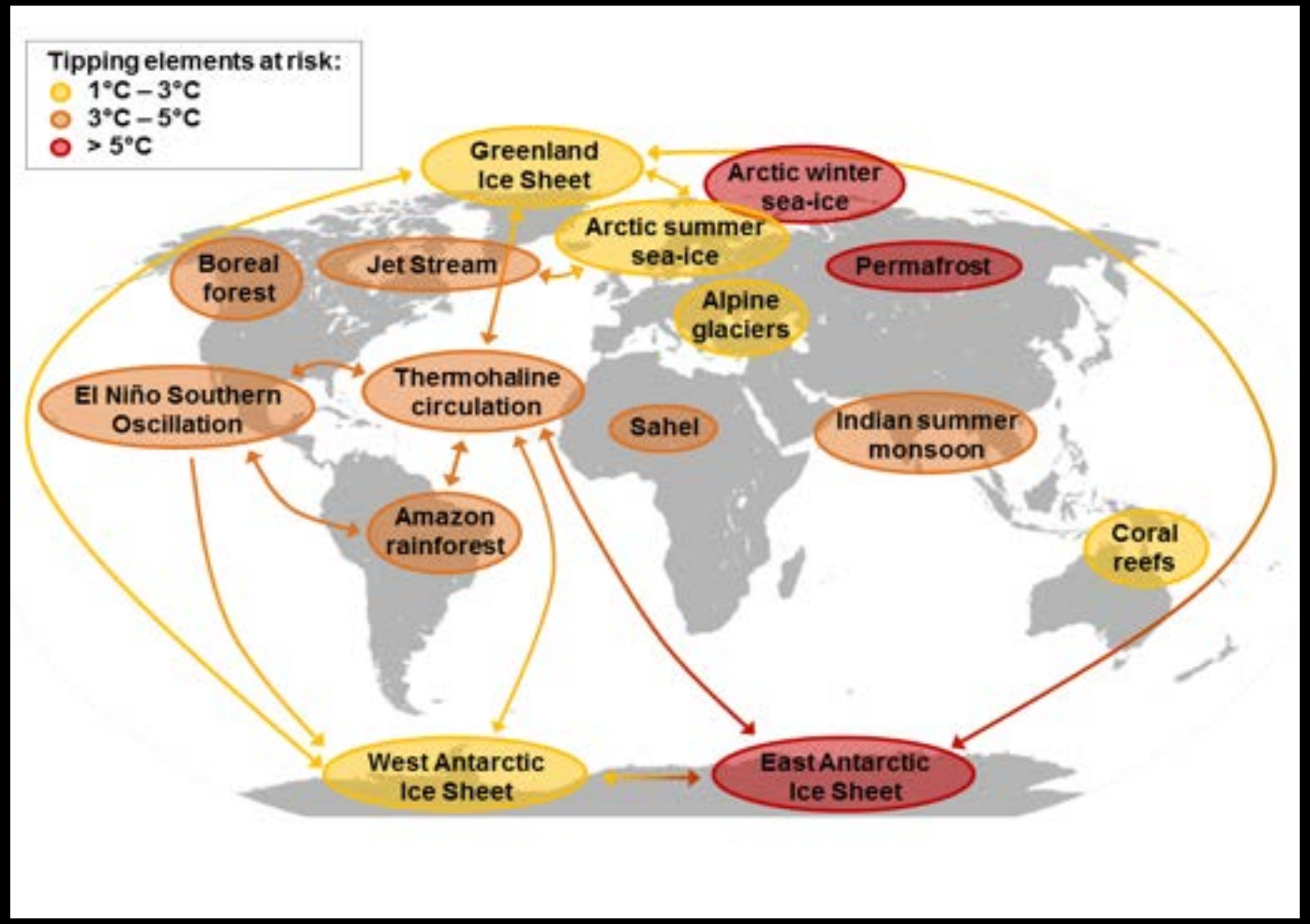
Tipping Points?

Committed



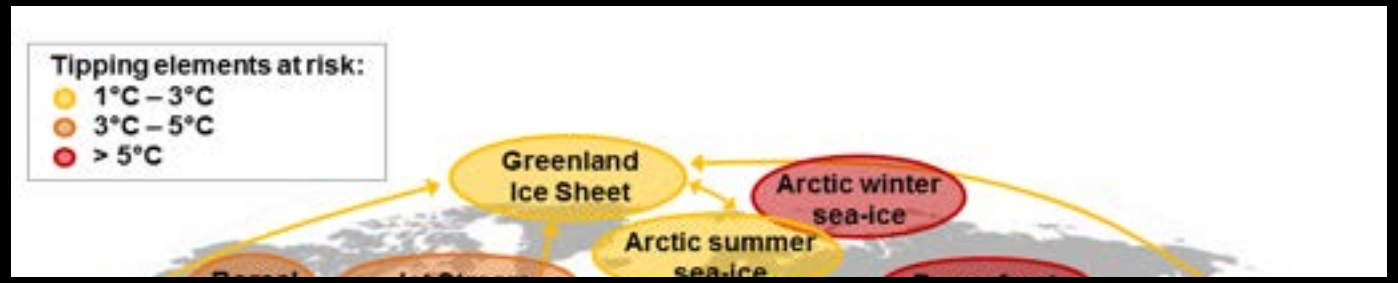
Summerhayes 2015

Tipping Cascades



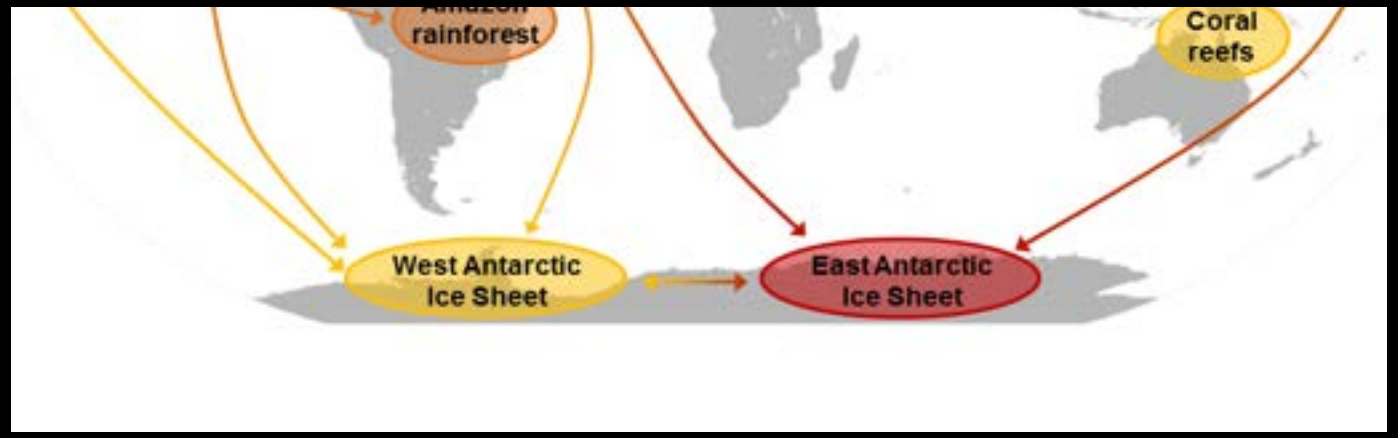
Source: J. Donges and R. Winkelmann in Steffen et al. 2018

Tipping Cascades



Moderate risk of 'large scale singular events' (e.g., tipping points) at 1°C and high risk at 2.5°C of warming

IPCC SR1.5 (2018)



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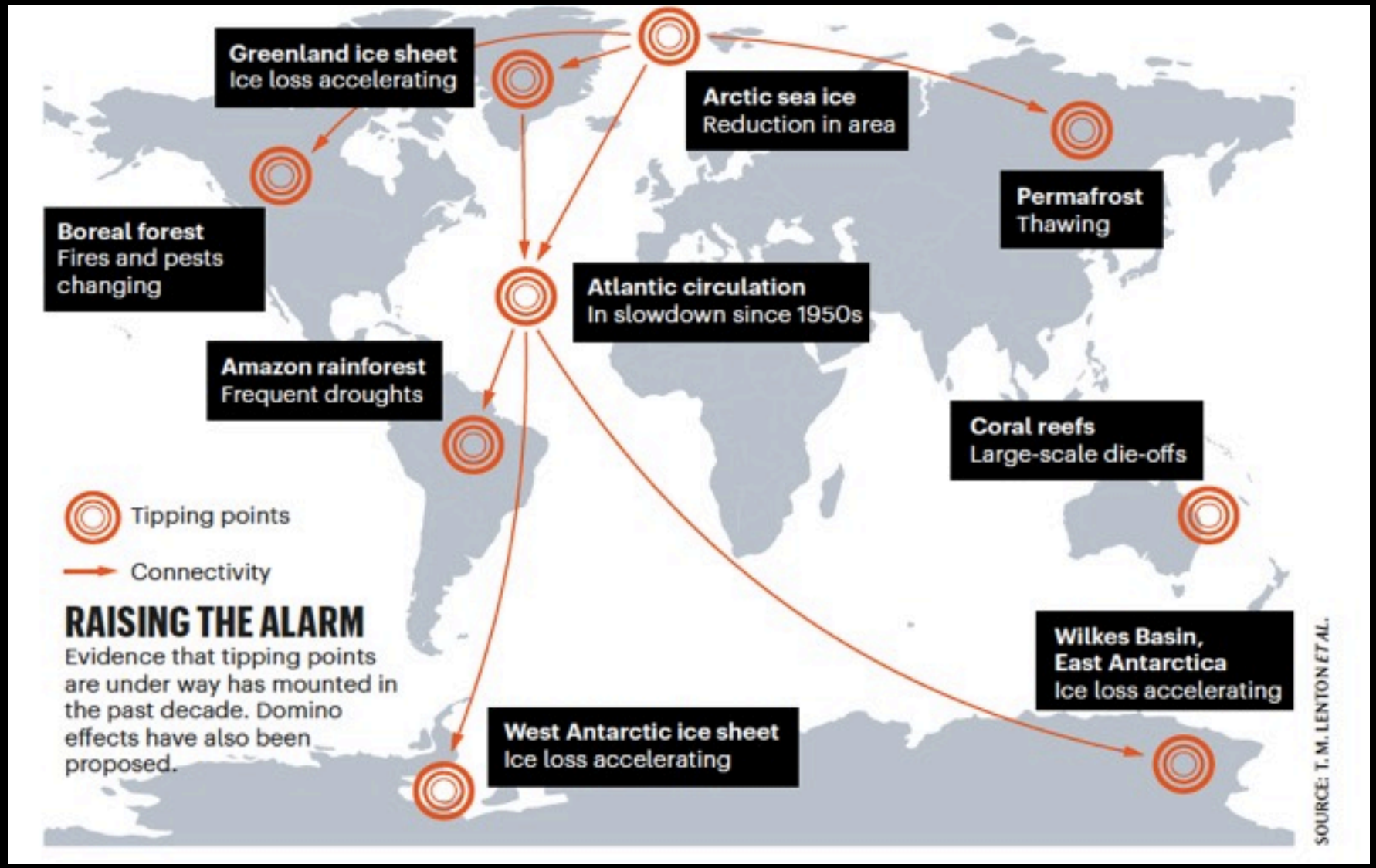
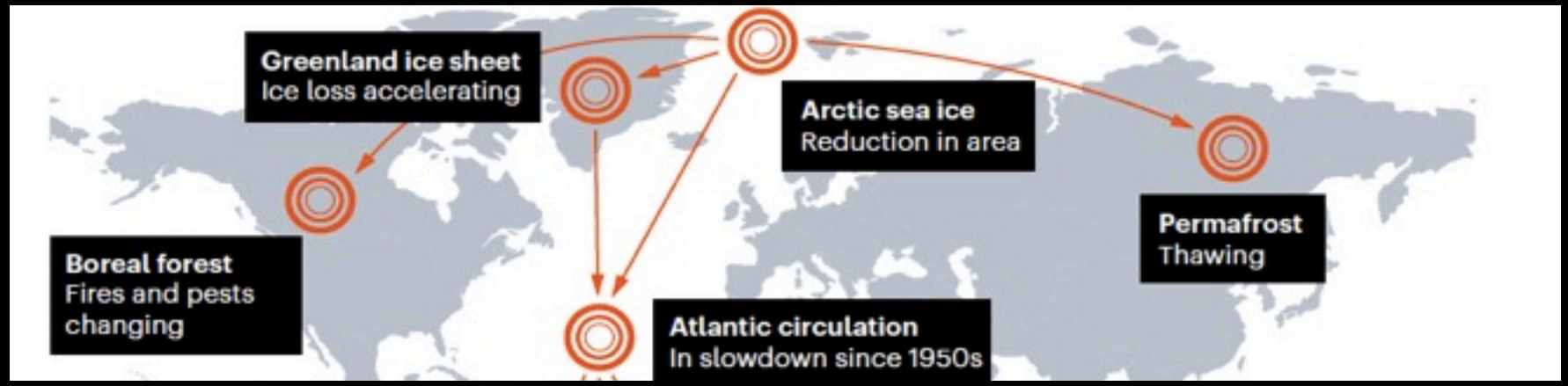
Global Tipping Cascade

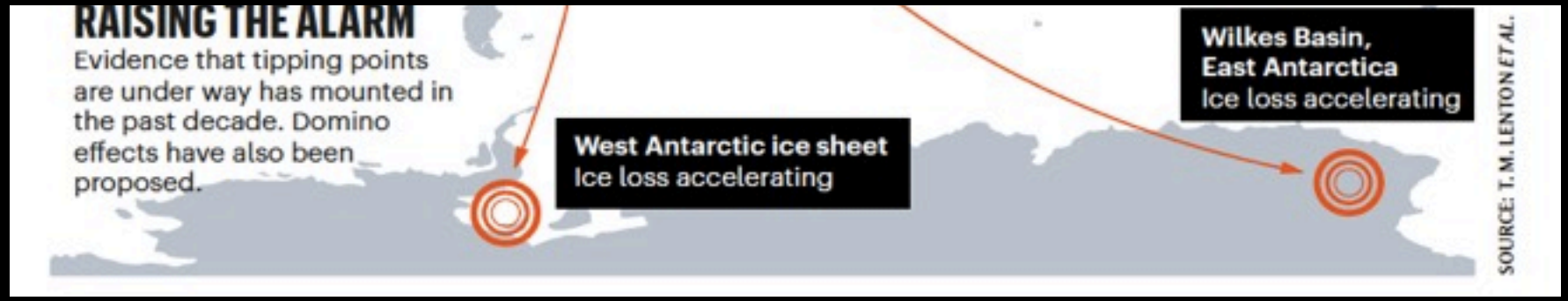


Lenton et al. 2019

Global Tipping Cascade

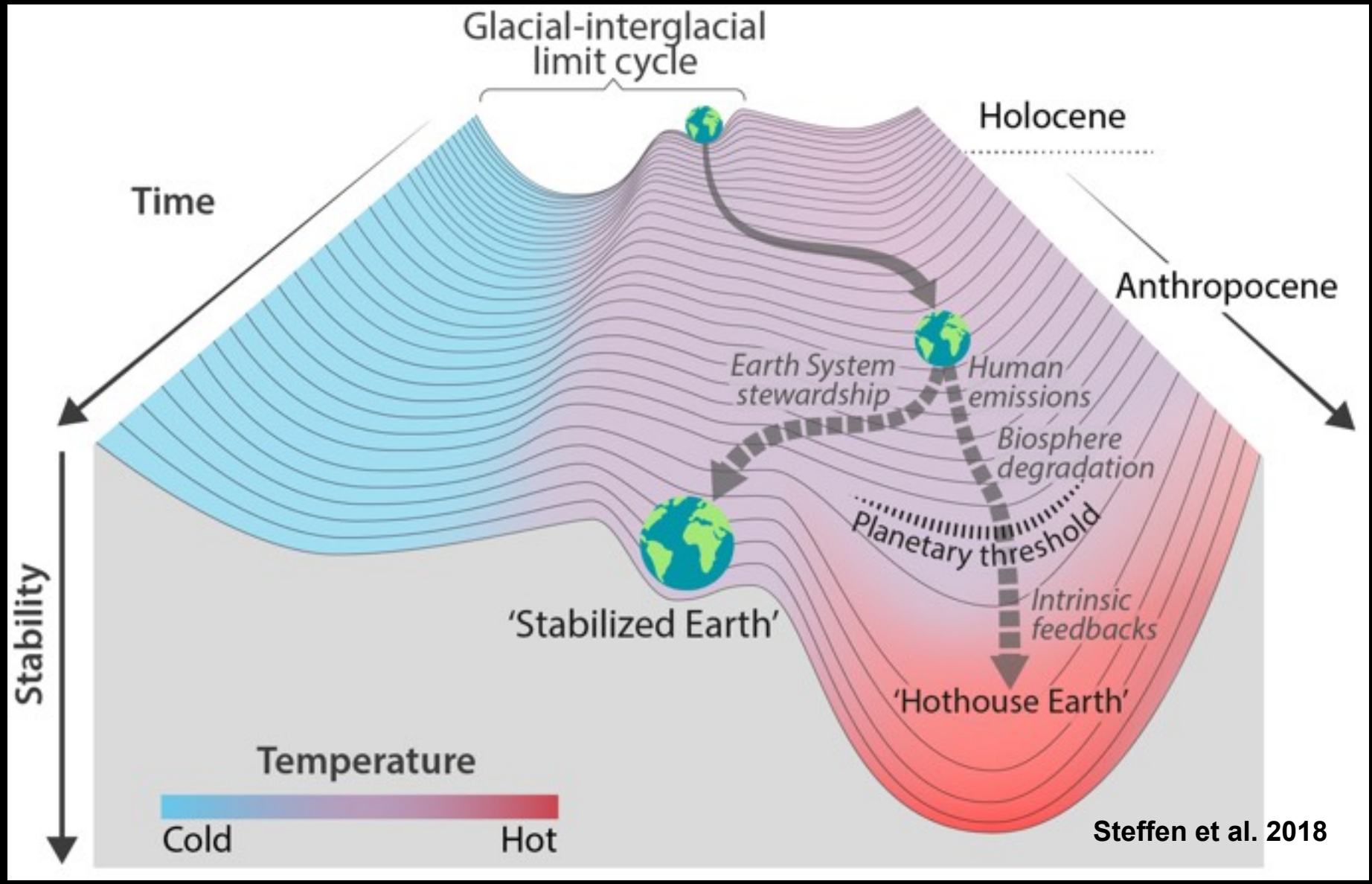


"If damaging tipping cascades can occur and a global tipping point cannot be ruled out, then this is an existential threat to civilization. No amount of economic cost-benefit analysis is going to help us."



Lenton et al. 2019

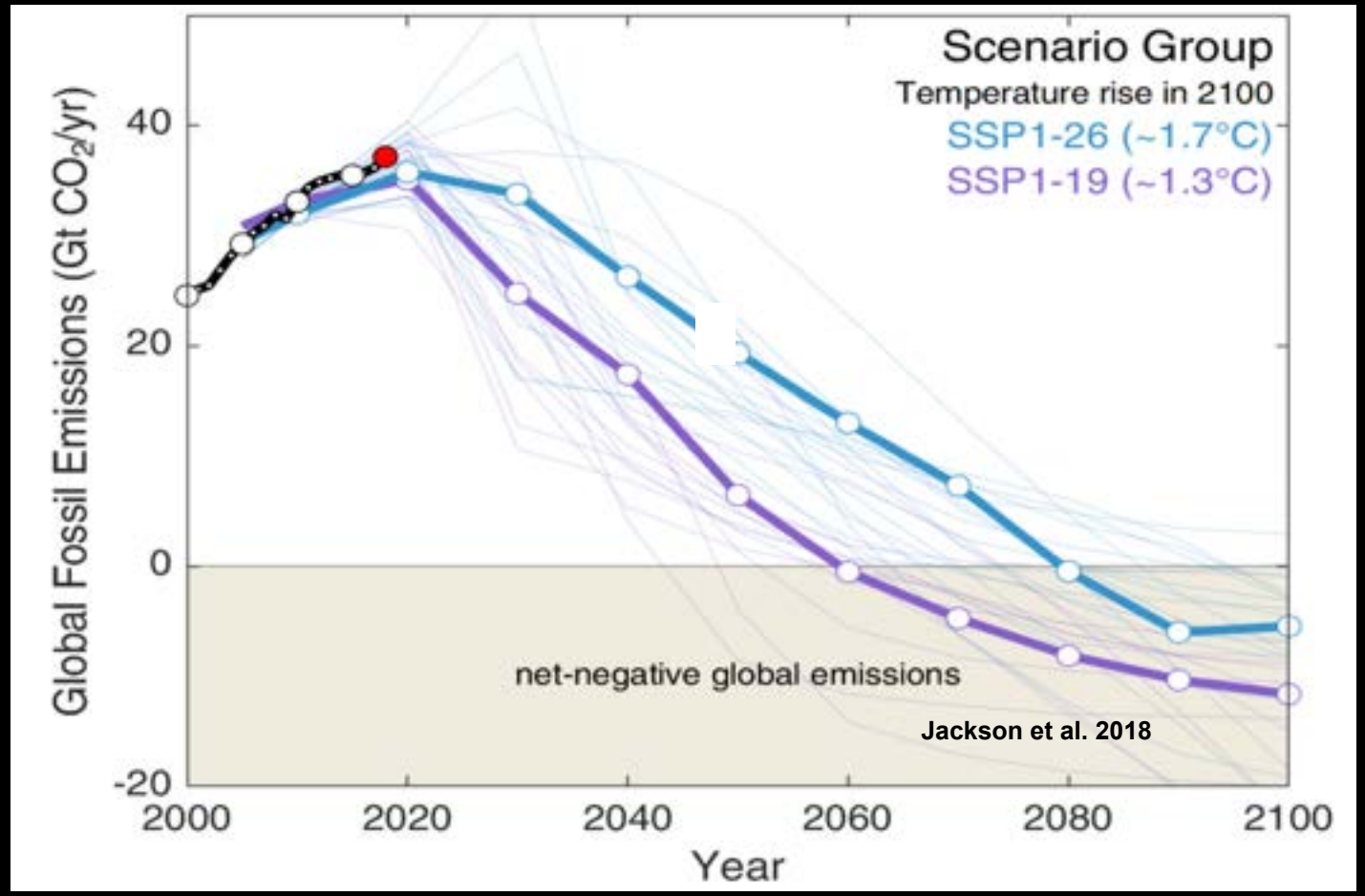
Earth System Trajectories



Steffen et al. 2018

The Climate Emergency

‘Intervention Time’ and ‘Reaction Time’



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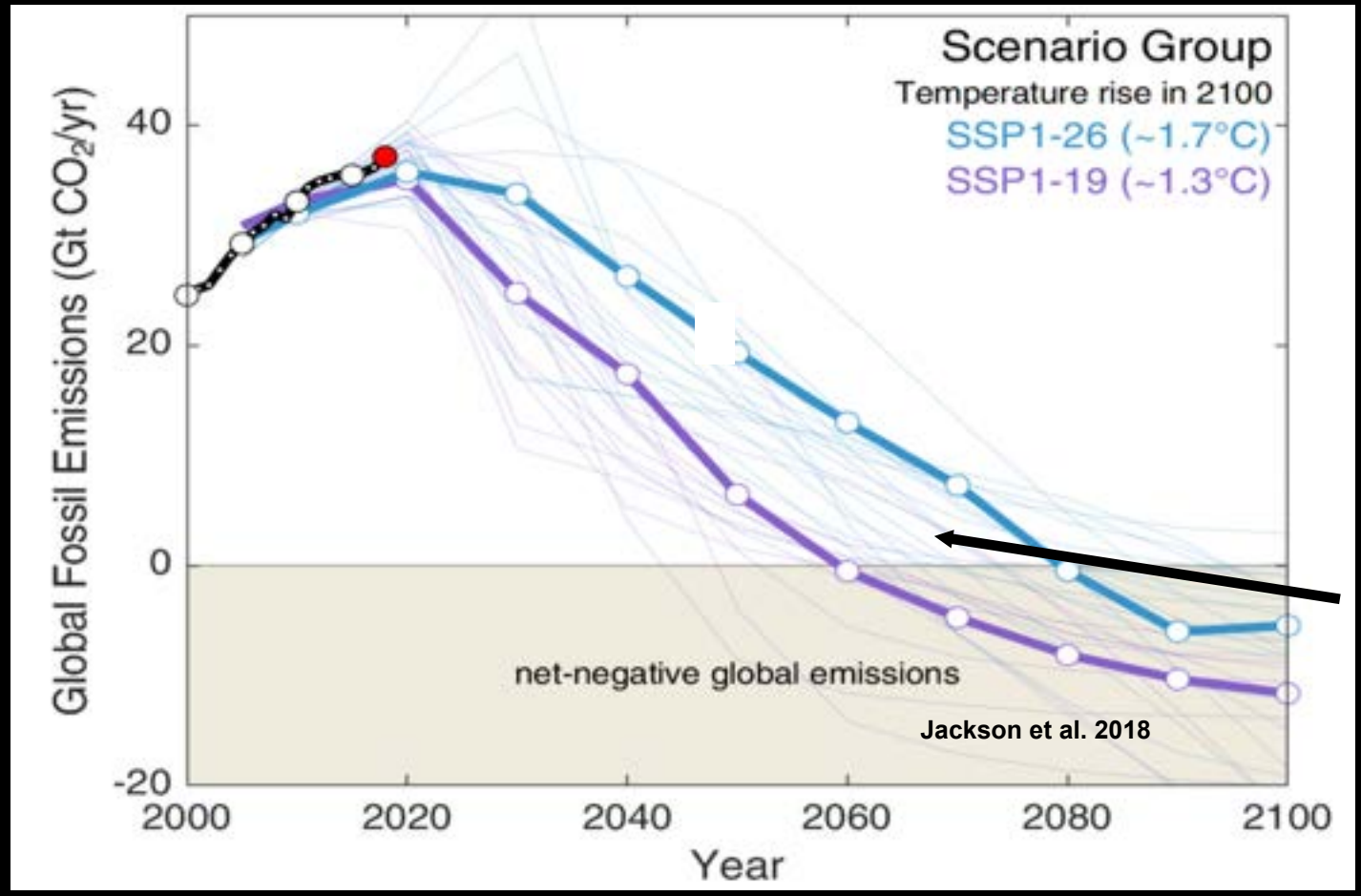

‘Reaction Time’ to net zero emissions is 40-60 years (30 years at best)

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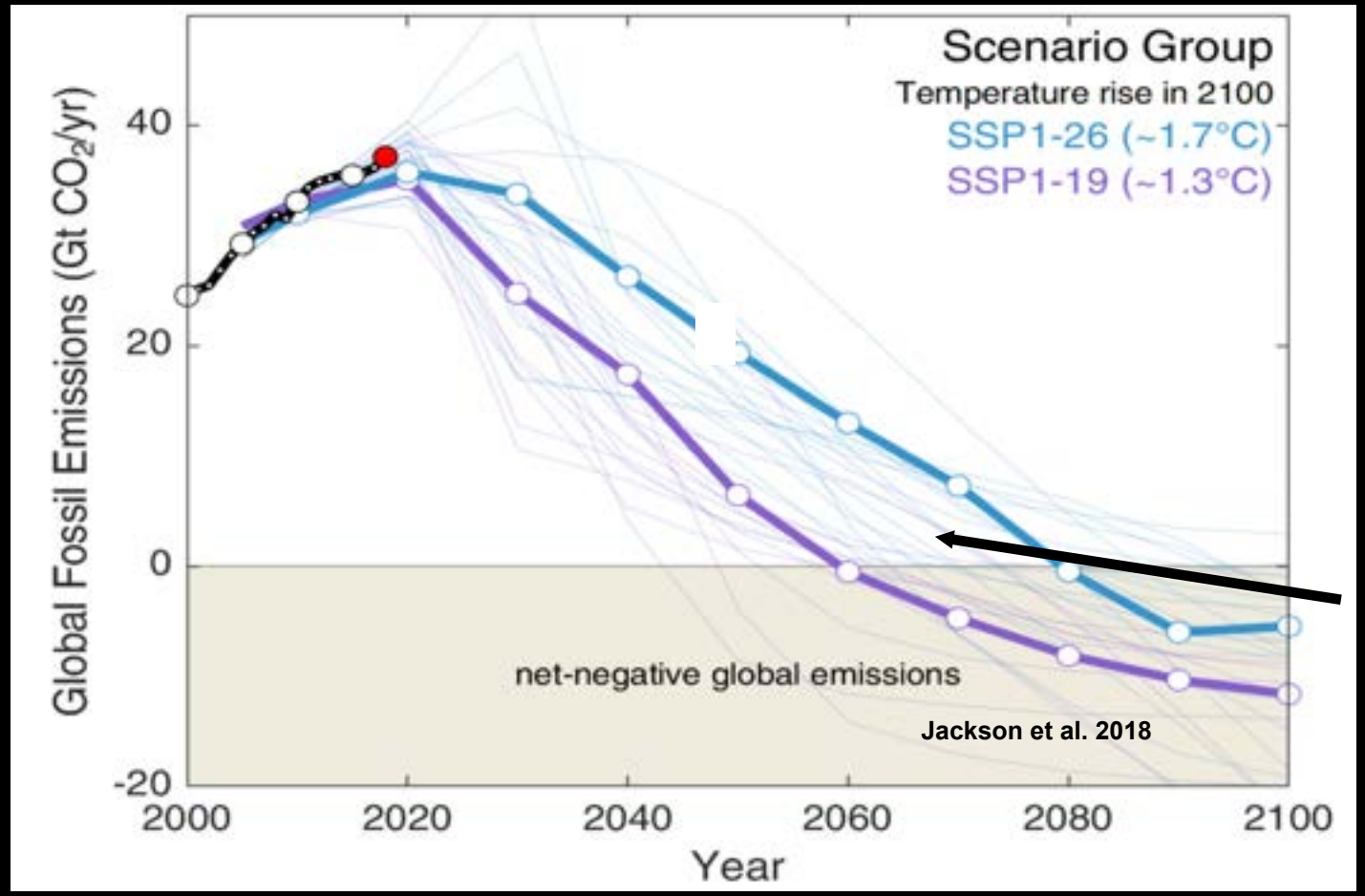

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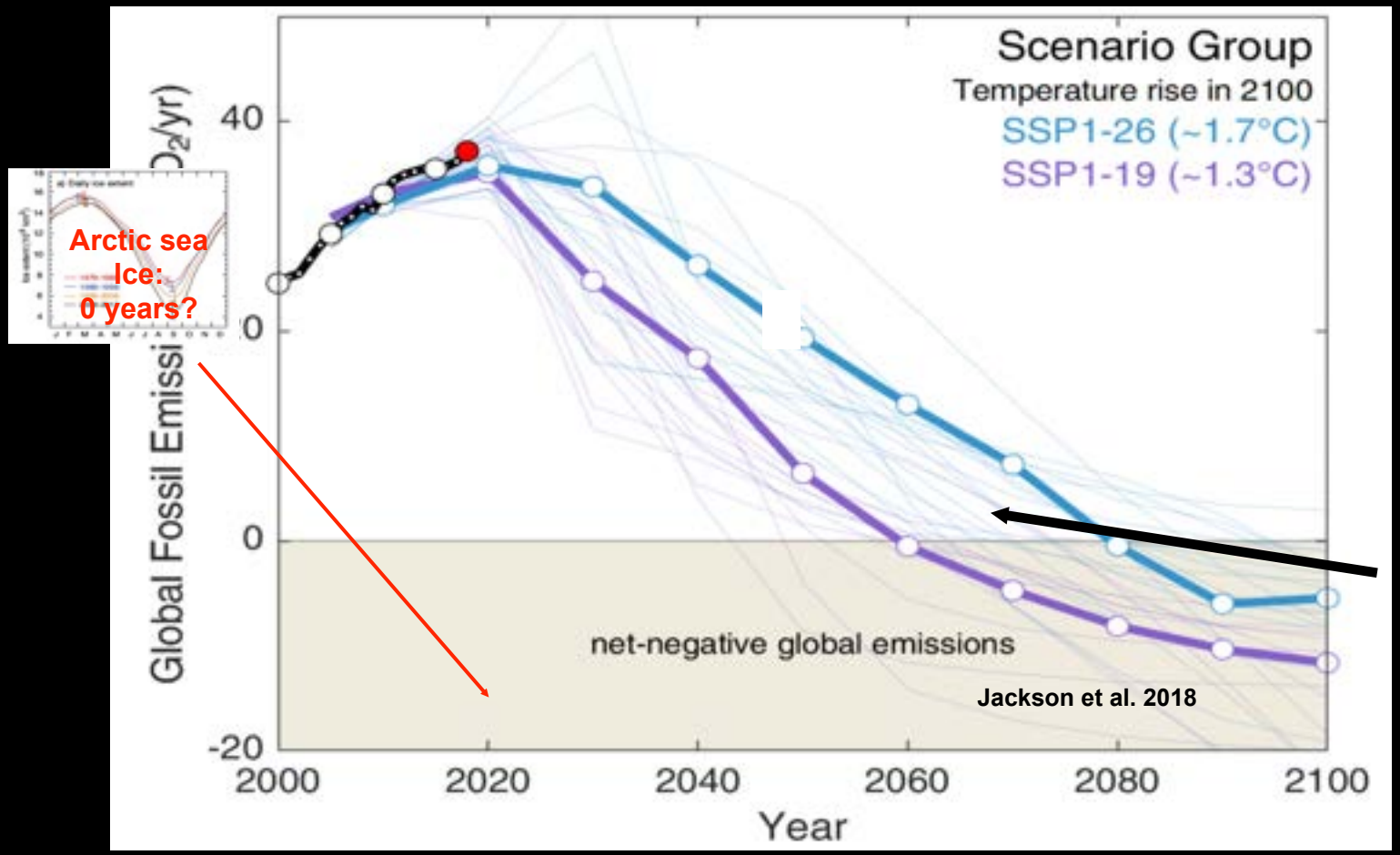

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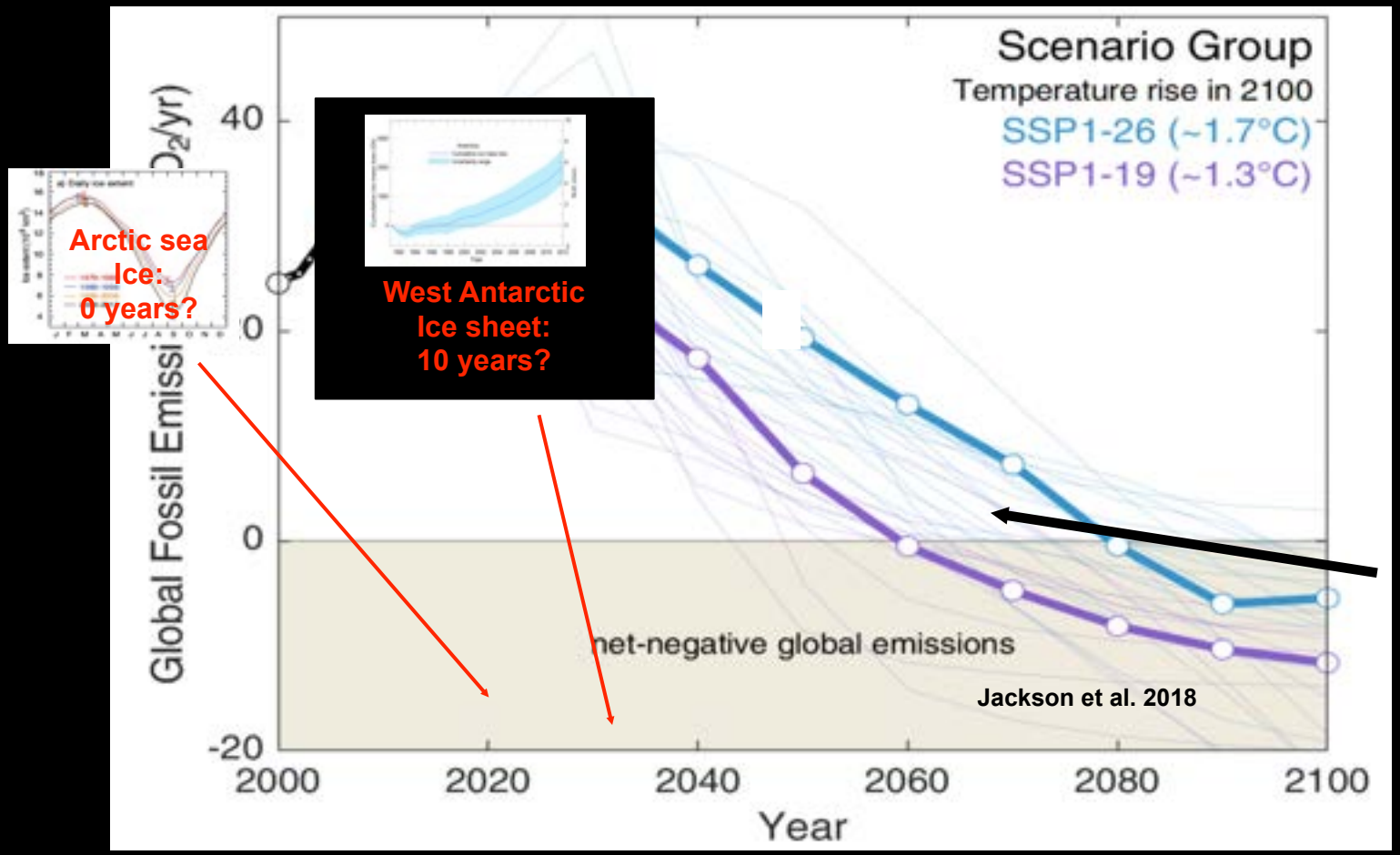

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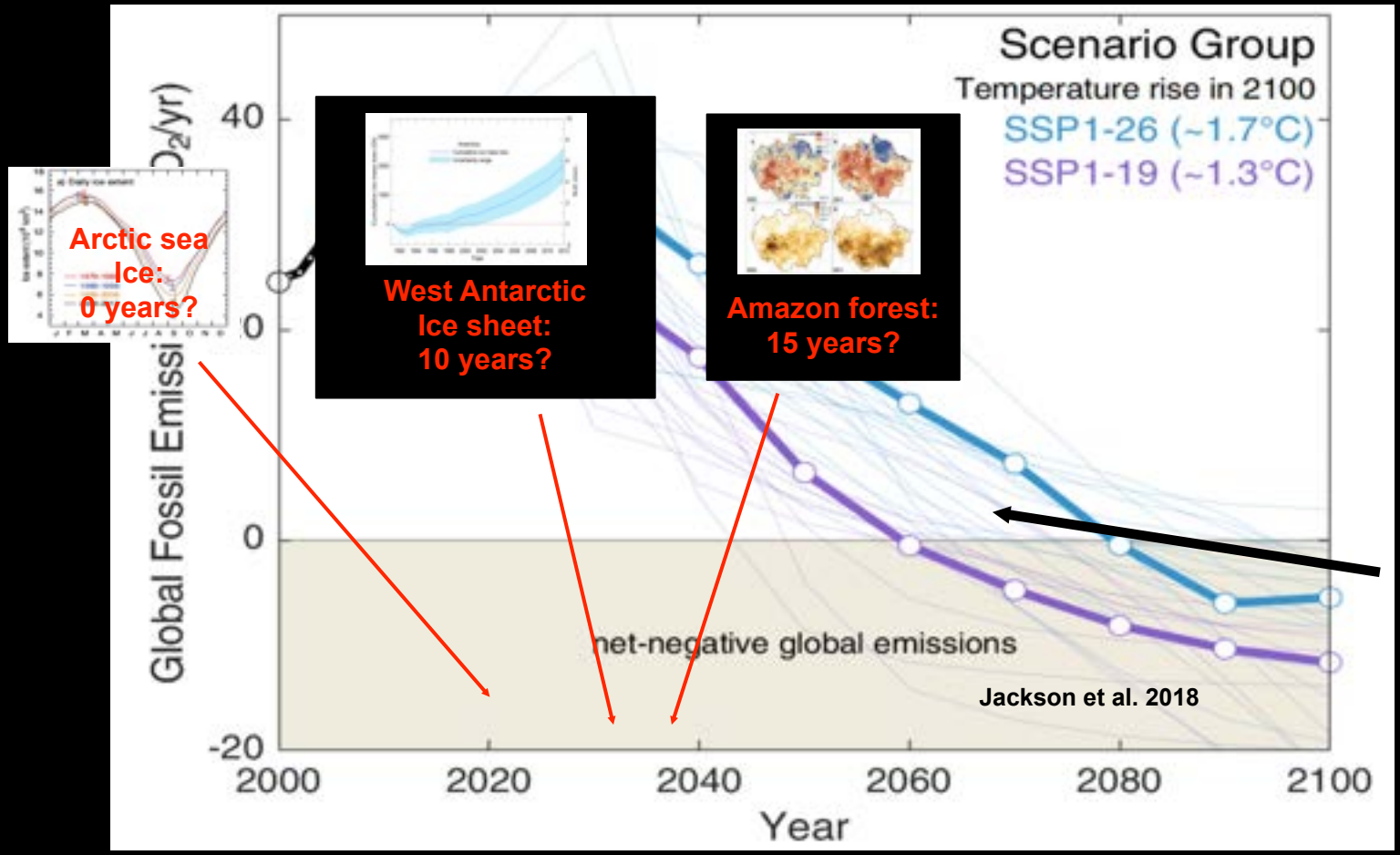

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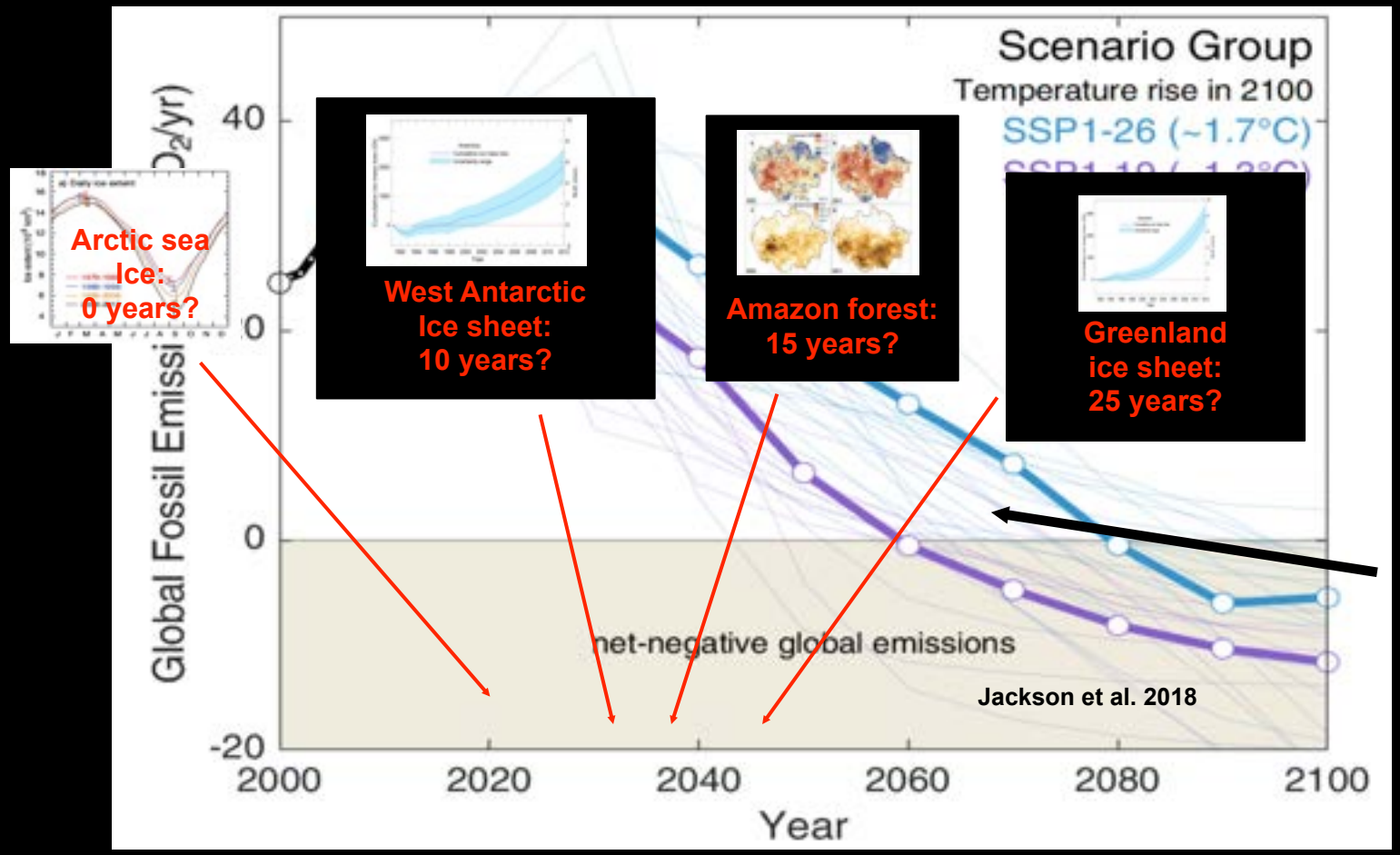

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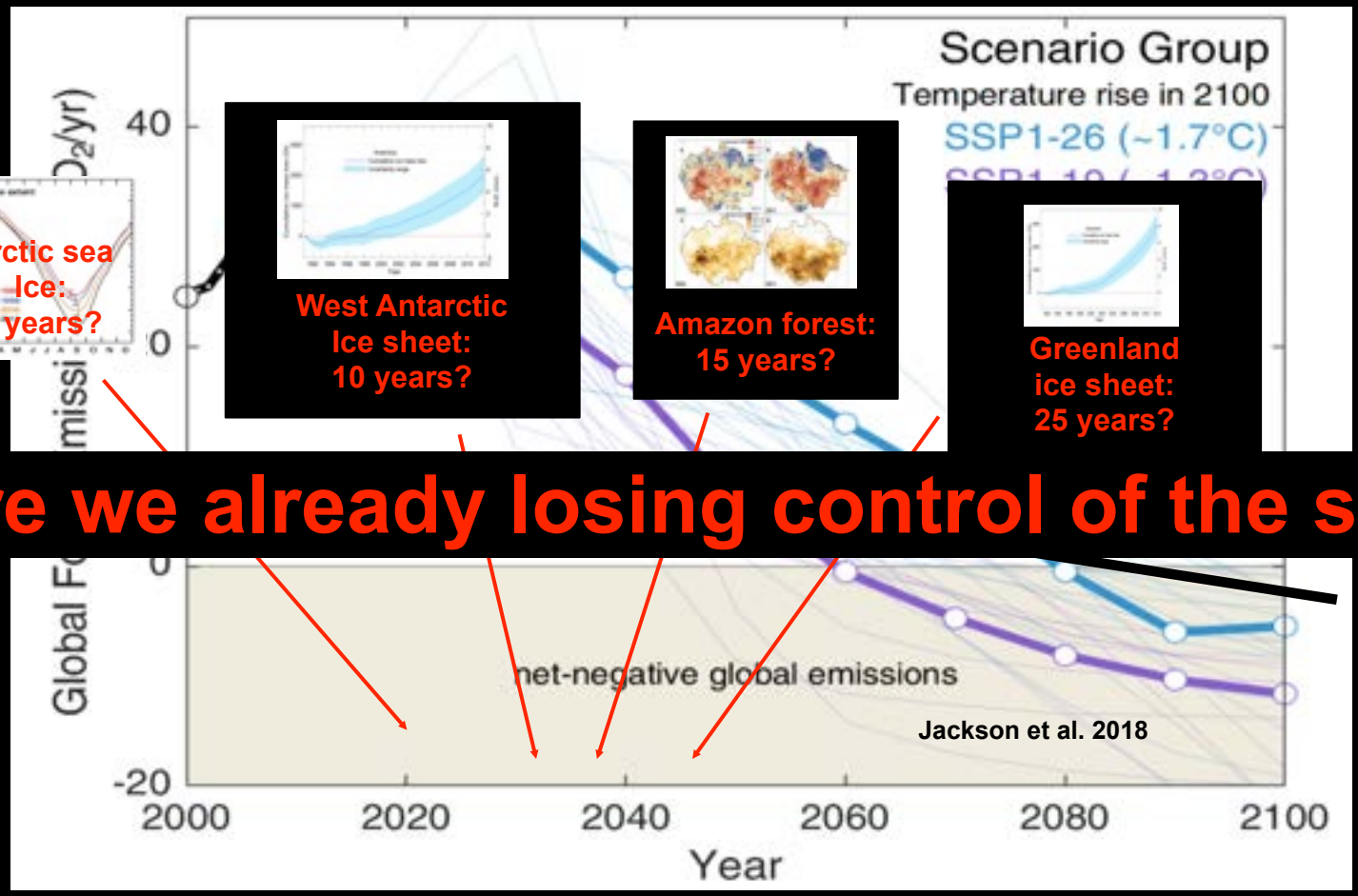

‘Intervention Times’?

Are we already losing control of the system?

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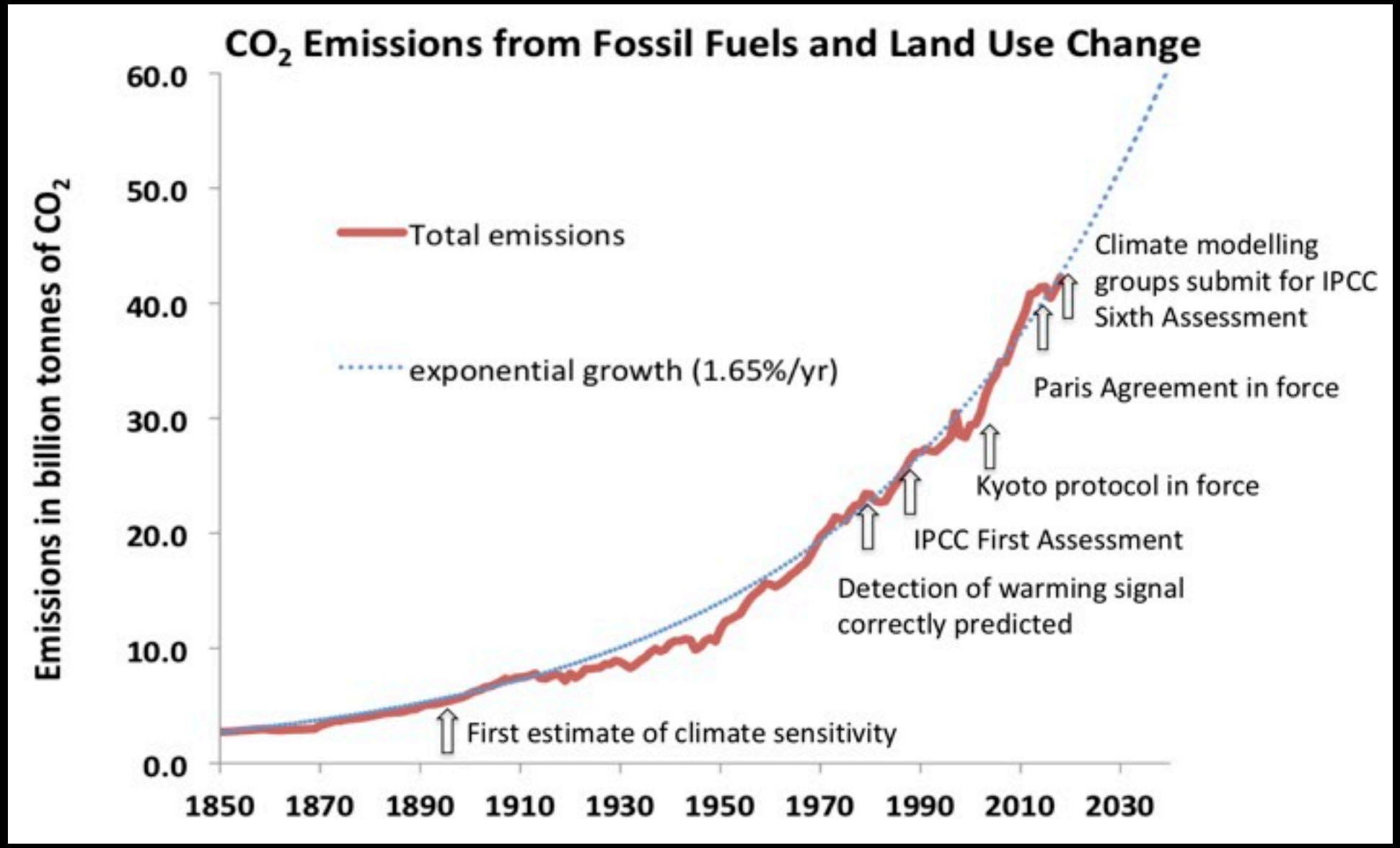
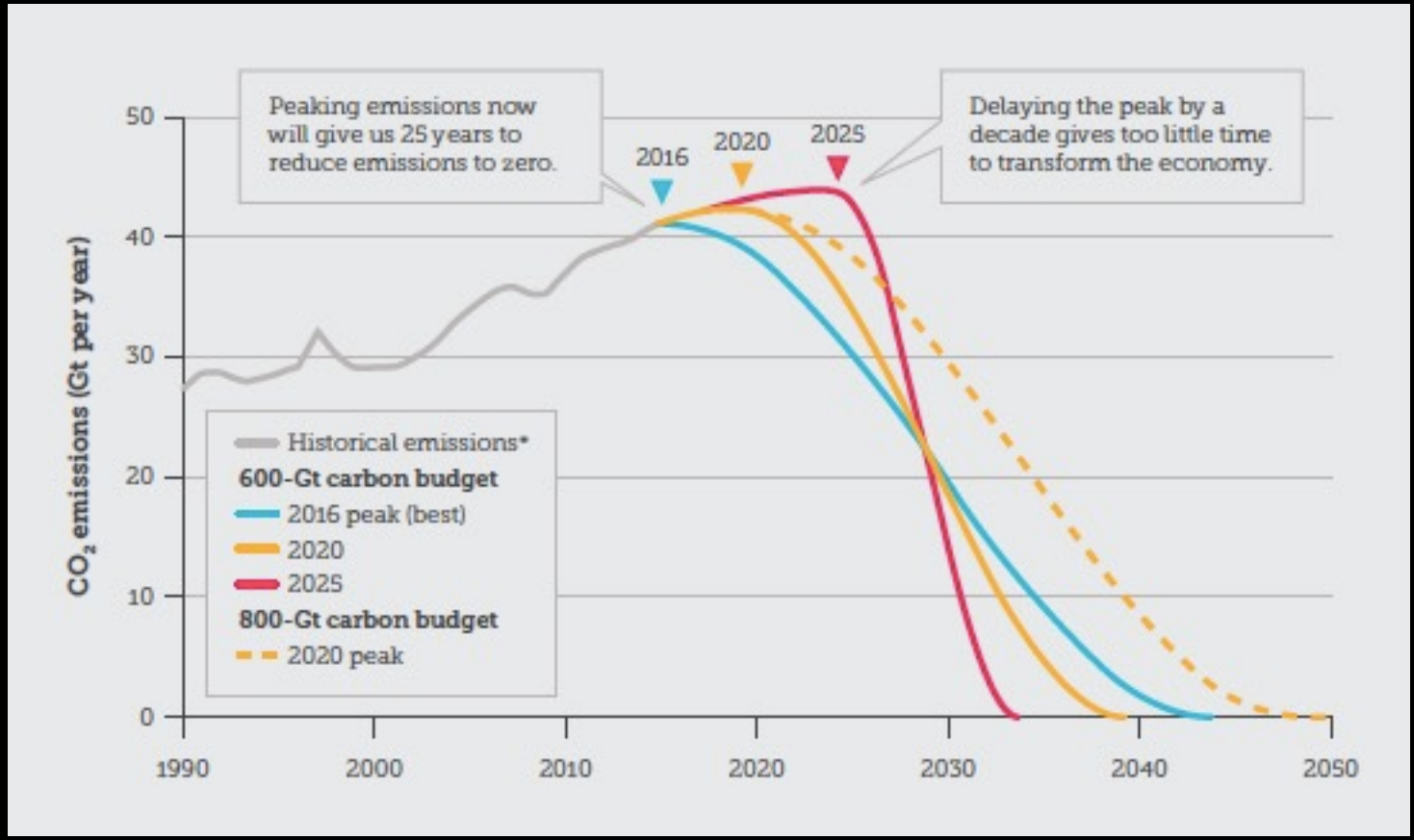
Lenton et al. 2019



Source: W. Knorr, 2019

Emission Reduction Pathways for Meeting the Paris Target



Figueres et al. 2017

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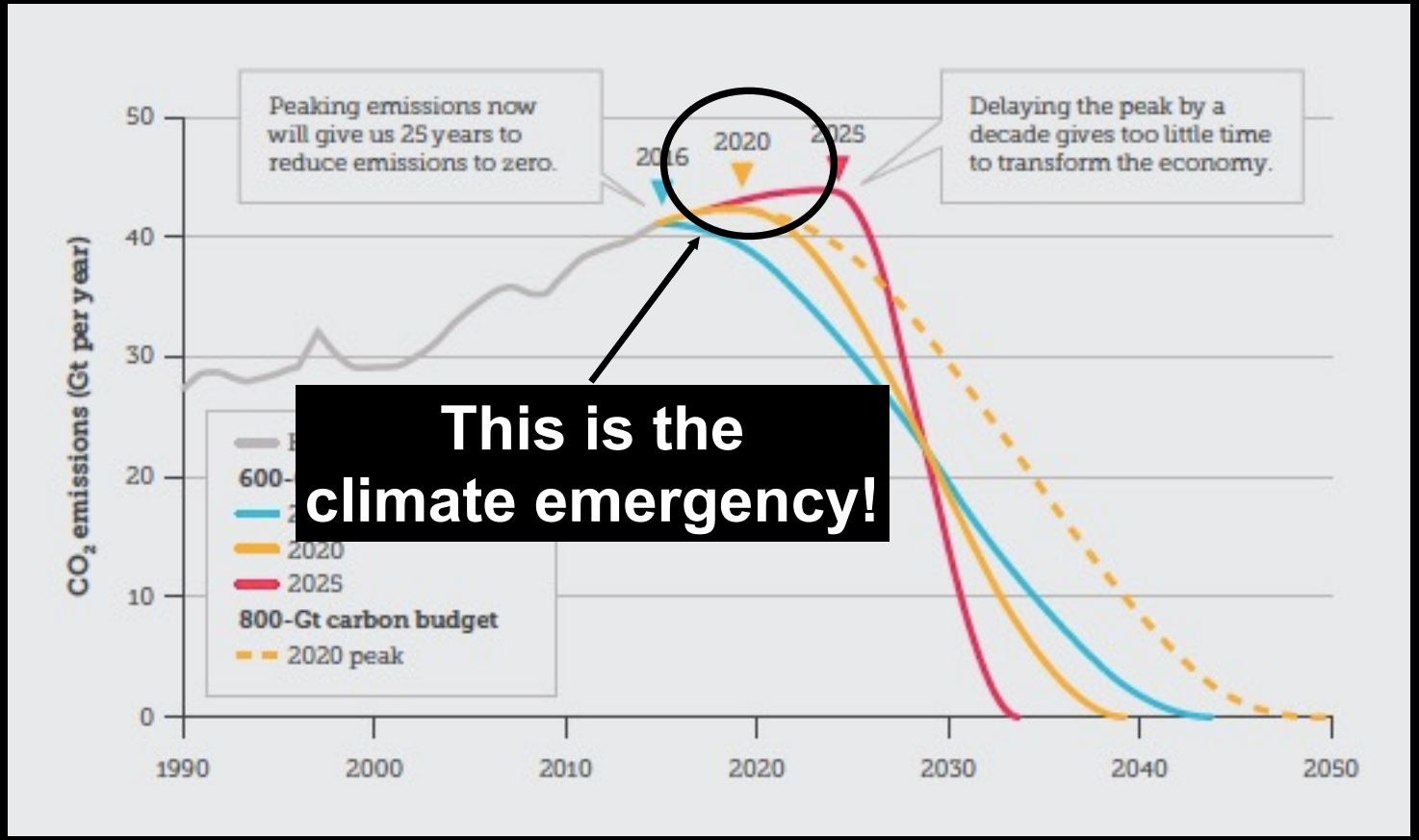

Figueres et al. 2017

Studentstrejk, Stockholm 15 mars 2019

Scientifically, the children are right:

We are facing a climate emergency

Studentstrejk, Stockholm 15 mars 2019


I've seen
Smarter
Cabinets
at
IKEA
SYSTEM
CHANGE
NOT
CLIMATE
CHANGE

Greta Thunberg

Excerpts from G.T. speech at COP24, Poland, 2018

Greta Thunberg

“Our civilization is being sacrificed for the opportunity of a very small number of people to continue making enormous sums of money.”

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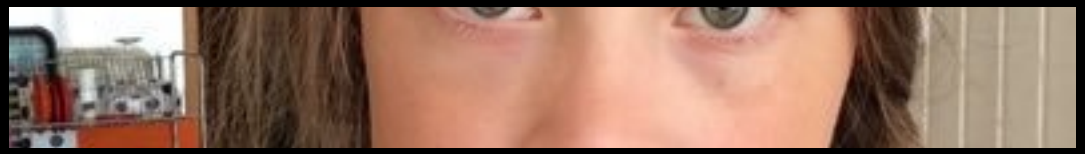
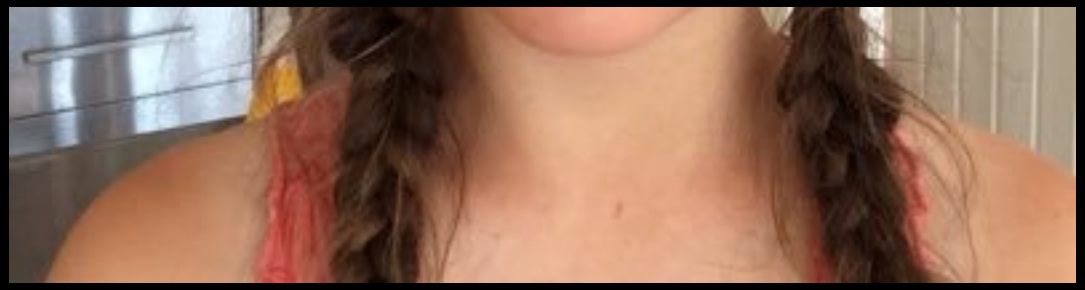
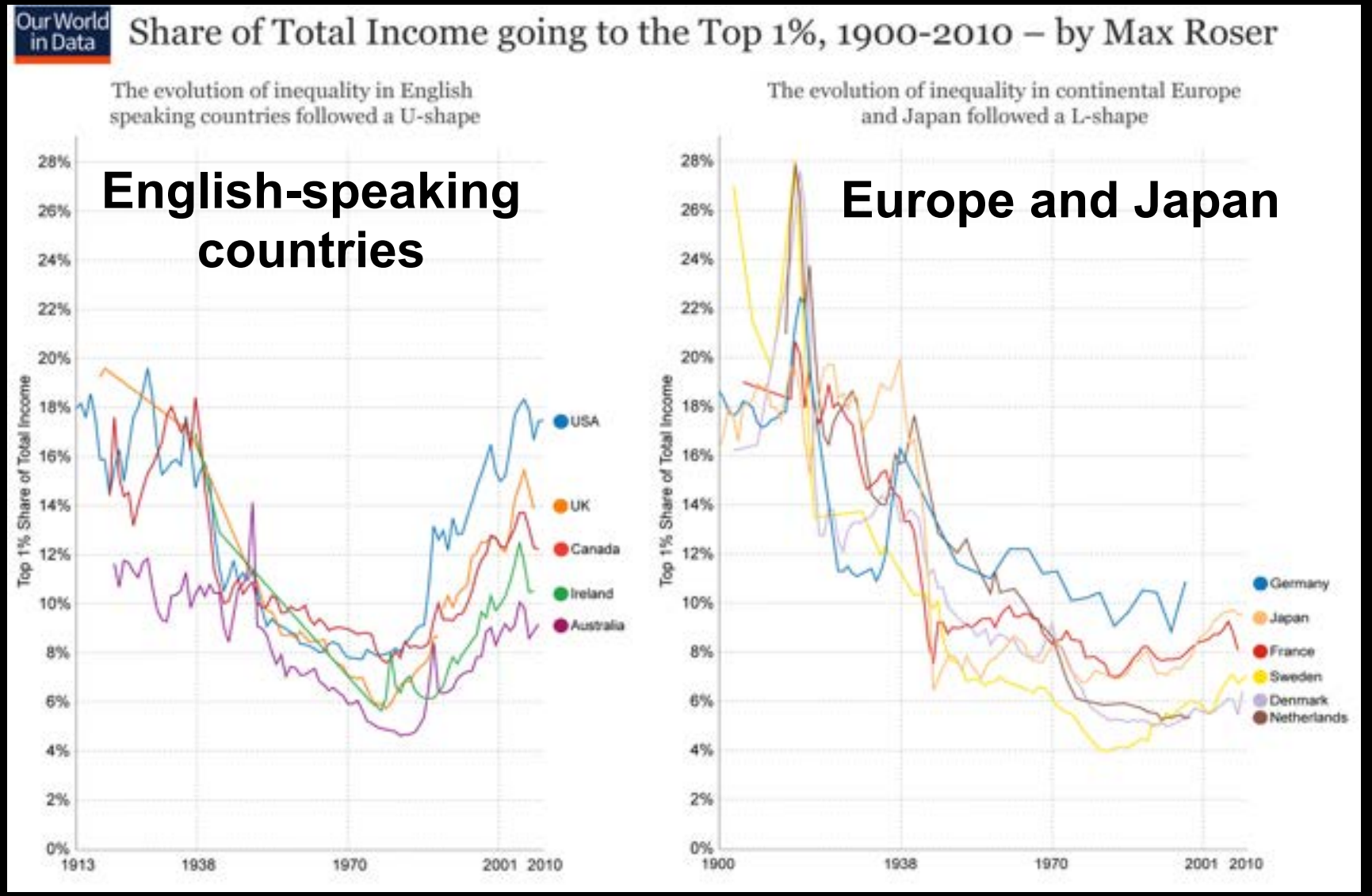


“You are stealing children’s future in front of their very eyes.”



Excerpts from G.T. speech at COP24, Poland, 2018

Evolution of Income Equality

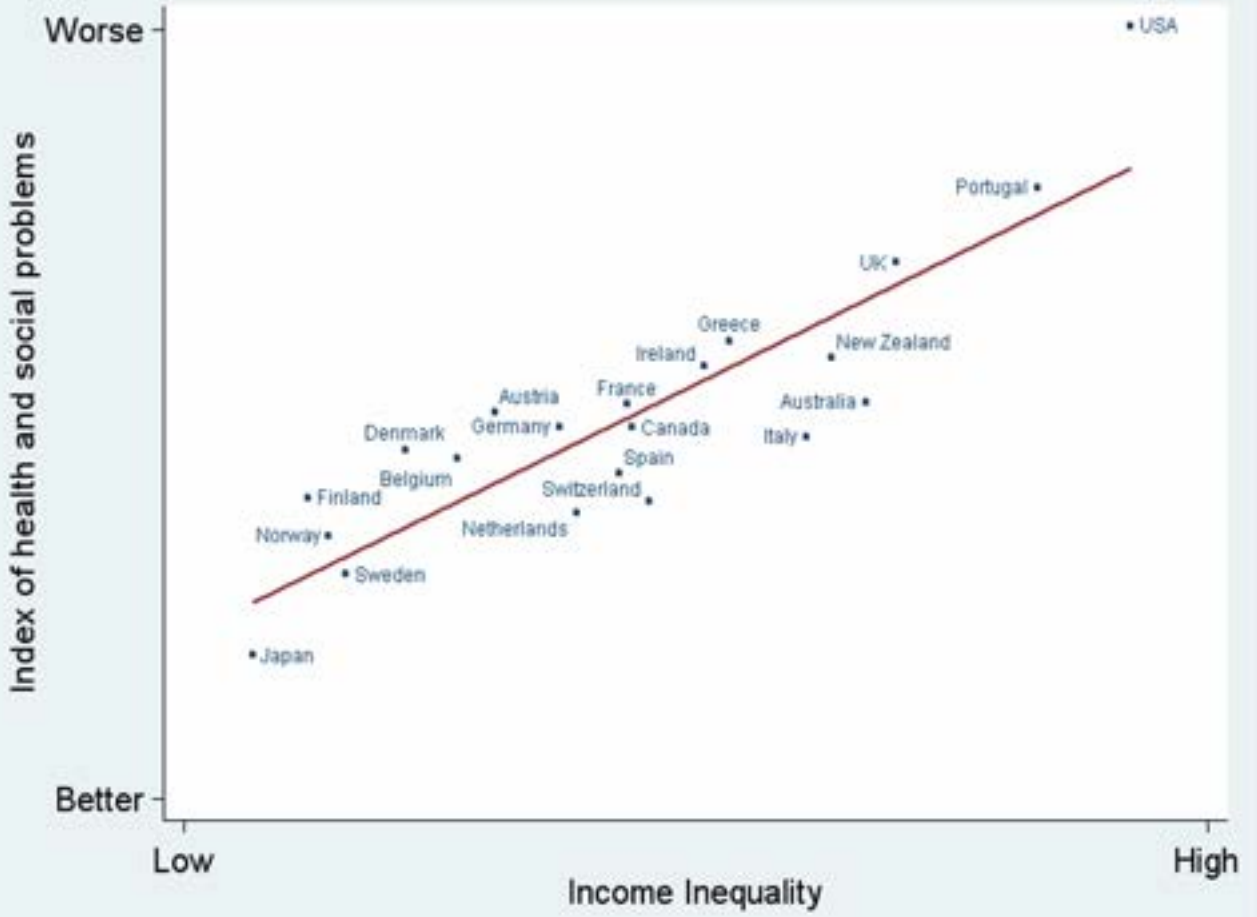


Source: S. van der Leeuw

Health and Social Problems are Worse in More Unequal Countries

Index of:

- Life expectancy
- Math & Literacy
- Infant mortality
- Homicides
- Imprisonment
- Teenage births
- Trust
- Obesity
- Mental illness – incl. drug & alcohol addiction
- Social mobility

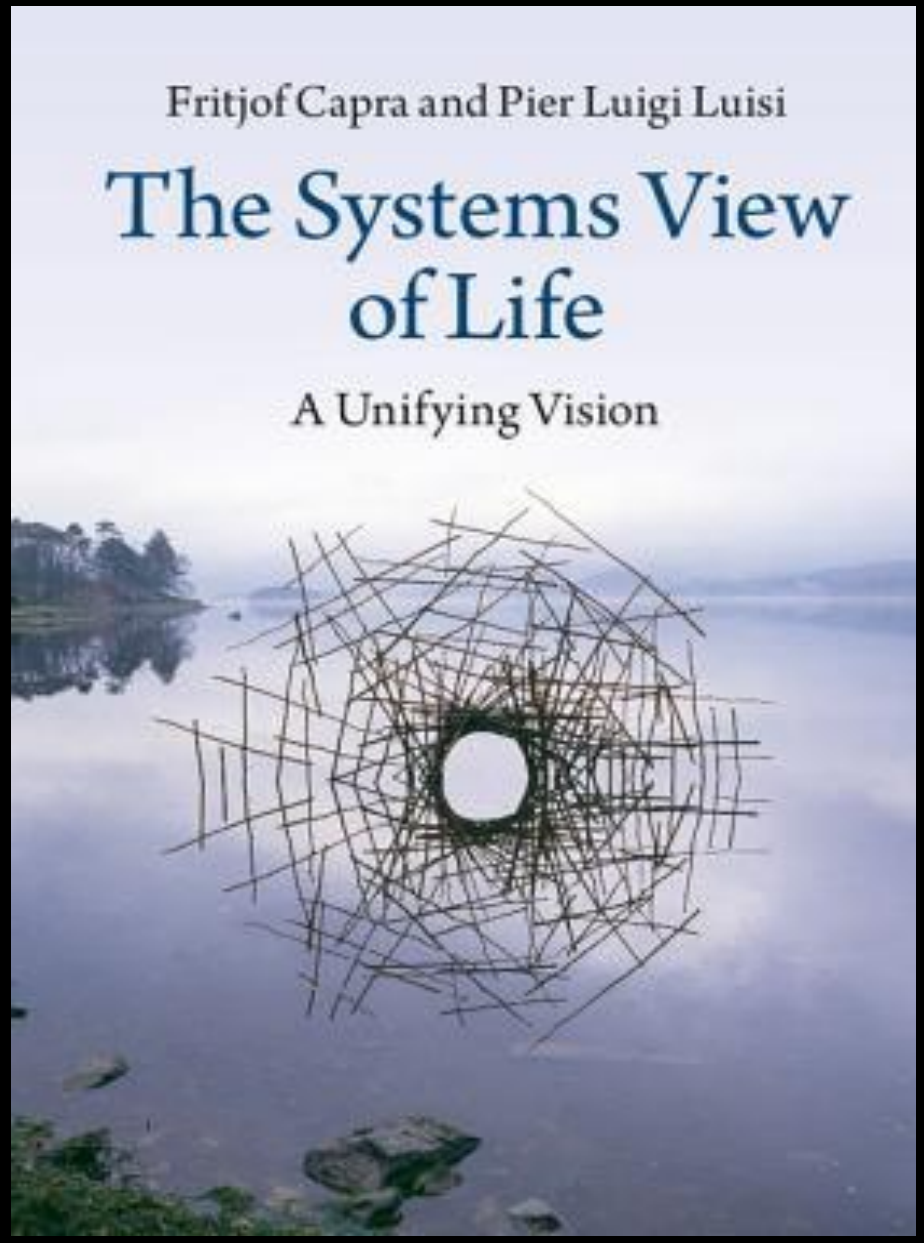


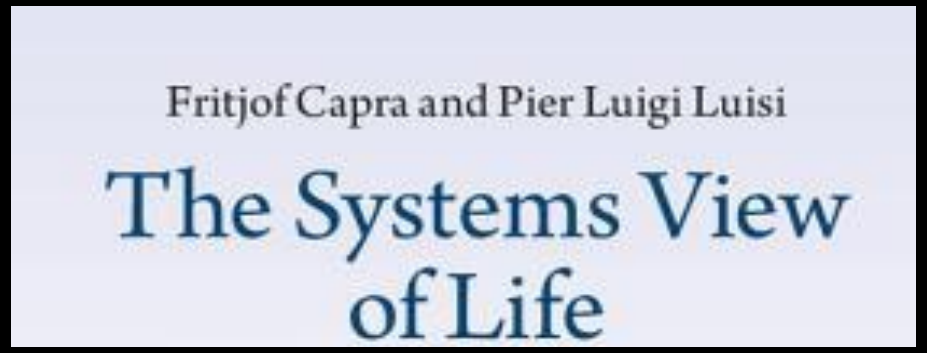
Source: Wilkinson & Pickett, The Spirit Level (2009)

www.equalitytrust.org.uk

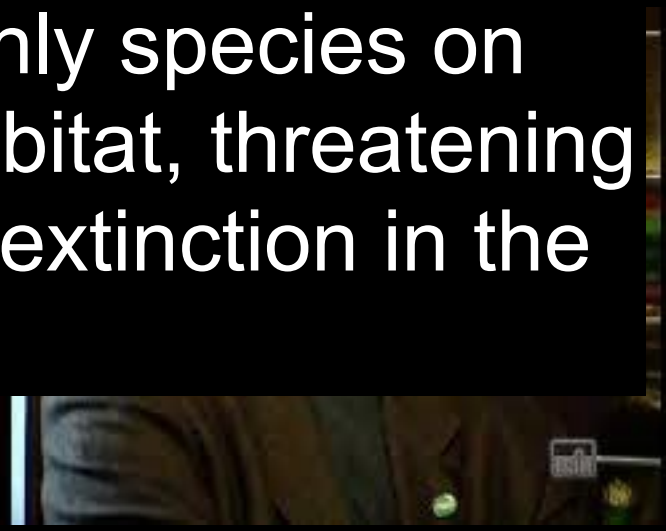
The Equality Trust

Pickett and Wilkinson 2015


Fritjof Capra and Pier Luigi Luisi
The Systems View of Life
A Unifying Vision



…Our world today is dominated by a global economic system with disastrous social and environmental impacts – “predatory capitalism”.... We are the only species on Earth who destroys its own habitat, threatening countless other species with extinction in the process.



Barriers to Climate Action in Australia

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Divisive politics: Lack of bipartisan action

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Vested interests – e.g., fossil fuel sector

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Murdoch media – Sky News, The Australian etc.

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Conservative ideologies

Cascading Pressures: Social Tipping Points
The Case of Coal

Photo: Mark Cuddy

Cascading Pressures: Social Tipping Points
The Case of Coal

- **Extreme weather: Linking coal to climate impacts**

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Cascading Pressures: Social Tipping Points
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- Technology/economics: Dramatic cost reductions for renewables

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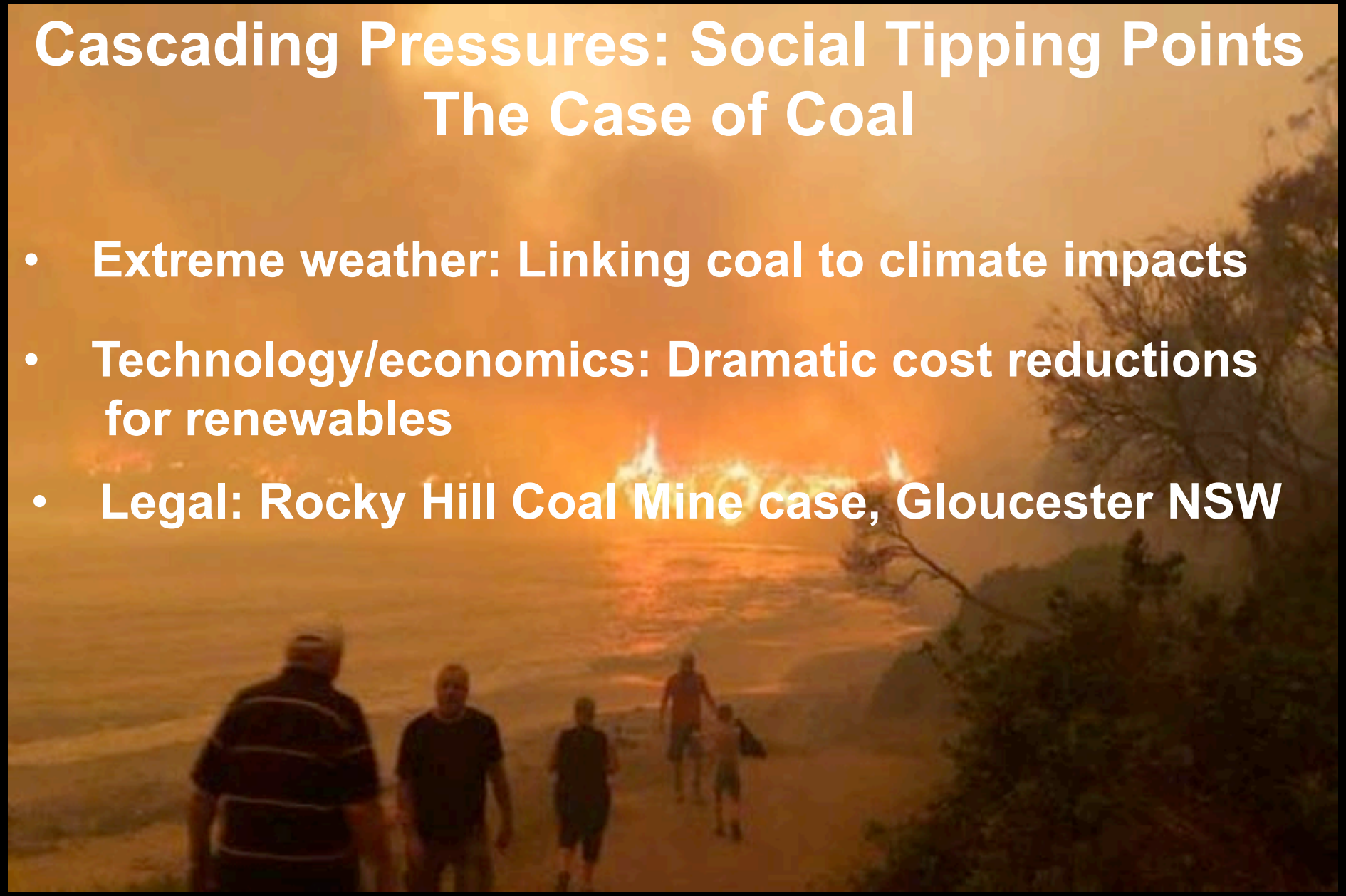

Photo: Mark Cuddy

Cascading Pressures: Social Tipping Points
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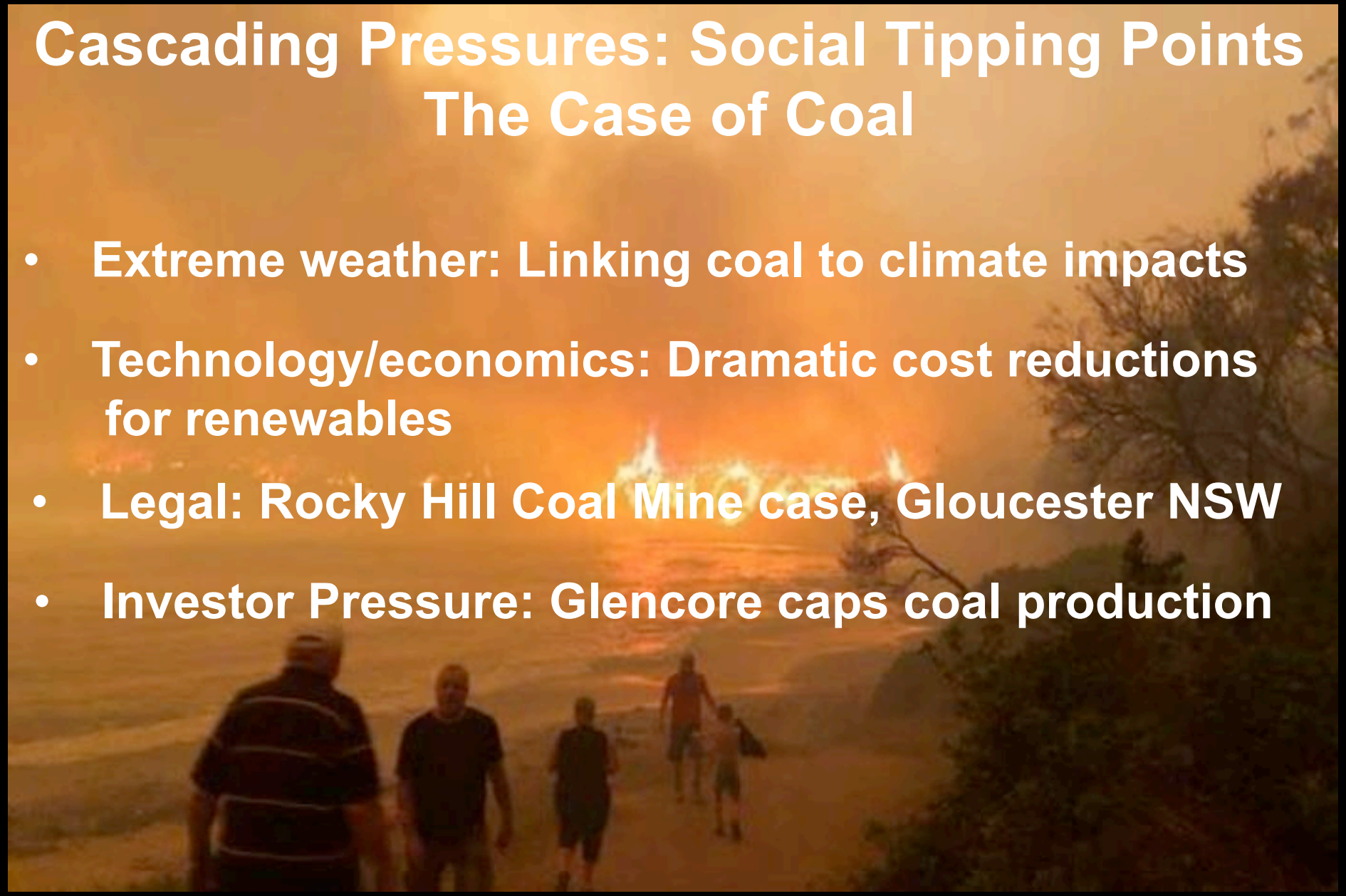

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Cascading Pressures: Social Tipping Points
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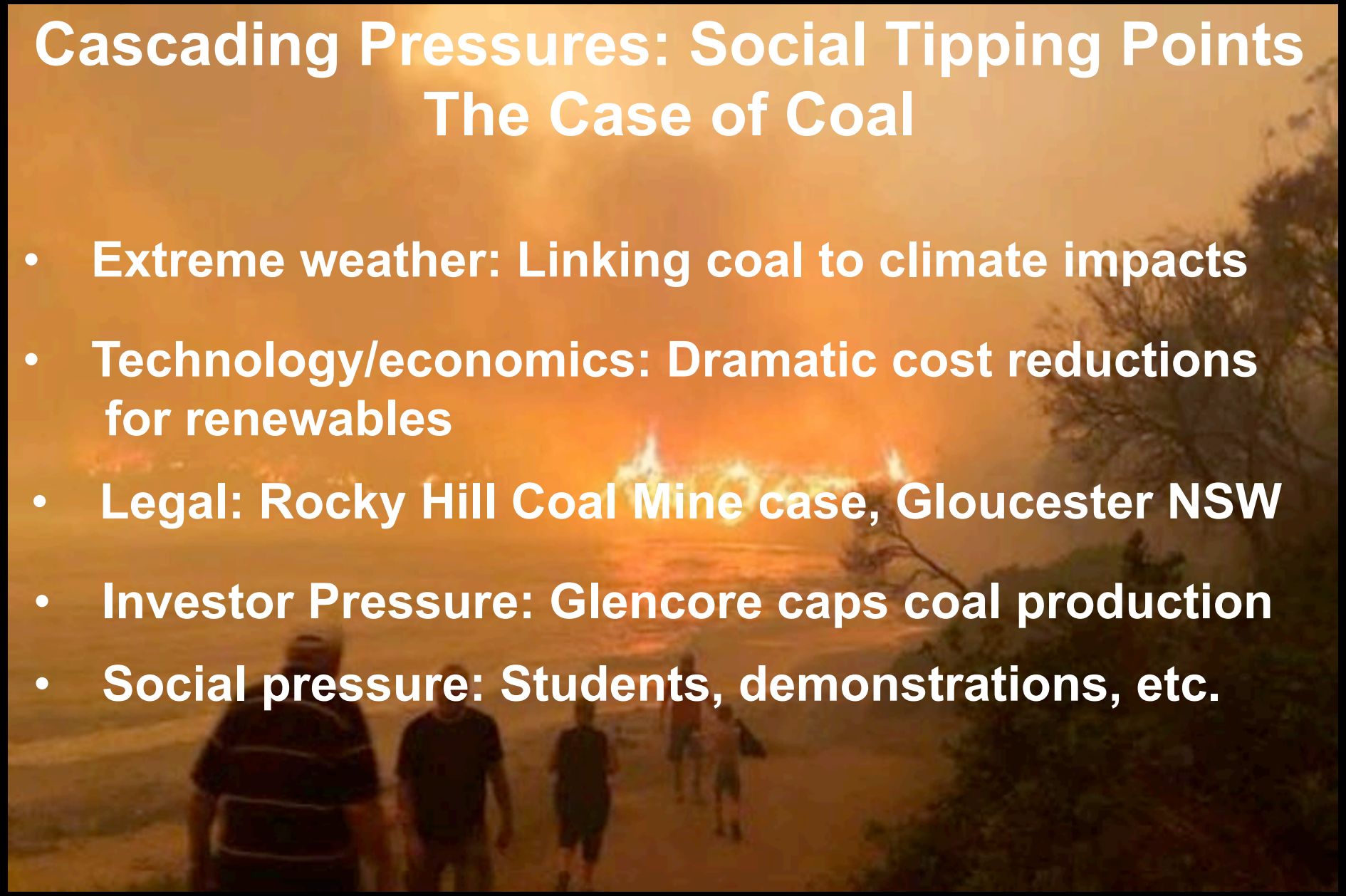
- Investor Pressure: Glencore caps coal production
- Social pressure: Students, demonstrations, etc.



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Approaching a Social Tipping Point?

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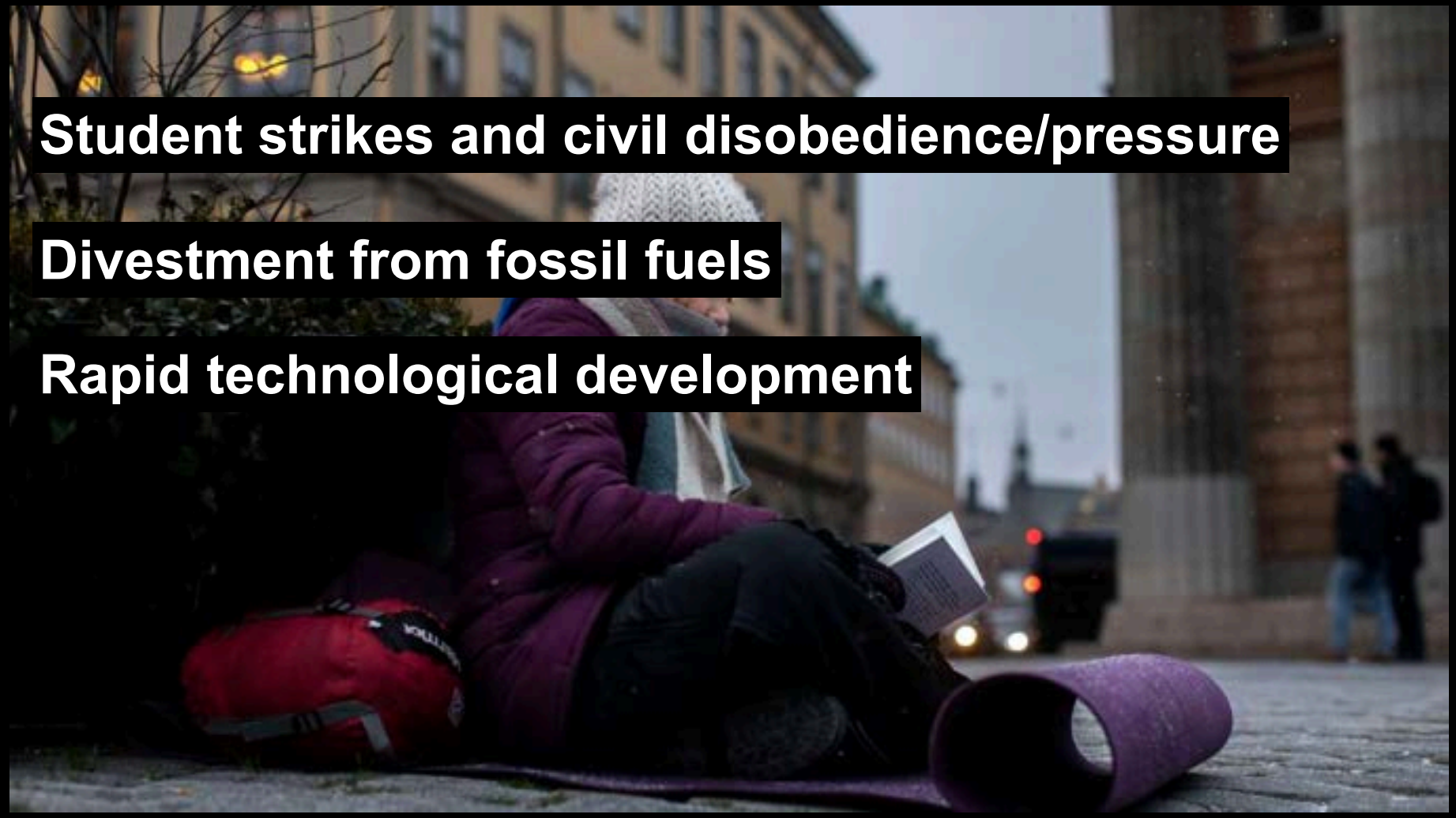

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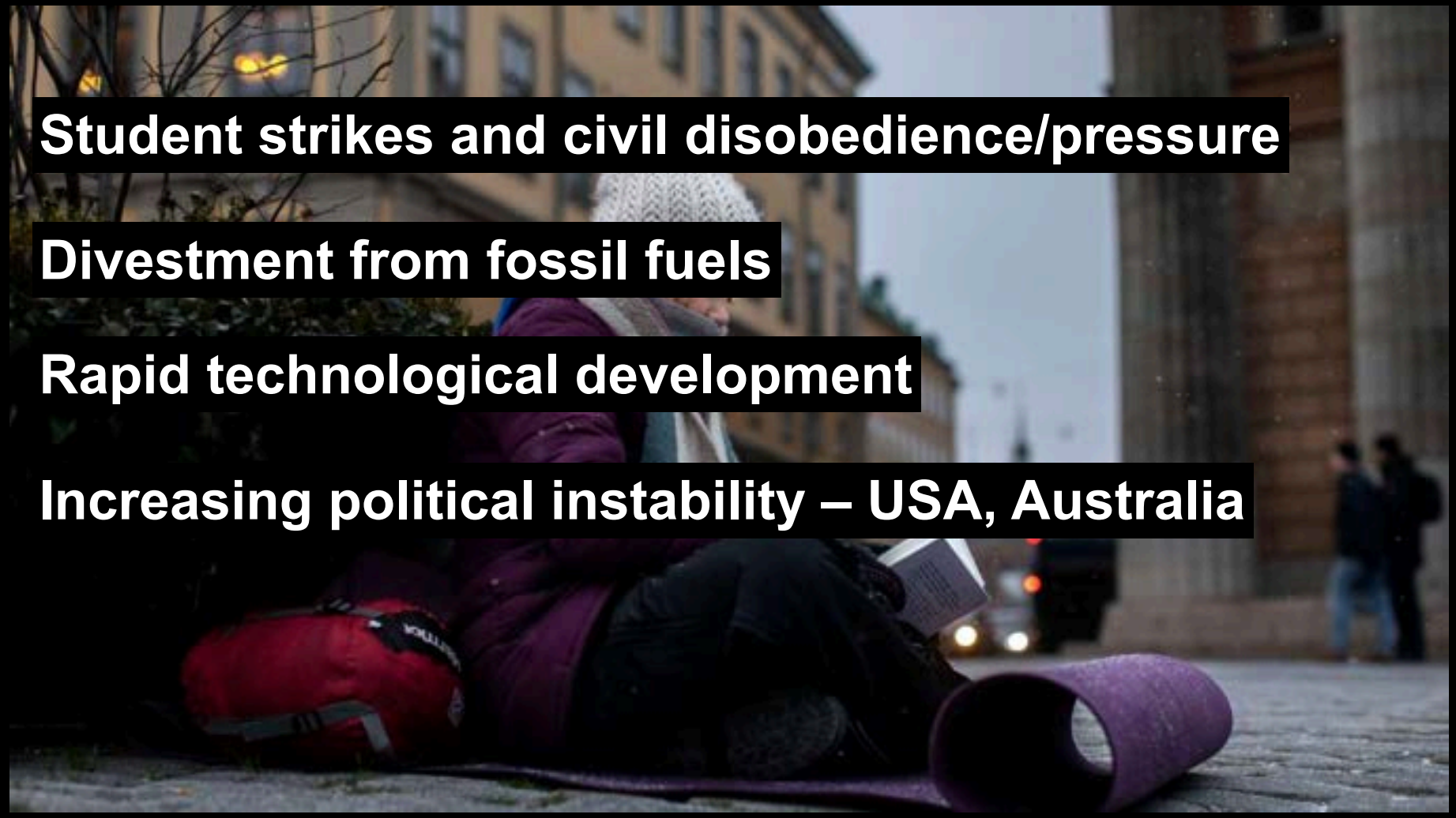

Student strikes and civil disobedience/pressure

Divestment from fossil fuels

Rapid technological development

Increasing political instability – USA, Australia

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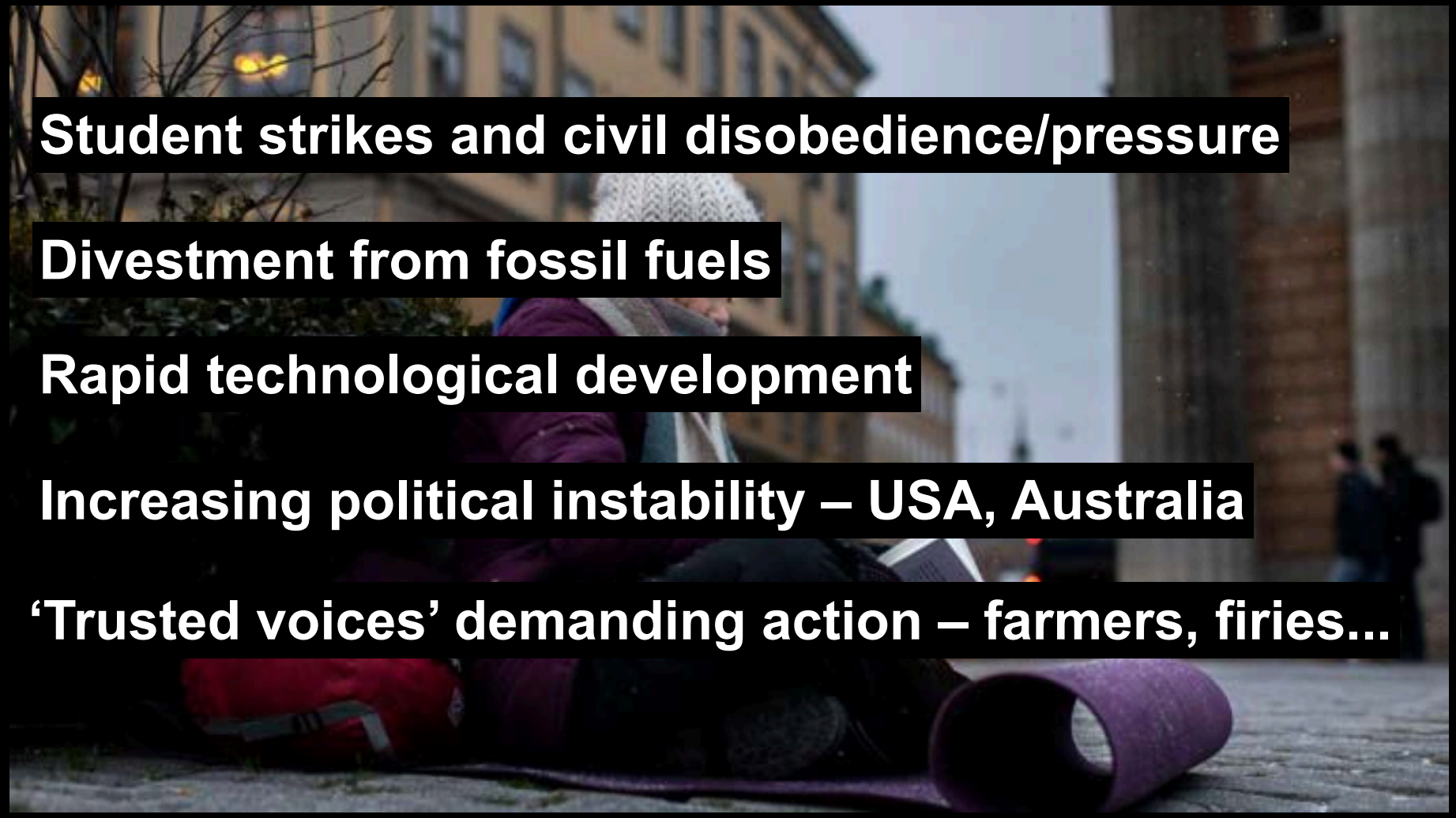

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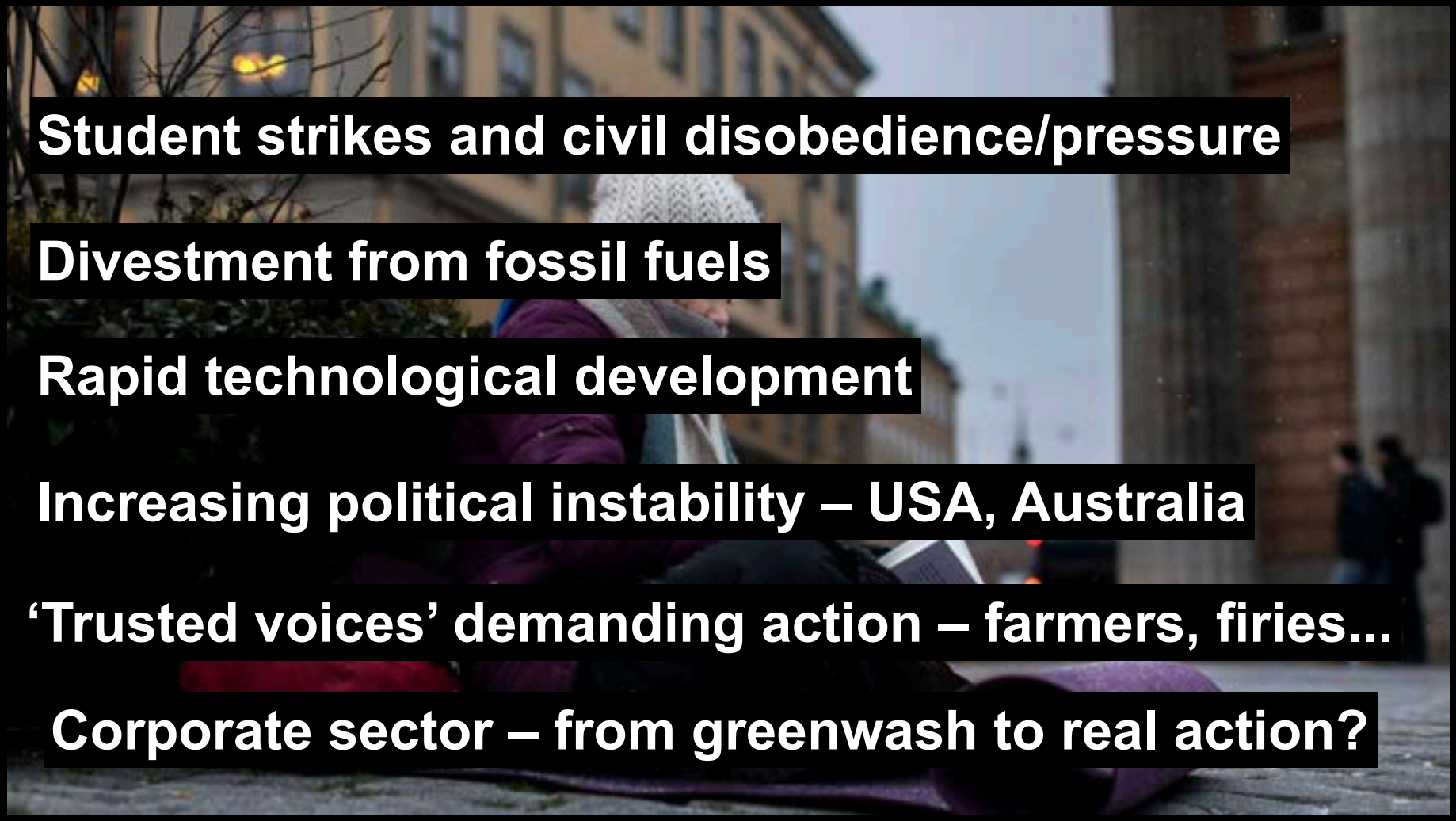

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Corporate sector – from greenwash to real action?

Responding to climate change and the coronavirus: What's the same, what's different?

<u>Similarities:</u>

1. **Respect the science!**

2. **Act BEFORE the real crisis hits! 'Flatten the curve'**

3. **Meeting the crisis takes precedence over other aspects of society: economy, sport, education etc**

…..and.....

Differences:

1. **The COVID-19 crisis is immediate. Climate change is a 'long fuse big bang' crisis (although increasingly serious impacts are already occurring).**

2. **Unlike COVID-19 which is damaging the economy, meeting the climate change challenge can lead to a healthier, more dynamic society and economy. But rapid, fundamental change is required!**

A COVID-19 type Response to Climate Change: Flattening the Curve!

South Canberra, January 2020

Photo: Brook Mitchell/Stringer/Getty Images

A COVID-19 type Response to Climate Change: Flattening the Curve!

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A COVID-19 type Response to Climate Change: Flattening the Curve!

World: there's no way we can shut everything down in order to lower emissions, slow climate change and protect the environment.

Mother Nature: here's a virus. Practice.