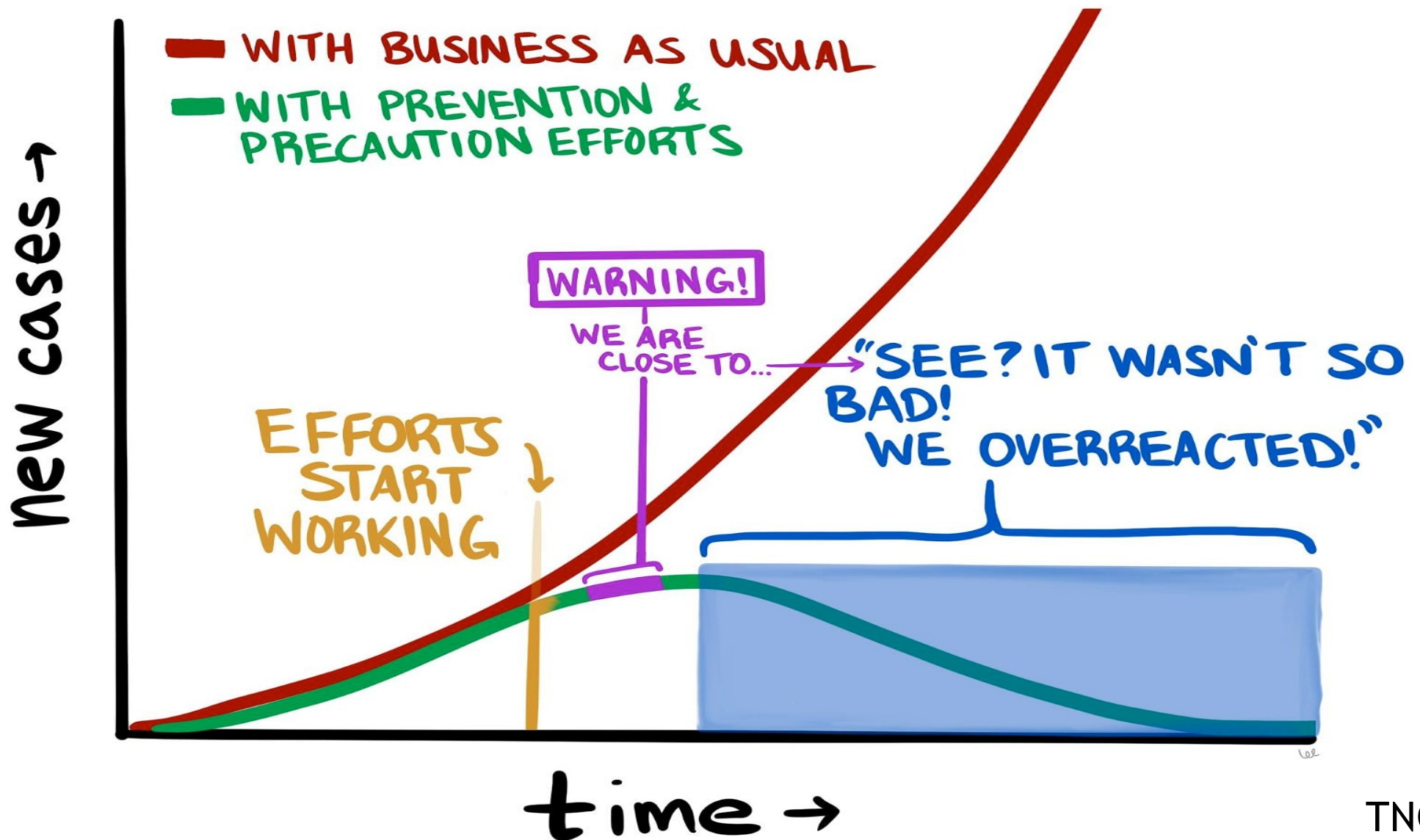
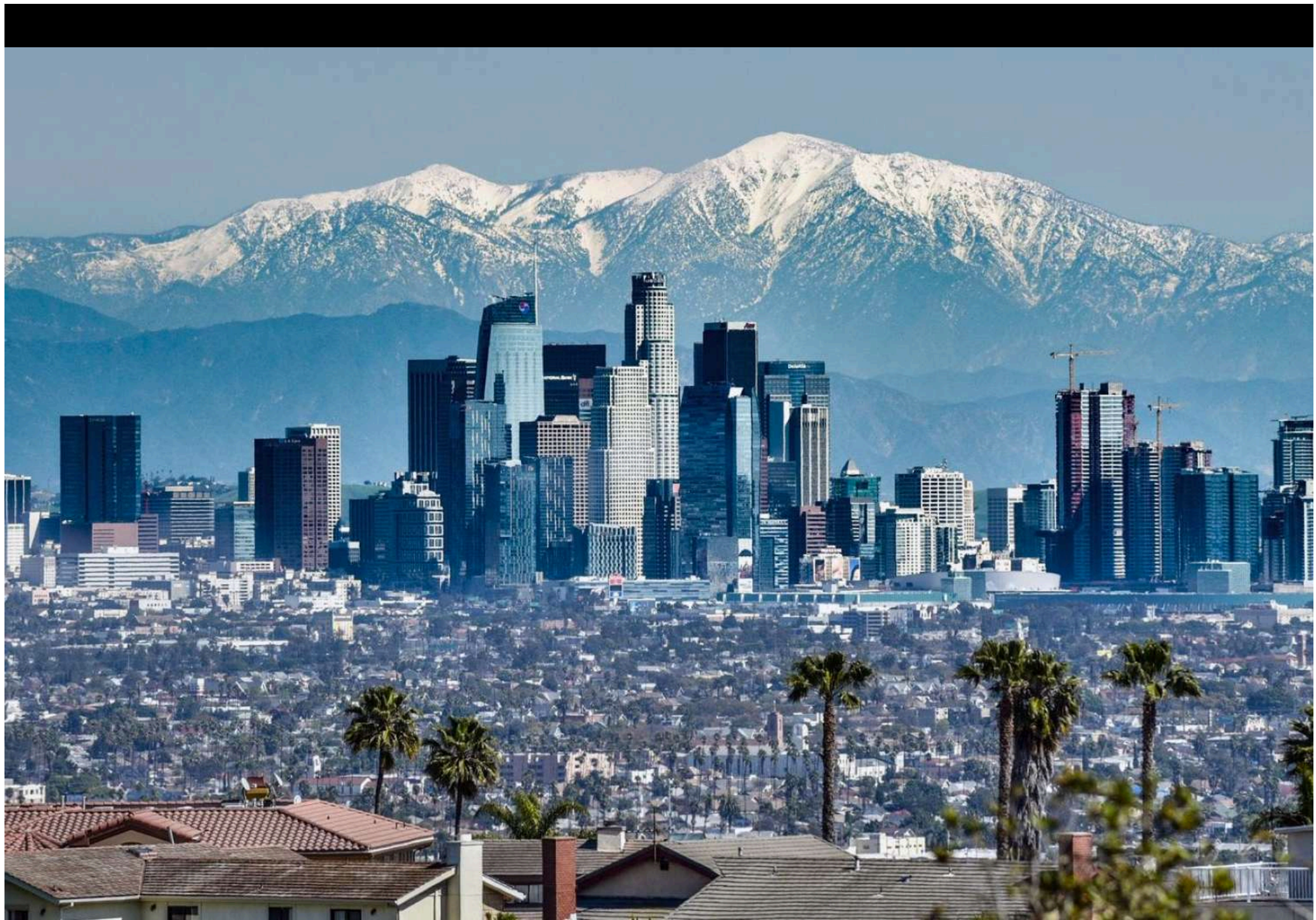


Thinking About Climate Change During These Times









<https://www.nytimes.com/2020/01/10/world/australia/australia-wildfires-photos.html>



First things first!



Amber Arnold, Wisconsin State Journal

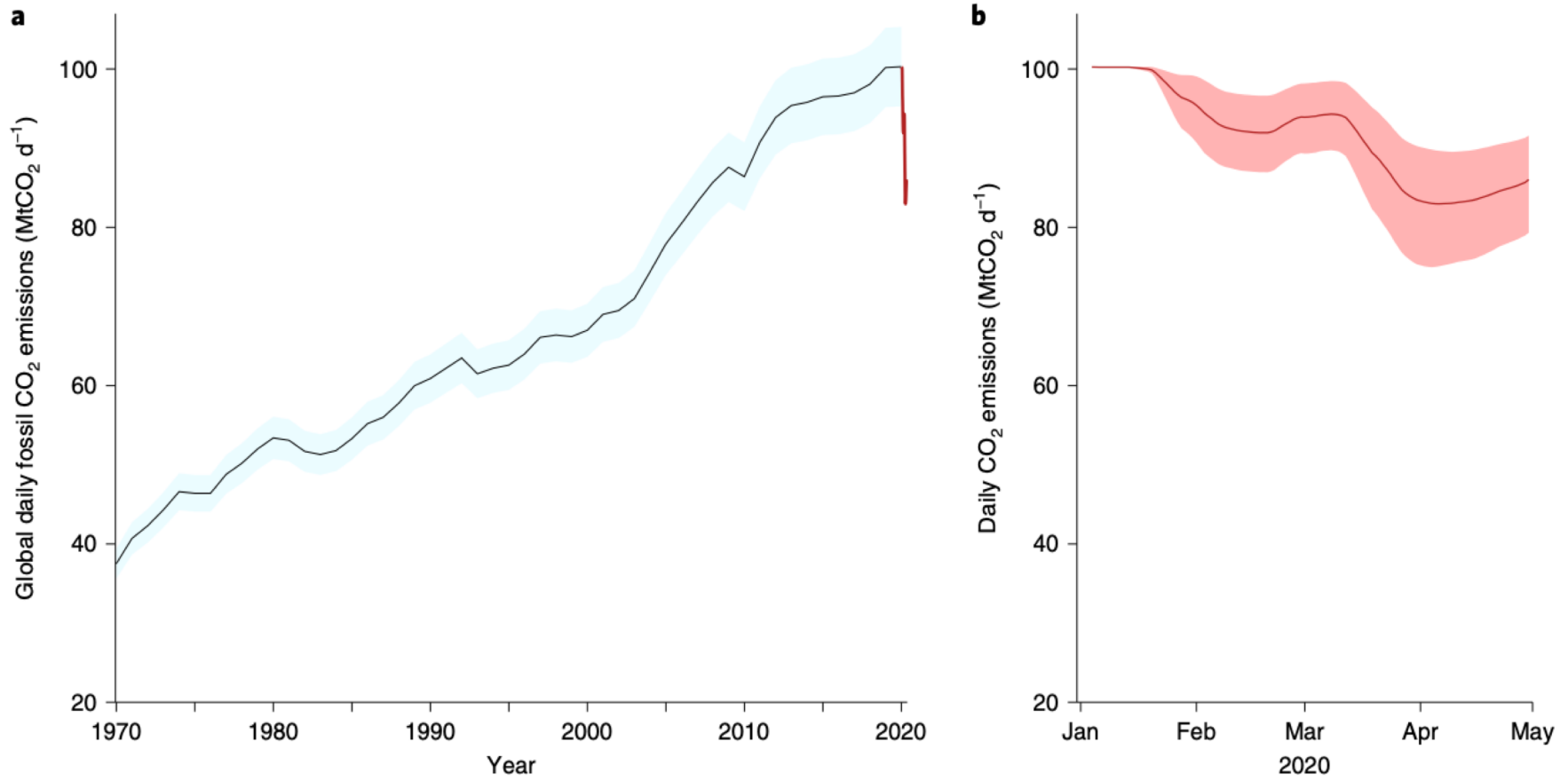
What we don't learn

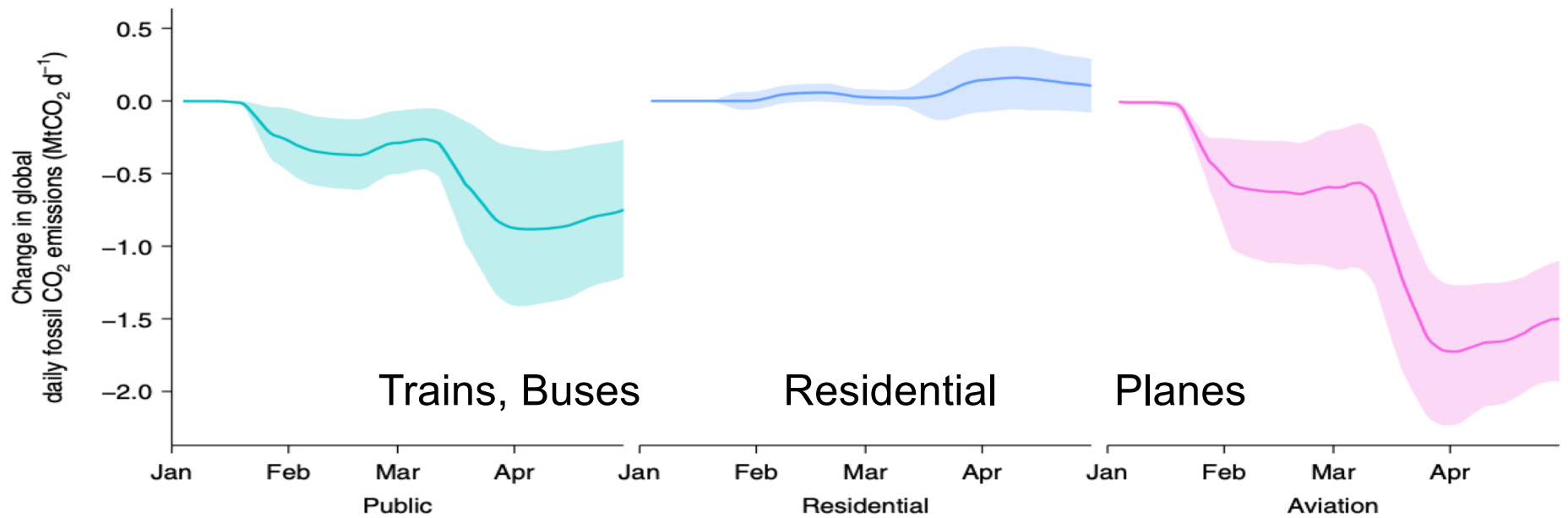
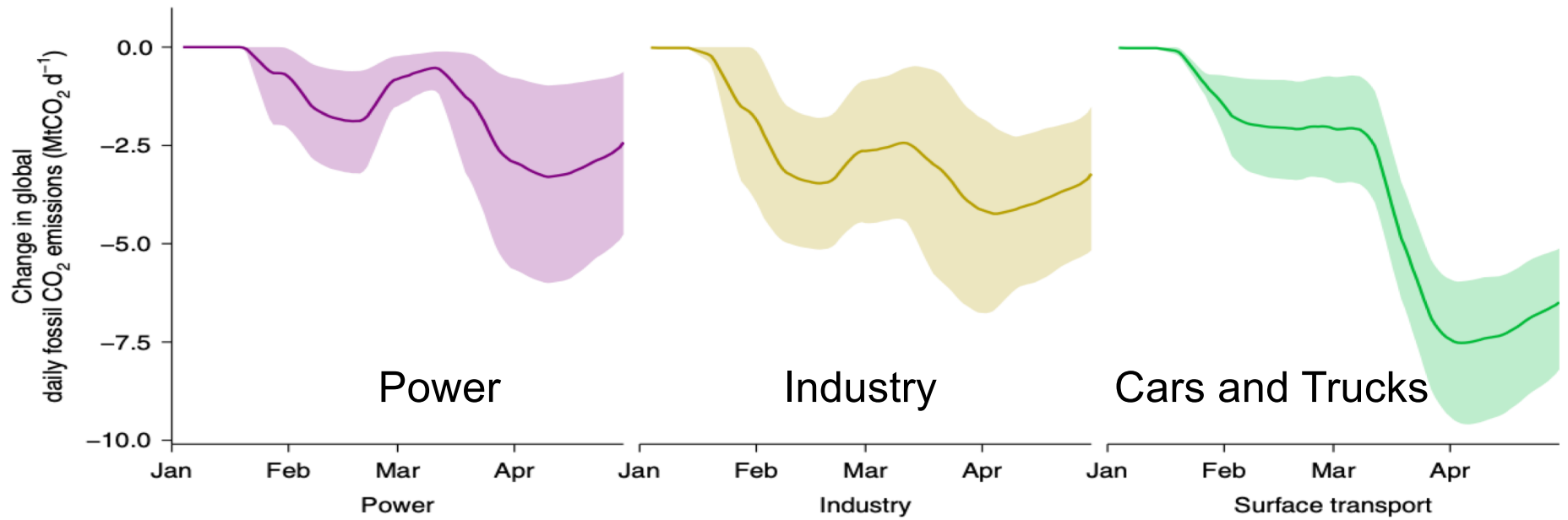
Fact check: The coronavirus pandemic isn't slowing climate change

[Matthew Brown](#), USA TODAY

Published 2:00 a.m. MT May 11, 2020 | Updated 9:34 a.m. MT May 11, 2020

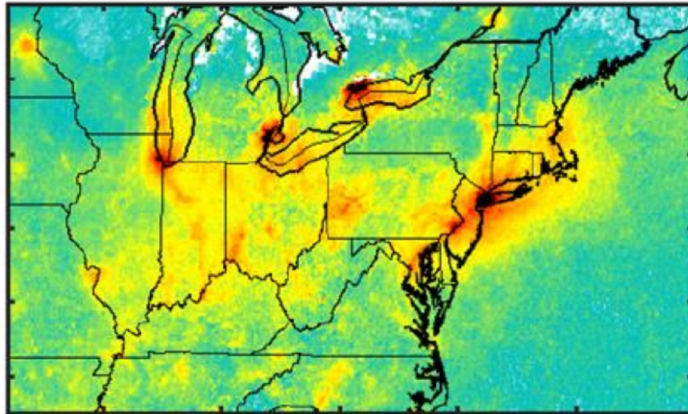
Global lockdowns led to a 17% drop in April CO₂ emissions, ~5-8% for the year



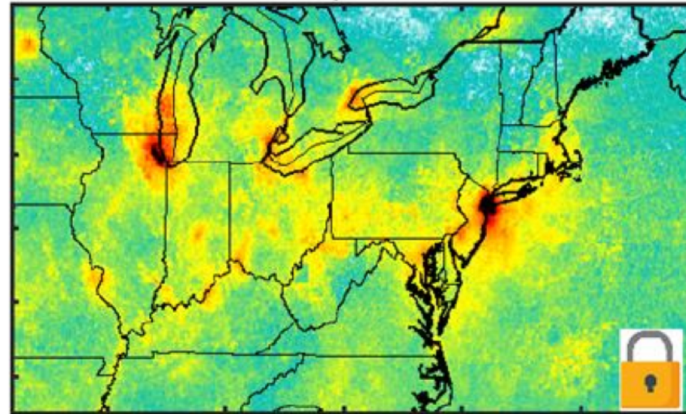


After
(2020)

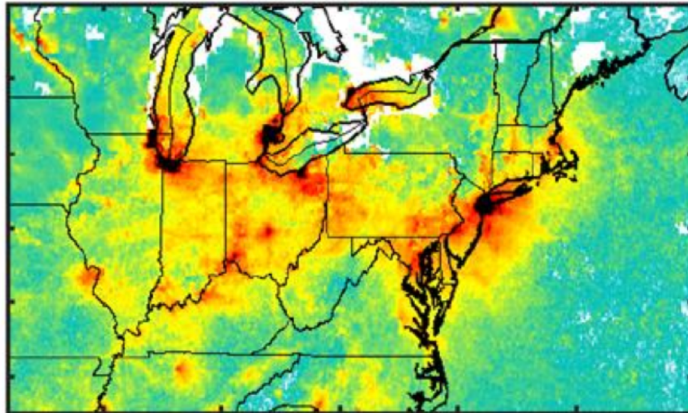
a. 23-Feb to
14-Mar-2020



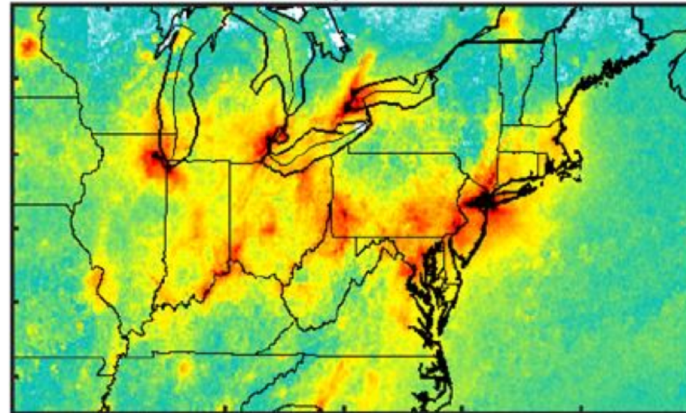
b. 24-Mar to
12-Apr-2020



c. 23-Feb to
15-Mar-2019



d. 24-Mar to
12-Apr-2019

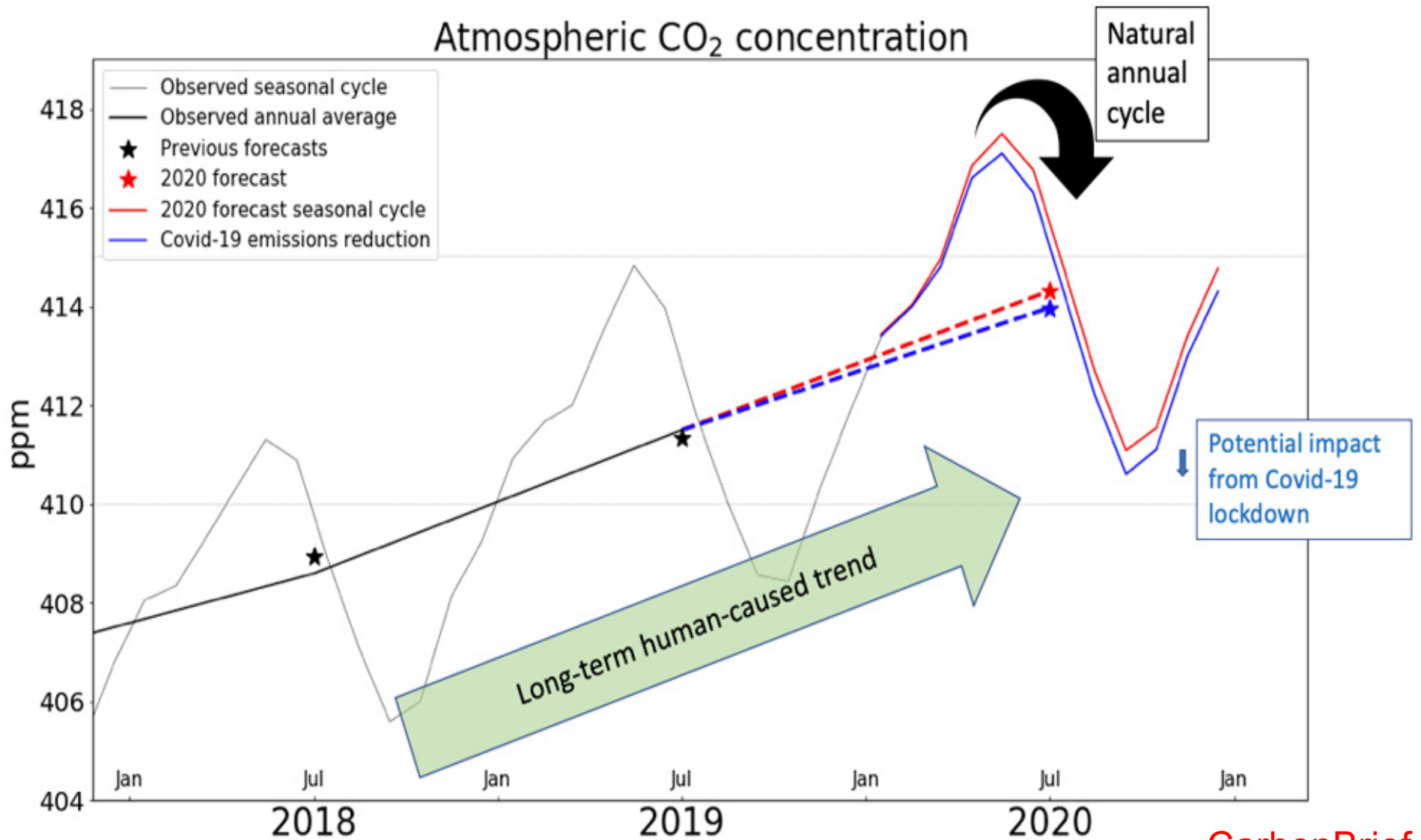


Before
(2019)

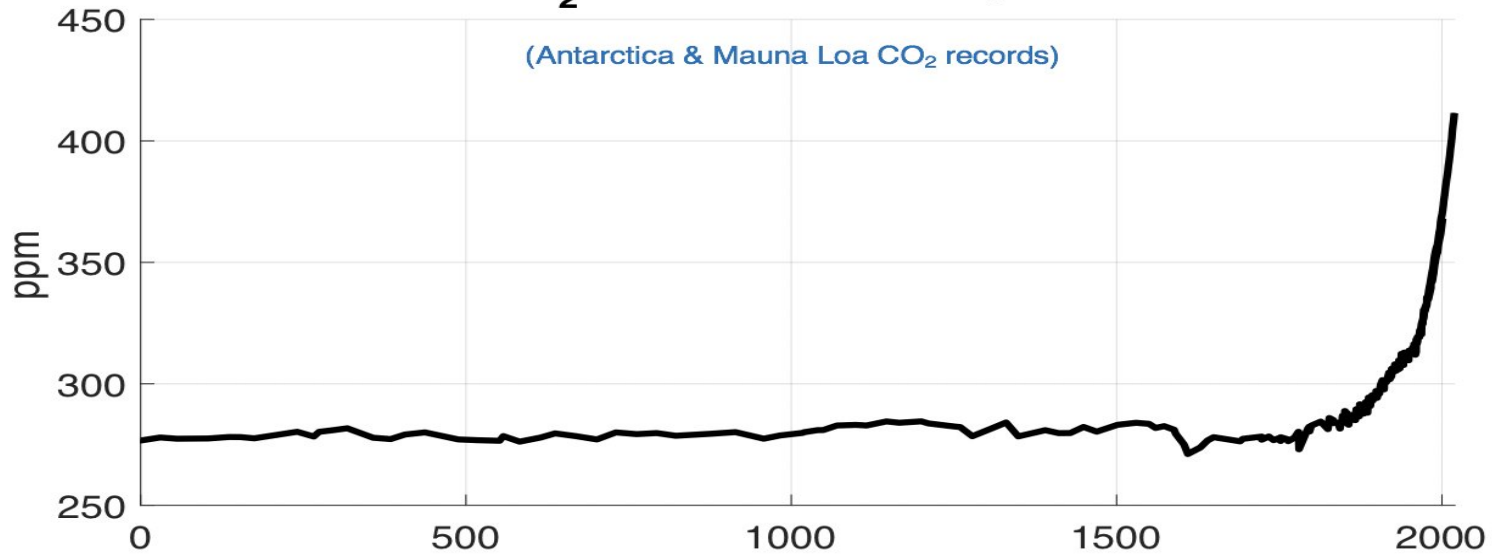
TROPOMI NO₂ (10¹⁵ molec. cm⁻²)



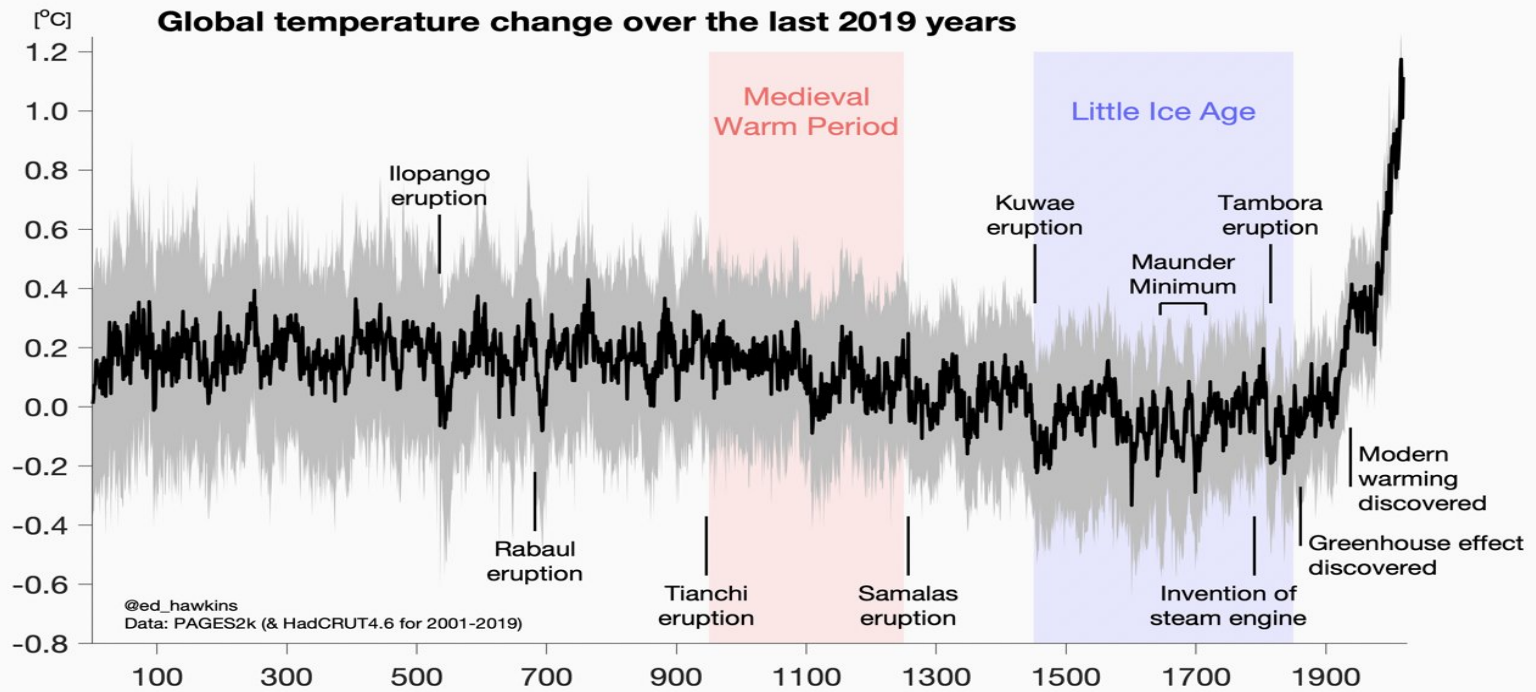
Lockdowns are not the solution to our environmental challenges



CO₂ over the last 2019 years



Global temperature change over the last 2019 years



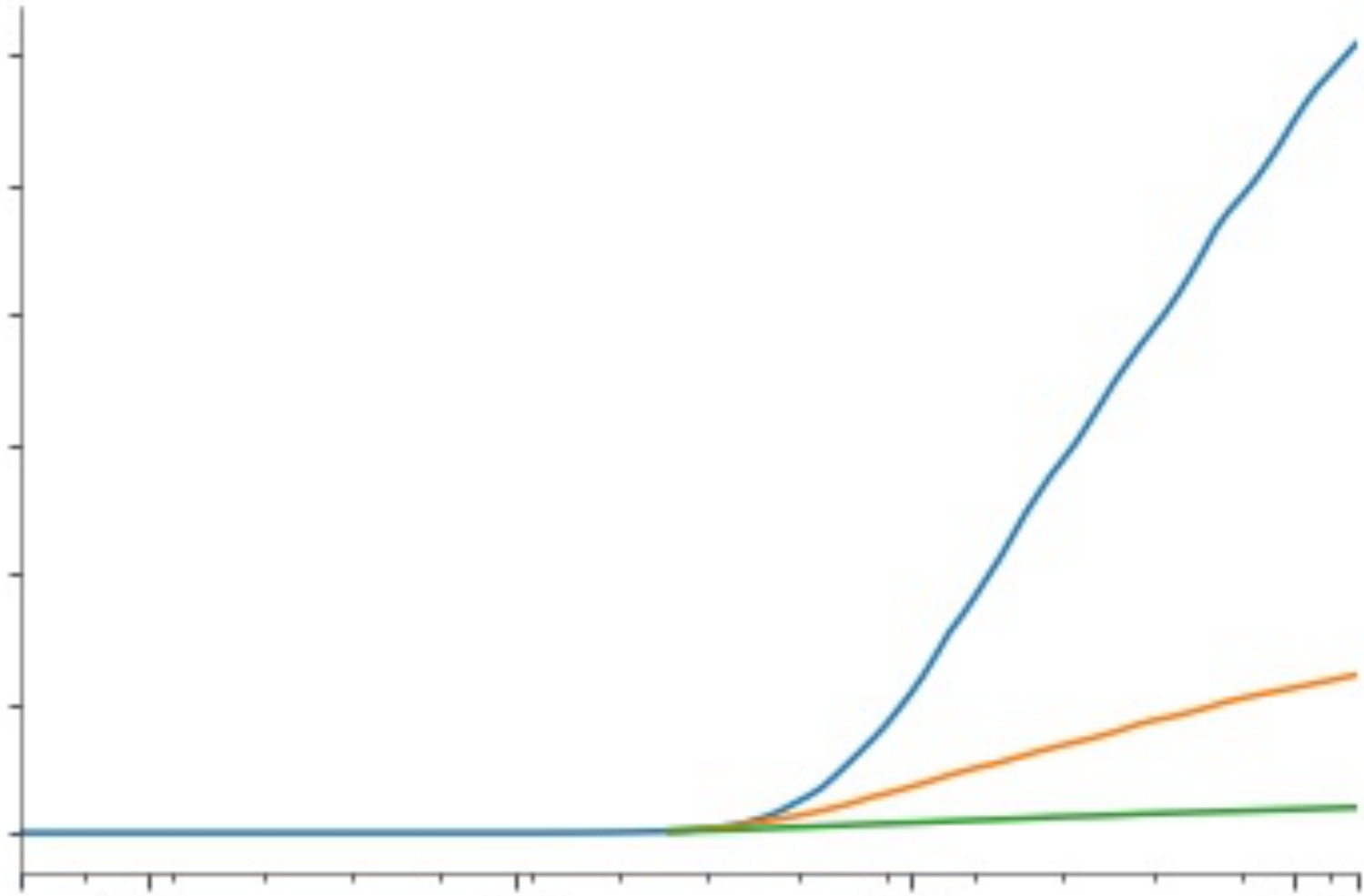
What we do learn

MY SOURDOUGH STARTER
IS COMING ALONG NICELY!

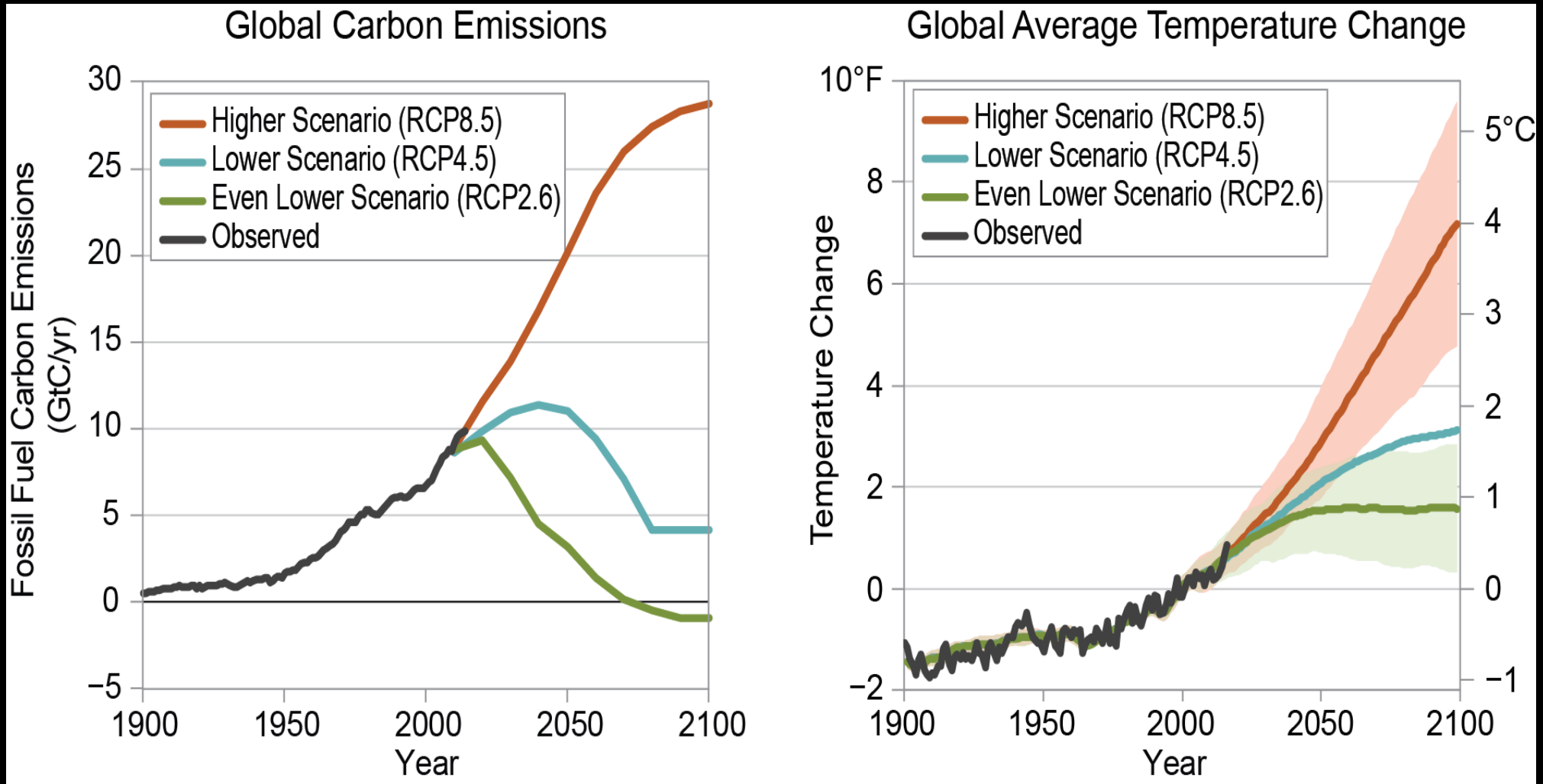


THEORY: THE CORONAVIRUS IS A
YEAST SYMBIONT WITH AN *EXTREMELY*
CONVOLUTED PARASITIC LIFE CYCLE.

Early action makes an impact



What does bending the climate curve look like?



The continued release of CO₂ to the atmosphere from burning fossil fuels would “almost certainly cause significant changes” and “could be deleterious from the point of view of human beings [...] and marked changes in climate, not controllable through local or even national efforts.

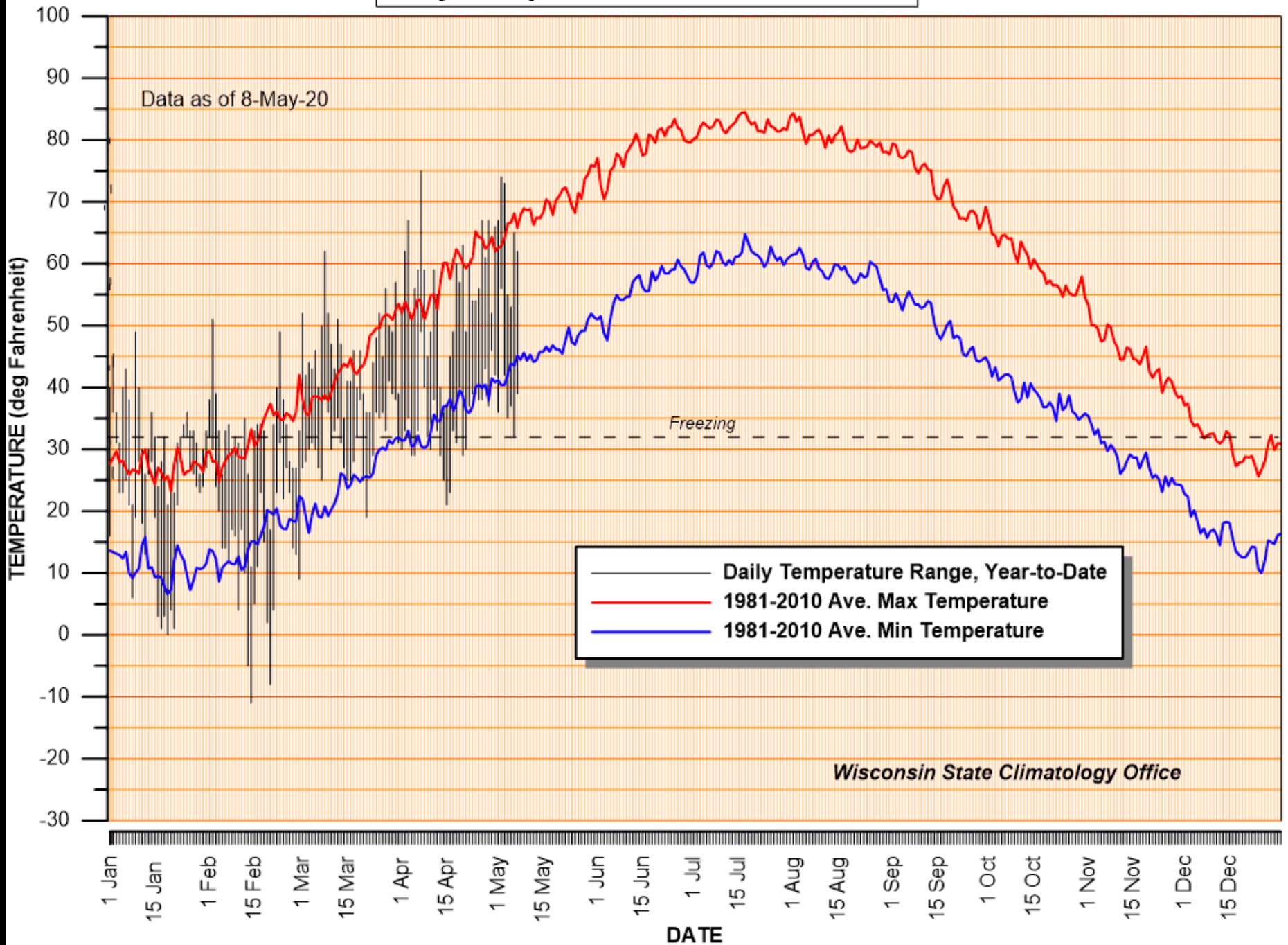


U.S. President's Science Advisory to President Lyndon B. Johnson 1966

What is Climate?

- Climate is the average of weather
 - “Climate is what you expect, weather is what you get” –Andrew John Herbertson
 - “Climate is your personality, weather is your mood” –Marshall Shepherd
- Climate changes naturally (over eons) and by humans (over centuries)

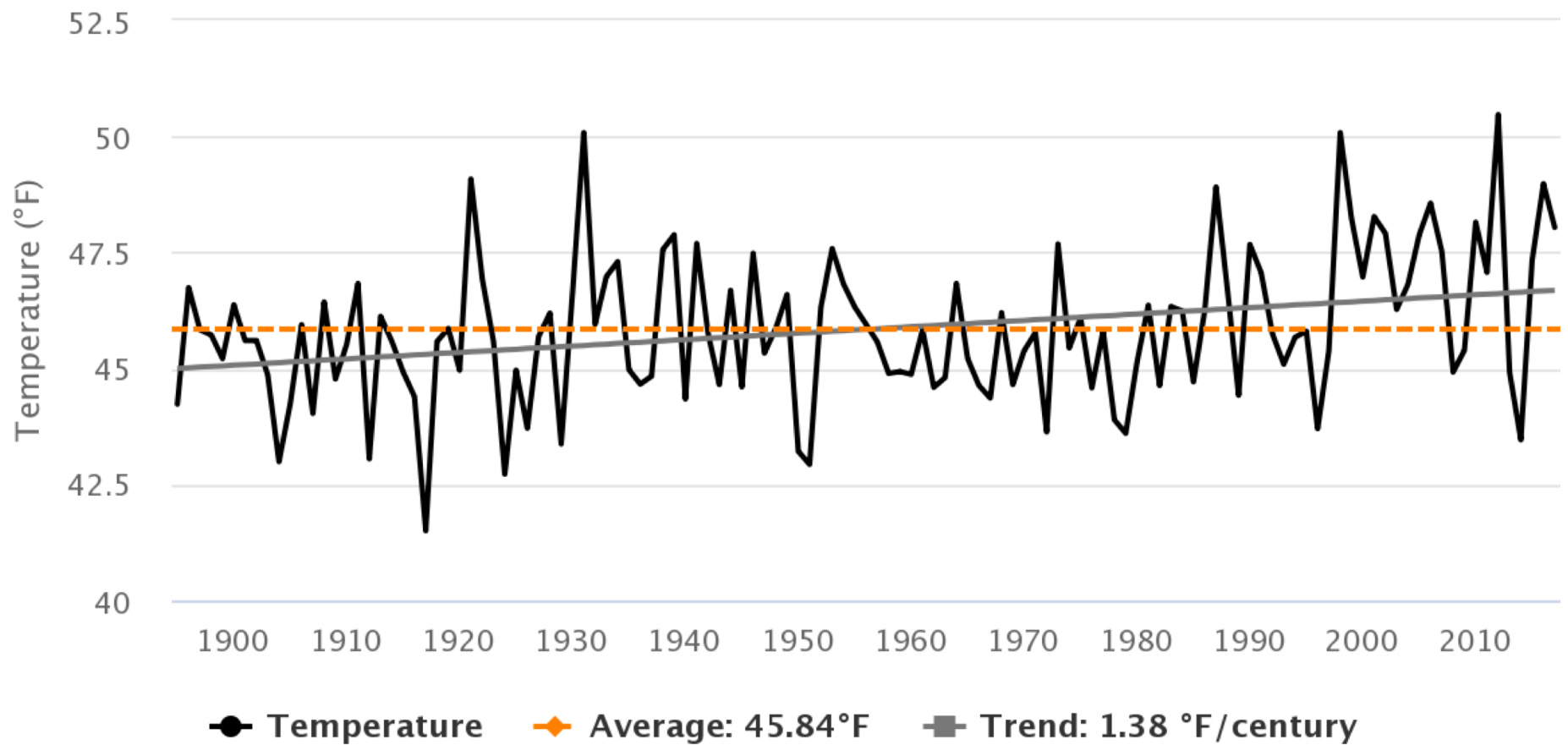
Daily Temperatures: MADISON 2020



Southern Wisconsin

WI08 Annual Temperature based on 1895–2017

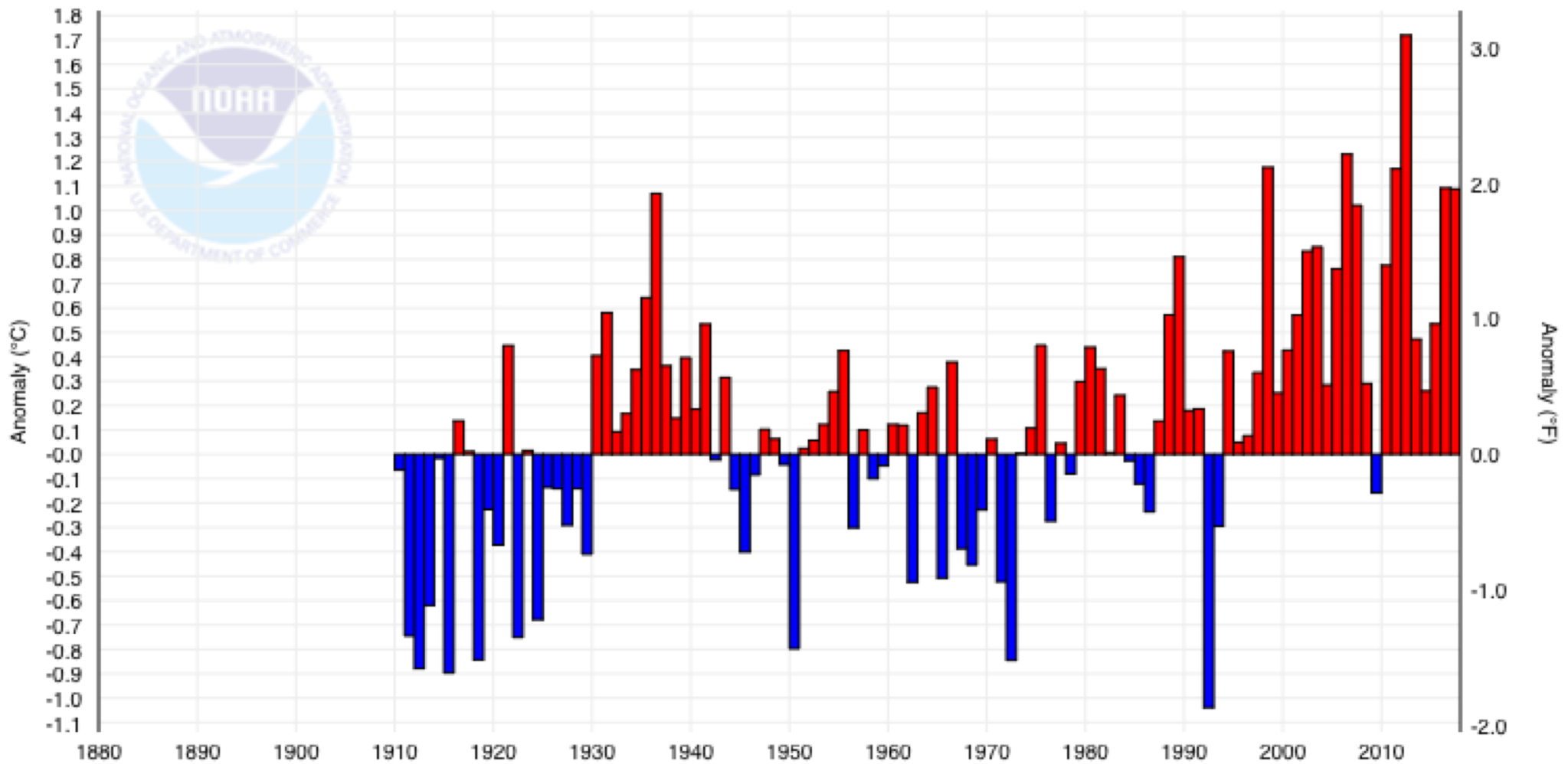
Midwestern Regional Climate Center



Click and drag to zoom

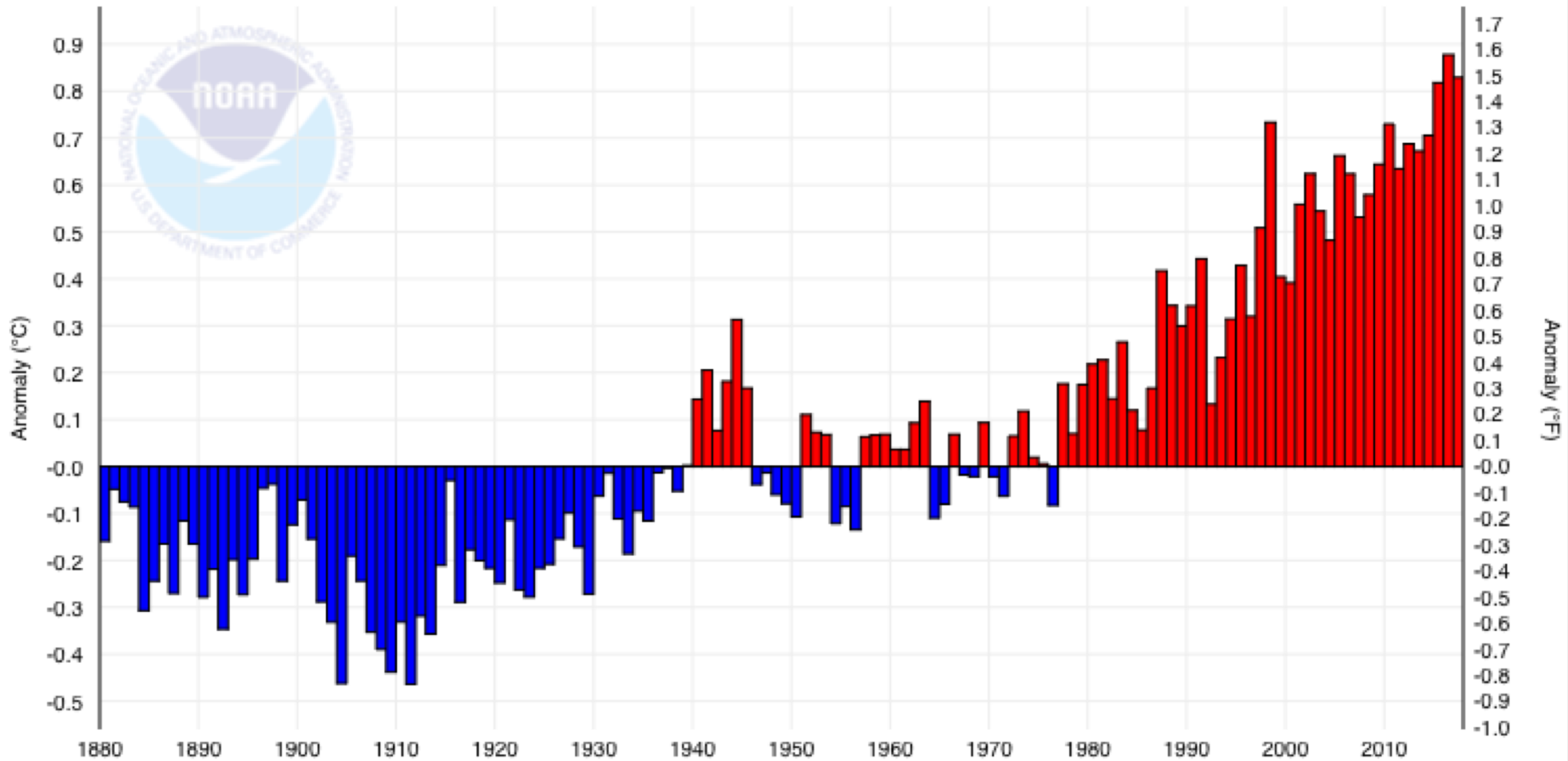
N America

North America Land Temperature Anomalies, July



WORLD

Global Land and Ocean Temperature Anomalies, July



“CO₂ is to climate what steroids was to baseball...” –Jason Samenow

Hotter

What's Really Warming the World?

Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Watch to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.

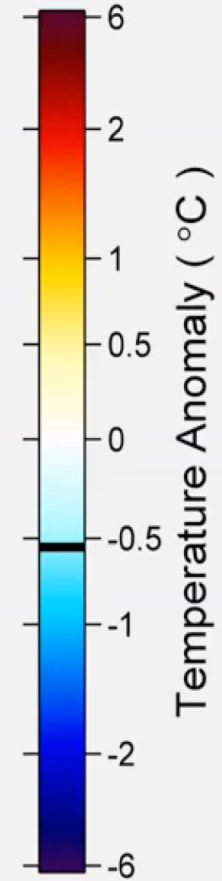
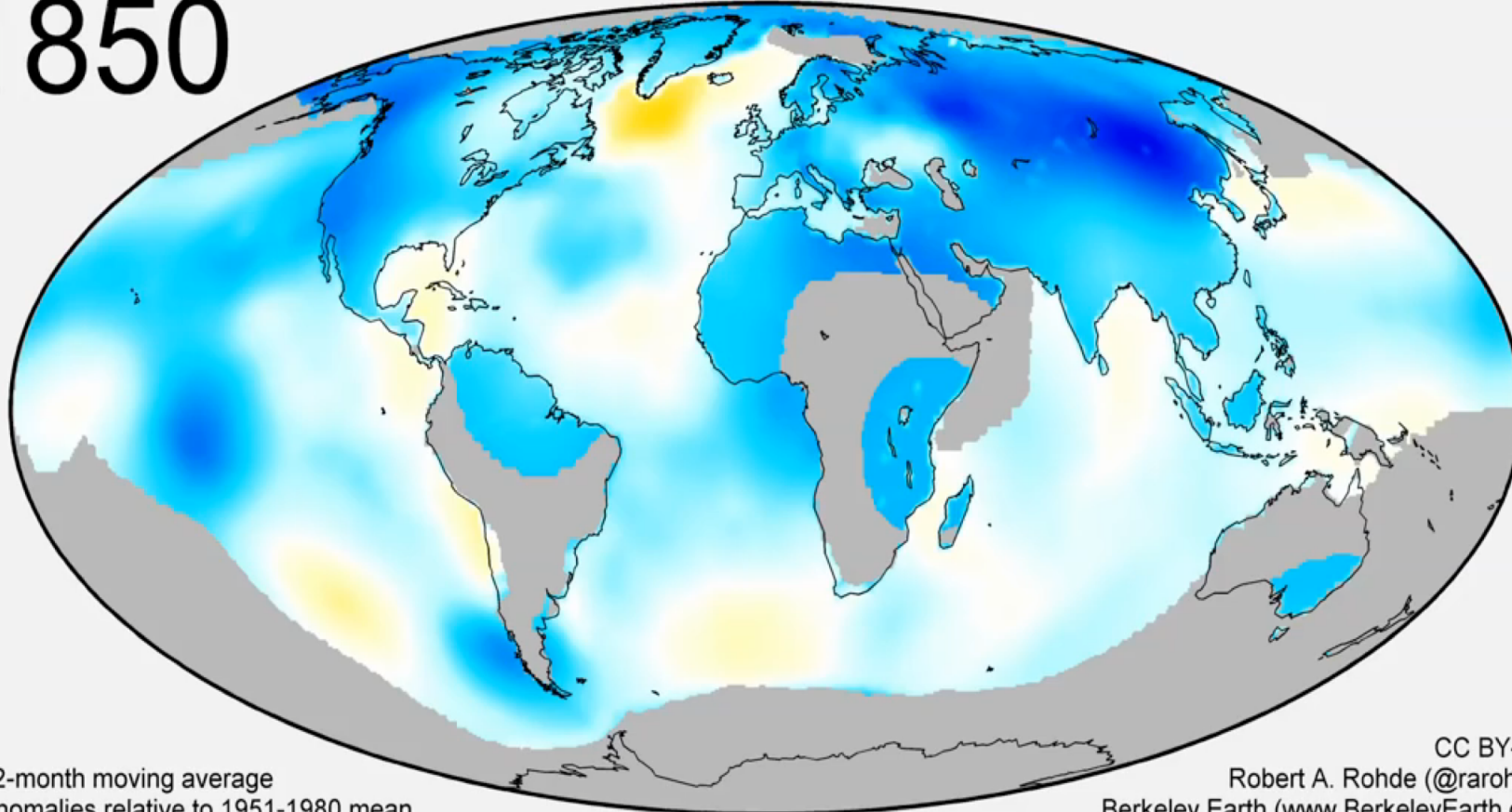
Colder



Based on an interactive by Bloomberg

<https://www.bloomberg.com/graphics/2015-whats-warming-the-world/>

1850



12-month moving average
Anomalies relative to 1951-1980 mean

CC BY-4.0
Robert A. Rohde (@rarohde)
Berkeley Earth (www.BerkeleyEarth.org)



Barriers to action

Stage 1. It's not happening

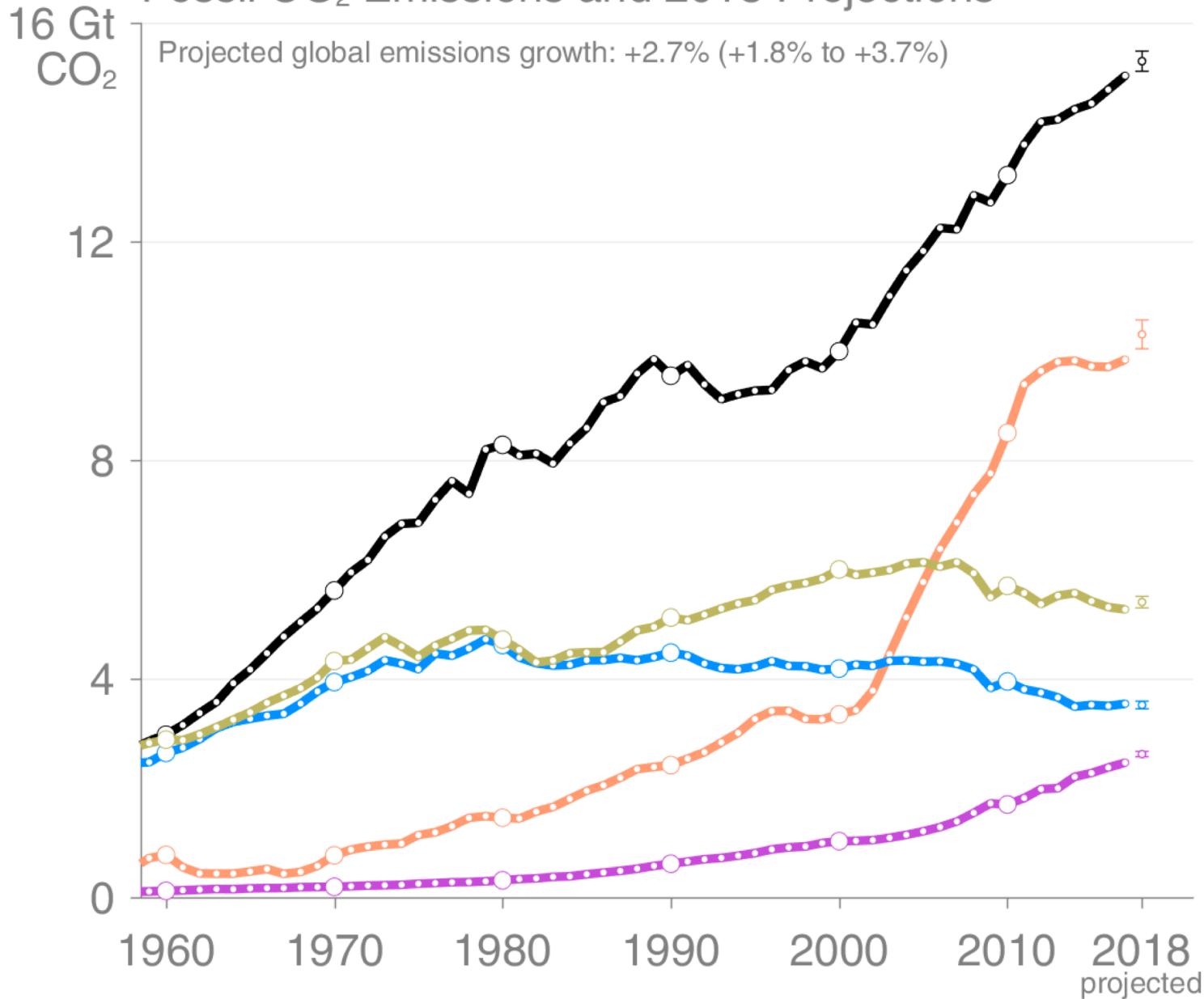
Stage 2. It's not our fault

Stage 3. It's not that bad

Stage 4. Solutions are too costly

Stage 5. It's too late

Fossil CO₂ Emissions and 2018 Projections



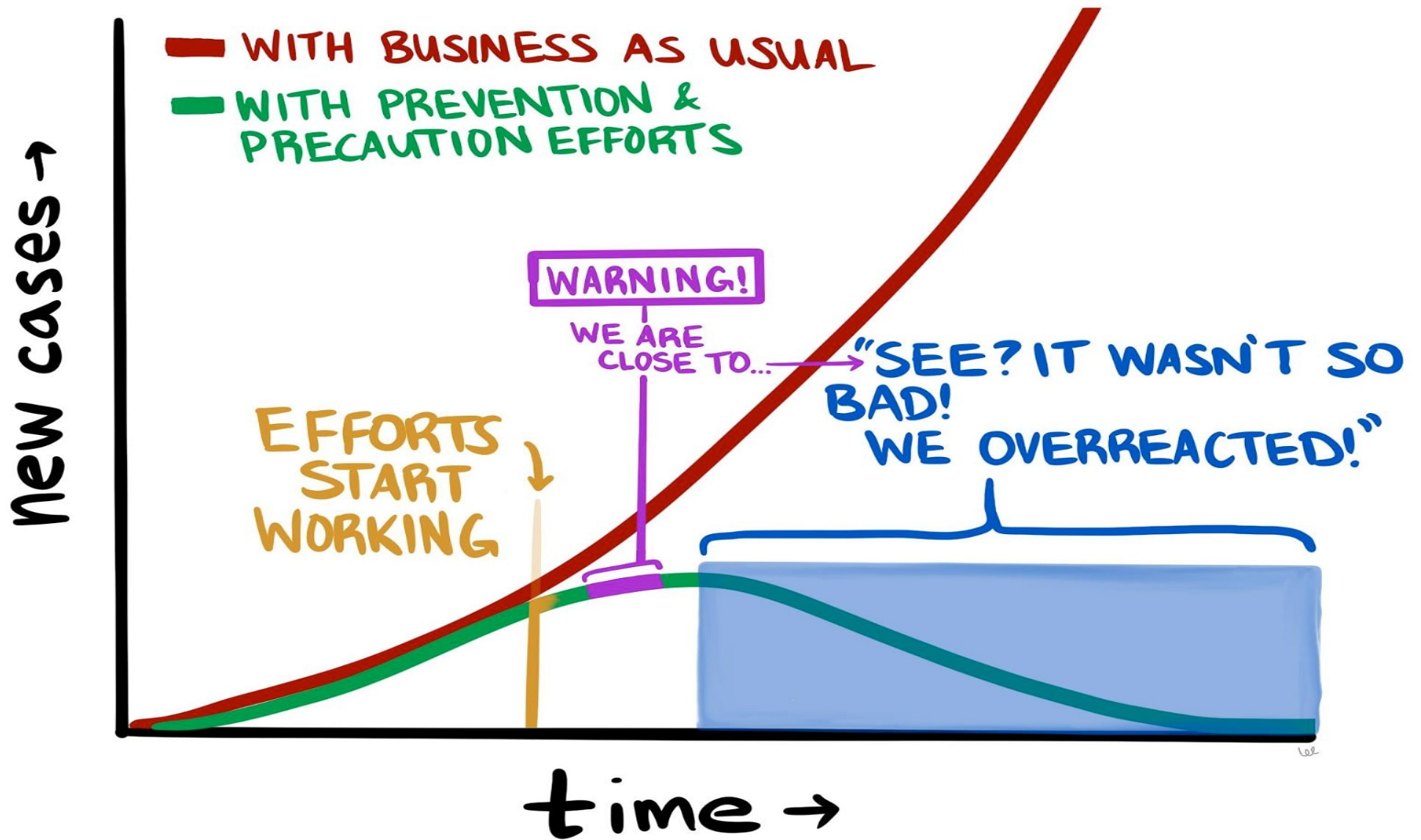
Projected Gt CO₂ in 2018
All others 15.3
 ▲ 1.8% (+0.5% to +3.0%)

China 10.3
 ▲ 4.7% (+2.0% to +7.4%)

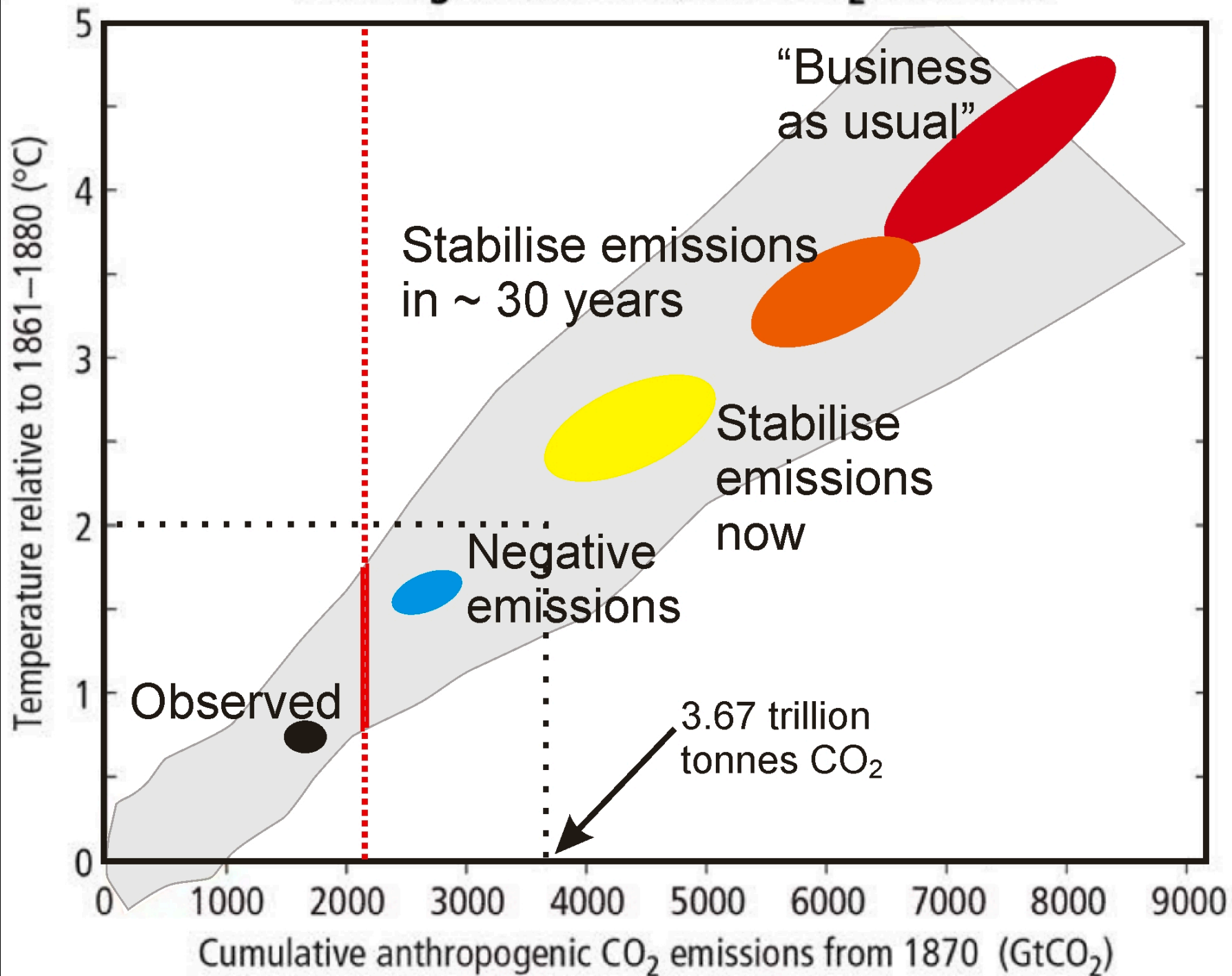
USA 5.4
 ▲ 2.5% (+0.5% to +4.5%)

EU28 3.5
 ▼ 0.7% (-2.6% to +1.3%)

India 2.6
 ▲ 6.3% (+4.3% to +8.3%)

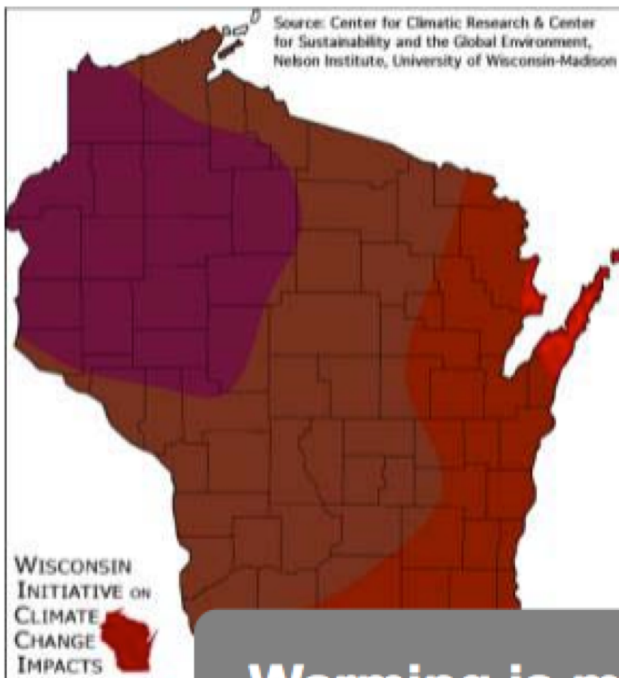


Warming versus cumulative CO₂ emissions



Projected Change in Seasonal Temperatures 1980 to 2055 (° F)

Winter



Spring

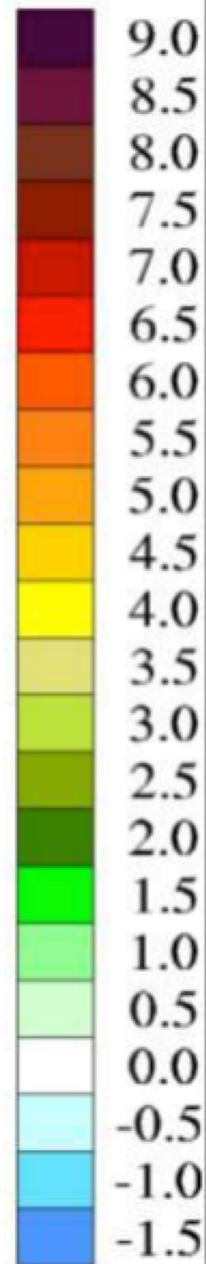


Warming is most pronounced in winter

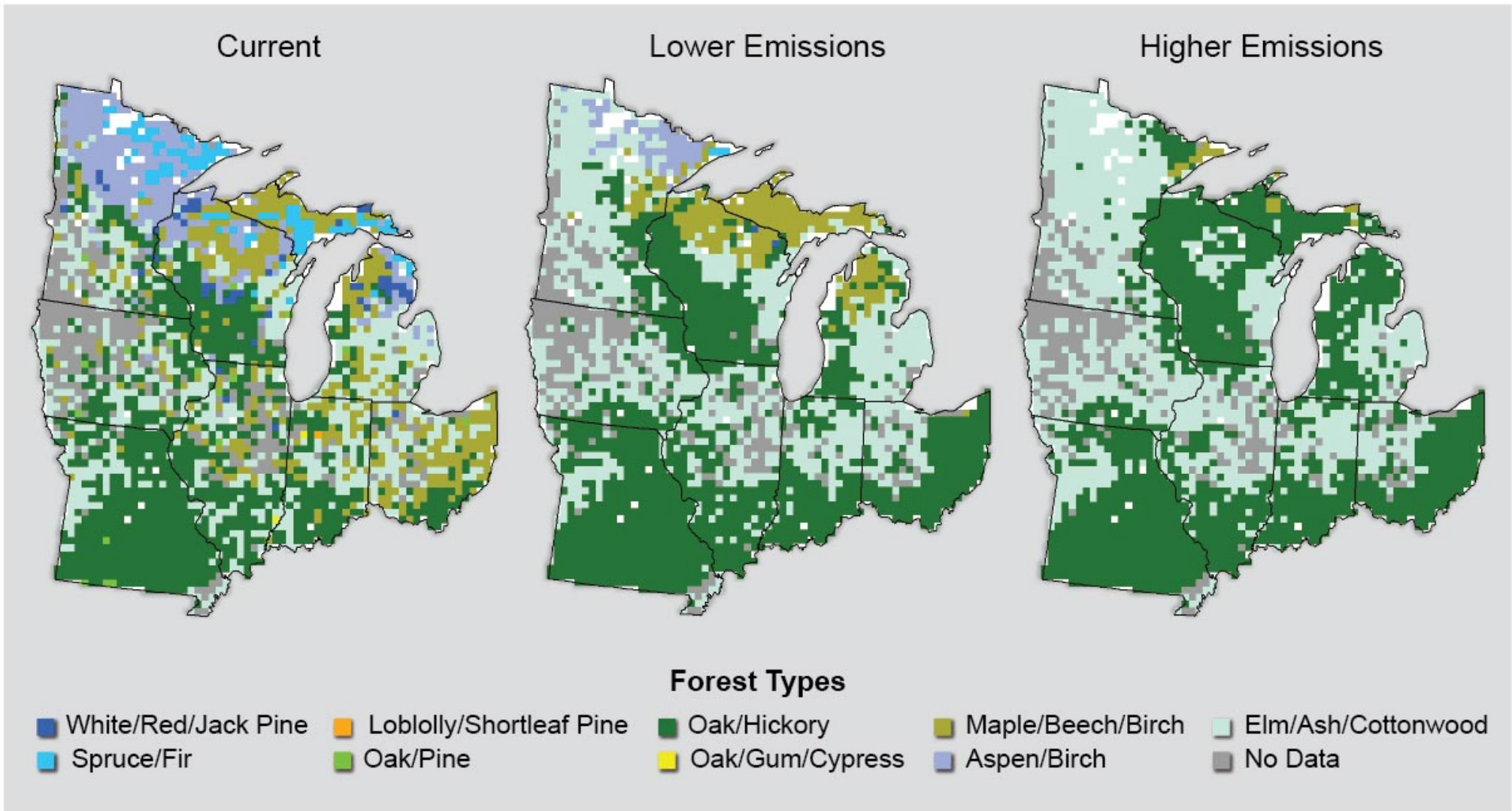
Summer



Fall



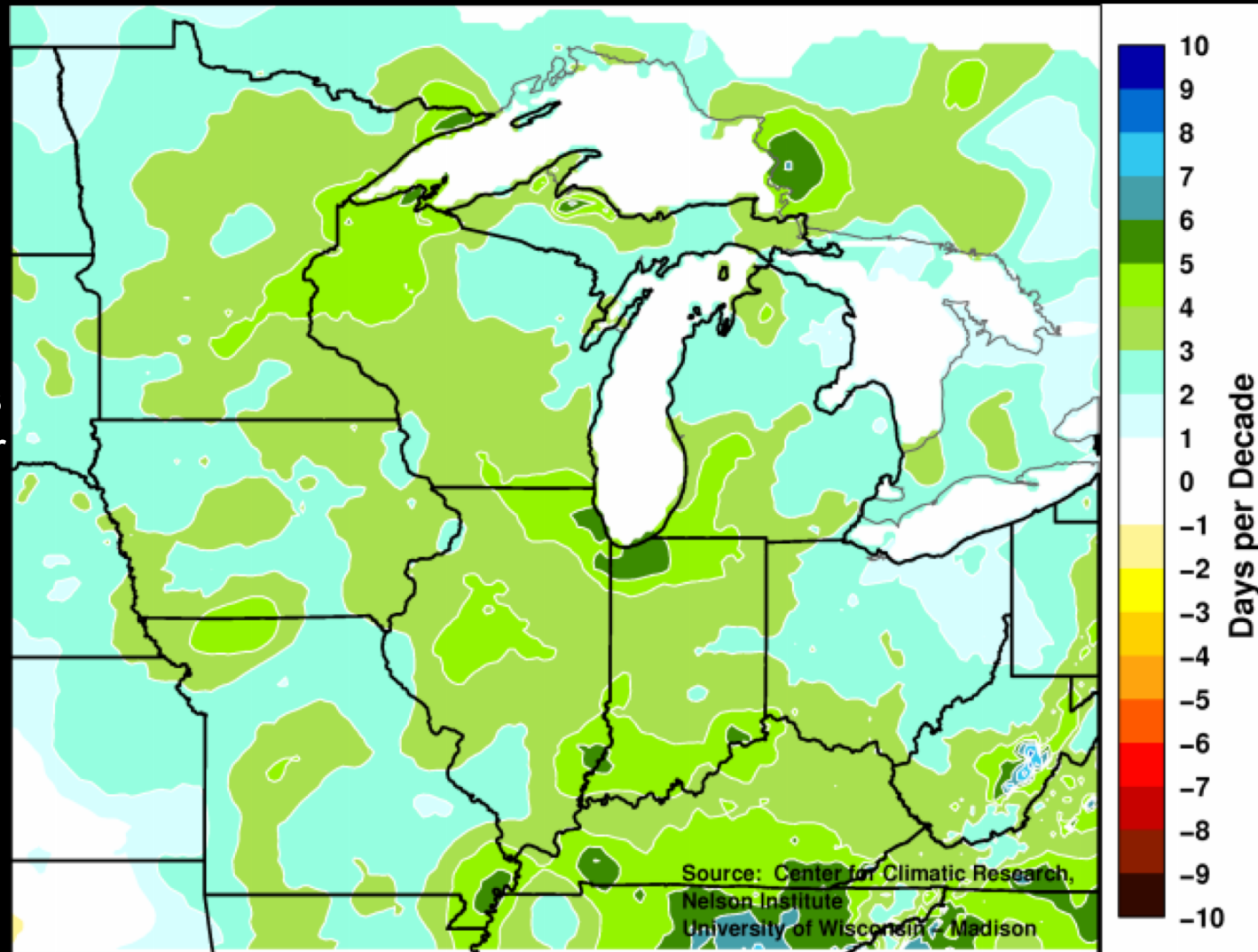
Forest Composition Shifts



Projected Heavy Rainfall

Change in 2"+ inches per 24 hr rain events:
Statistically downscaled GCM, 1980-2055 (SRES A1B)

2-5 days
more per
decade



Source: UW-Madison
Nelson Institute
Center for Climatic Research

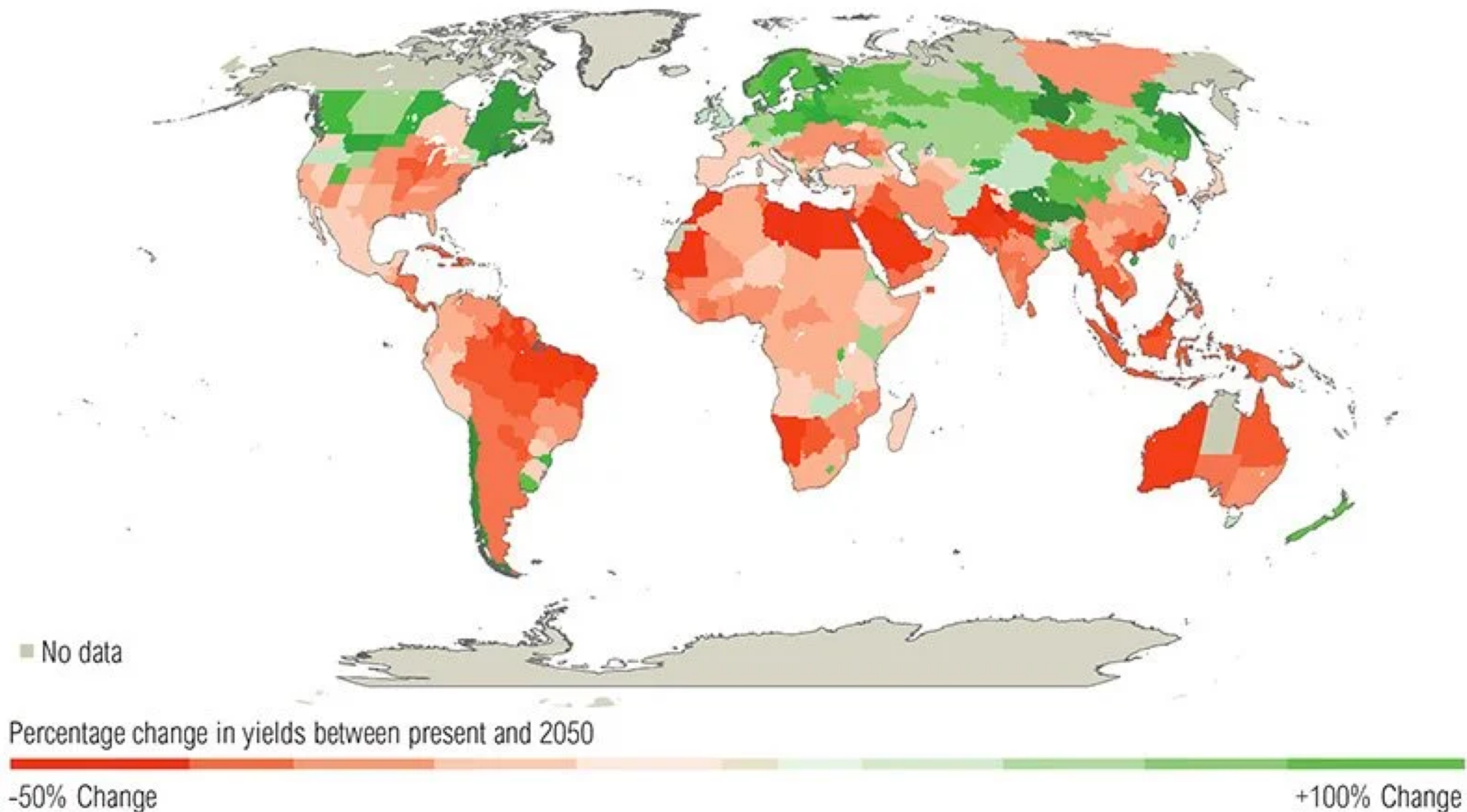


NCA 2018



NCA, 2018

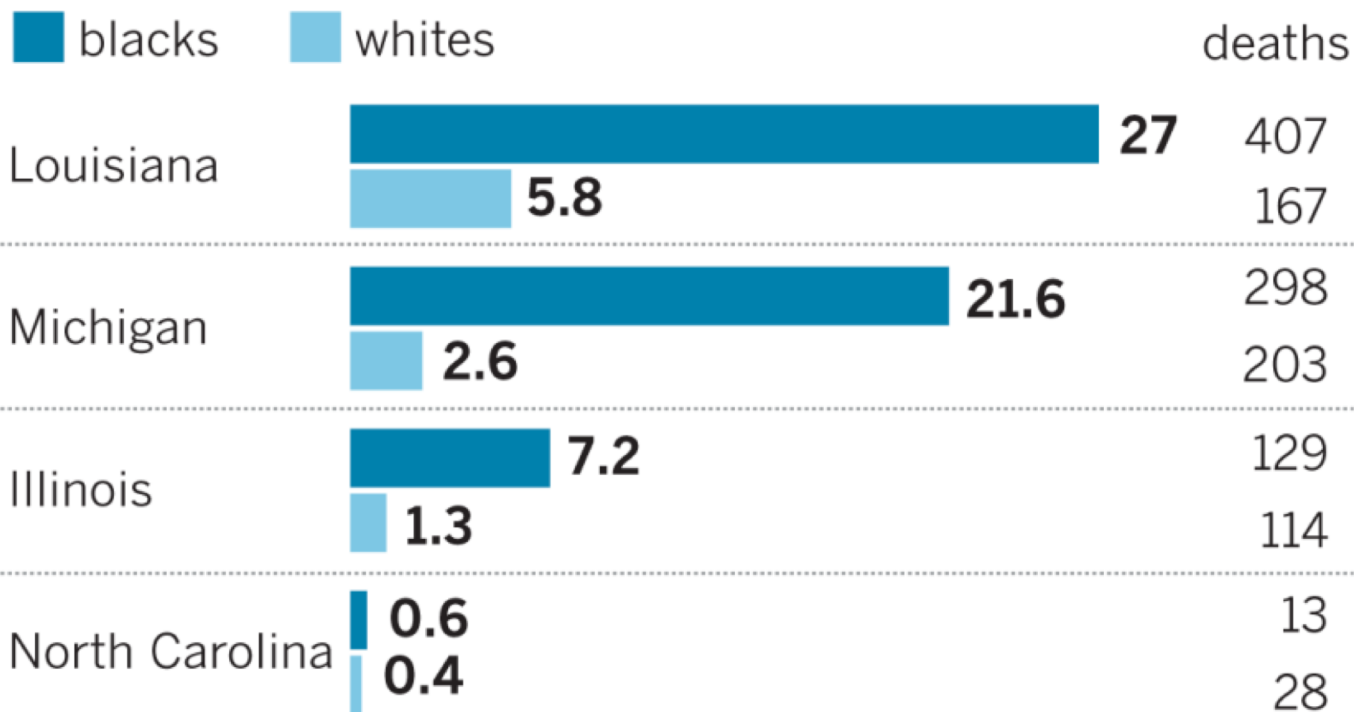
Most studies now project adverse impacts on crop yields due to climate change (3°C warmer world)



Coronavirus deaths and race

COVID-19 is disproportionately killing black Americans, according to data released by several states.

Deaths per 100,000



Death totals as of Tuesday afternoon.

State governments, U.S. Census Bureau

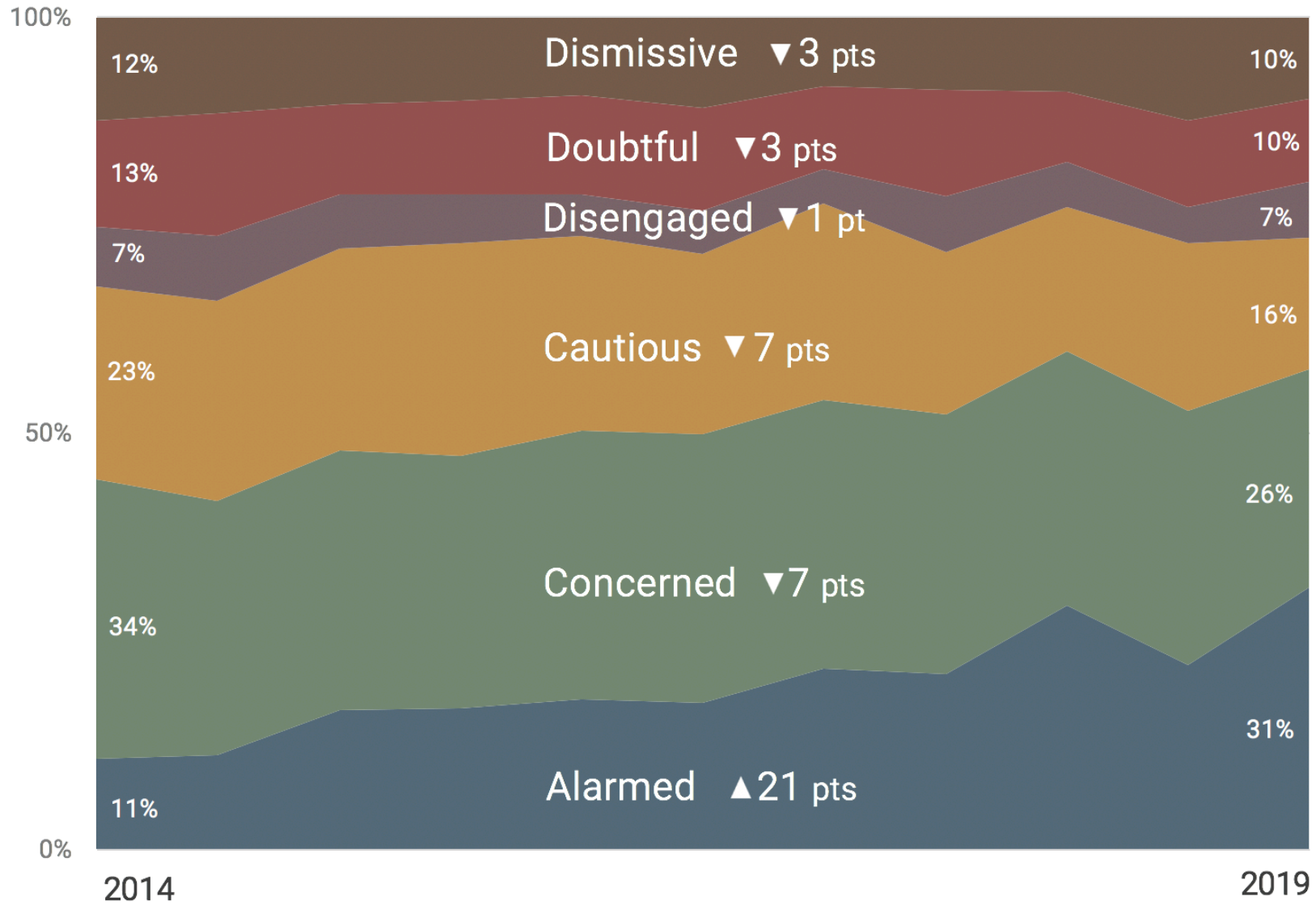
Lorena Elebee / Los Angeles Times

Climate change is fundamentally a public health emergency, and can not be separated from issues of social justice and poverty



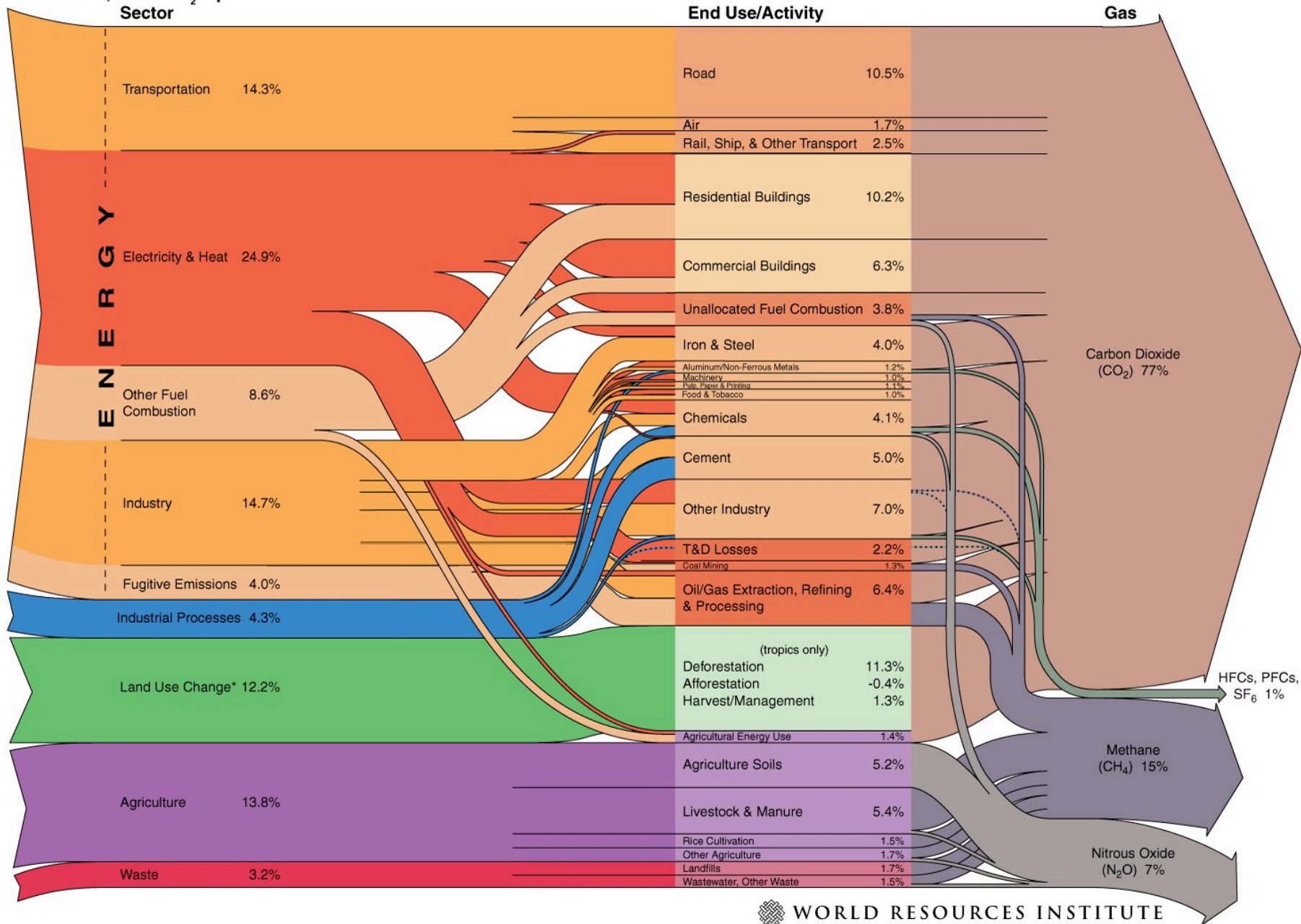


Global Warming's Six Americas: Five-year Trend



Data from 11 national surveys ($N = 13,854$) from Oct. 2014 to Nov. 2019. Difference scores are calculated before rounding (example: $12.3\% - 9.7\% = 2.6\%$ which, after rounding, would appear in the figure as $12\% - 10\% = 3\%$).

World Greenhouse Gas Emissions in 2005
Total: 44,153 MtCO₂ eq.



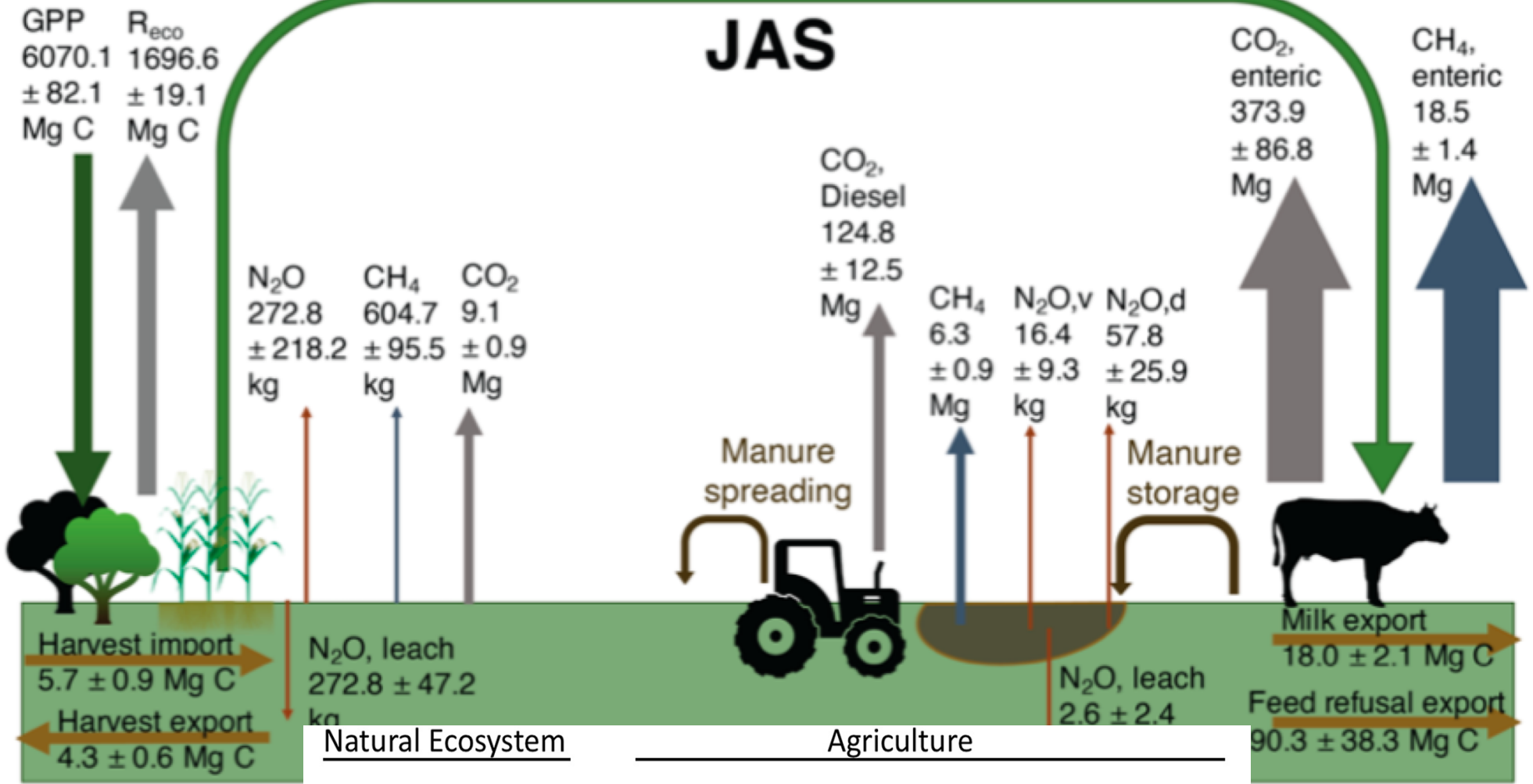
Solutions are abundant

- <https://www.drawdown.org/solutions>

* Gigatons CO2 Equivalent Reduced / Sequestered (2020–2050)

◆ SOLUTION	◆ SECTOR(S)	▼ SCENARIO 1*	◆ SCENARIO 2*
Reduced Food Waste	Food, Agriculture, and Land Use / Land Sinks	87.45	94.56
Health and Education	Health and Education	85.42	85.42
Plant-Rich Diets	Food, Agriculture, and Land Use / Land Sinks	65.01	91.72
Refrigerant Management	Industry / Buildings	57.75	57.75
Tropical Forest Restoration	Land Sinks	54.45	85.14
Onshore Wind Turbines	Electricity	47.21	147.72
Alternative Refrigerants	Industry / Buildings	43.53	50.53
Utility-Scale Solar Photovoltaics	Electricity	42.32	119.13
Improved Clean Cookstoves	Buildings	31.34	72.65
Distributed Solar Photovoltaics	Electricity	27.98	68.64
Silvopasture	Land Sinks	26.58	42.31
Peatland Protection and Rewetting	Food, Agriculture, and Land Use / Land Sinks	26.03	41.93
Tree Plantations (on Degraded Land)	Land Sinks	22.24	35.94
Temperate Forest Restoration	Land Sinks	19.42	27.85
Concentrated Solar Power	Electricity	18.60	23.96

JAS



Natural Ecosystem

Agriculture

Perennial-High Diversity

Annual-Low Diversity

Perennial-Moderate Diversity



+ 0.062 mm/vr

-1.47 mm/vr

-0.007 mm/vr



Copyright Chris Heller/The Nature Conservancy

© Tim Glass

The Land Institute

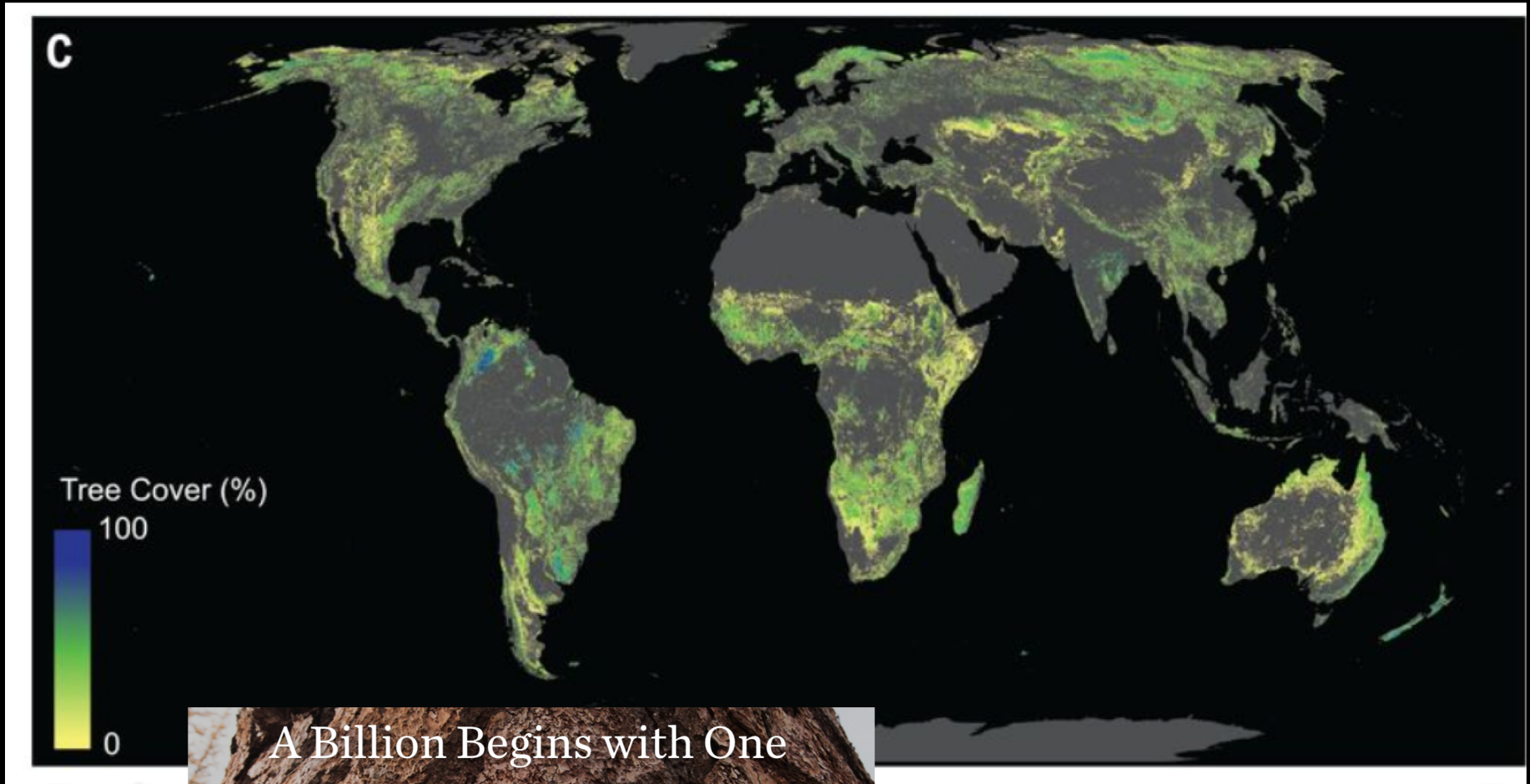
**Natural
Climate
Solutions**

Wiesner et al., 2020, Sustainability

RESTORATION ECOLOGY

The global tree restoration potential

Jean-Francois Bastin^{1*}, Yelena Finegold², Claude Garcia^{3,4}, Danilo Mollicone²,
Marcelo Rezende², Devin Routh¹, Constantin M. Zohner¹, Thomas W. Crowther¹



A Billion Begins with One

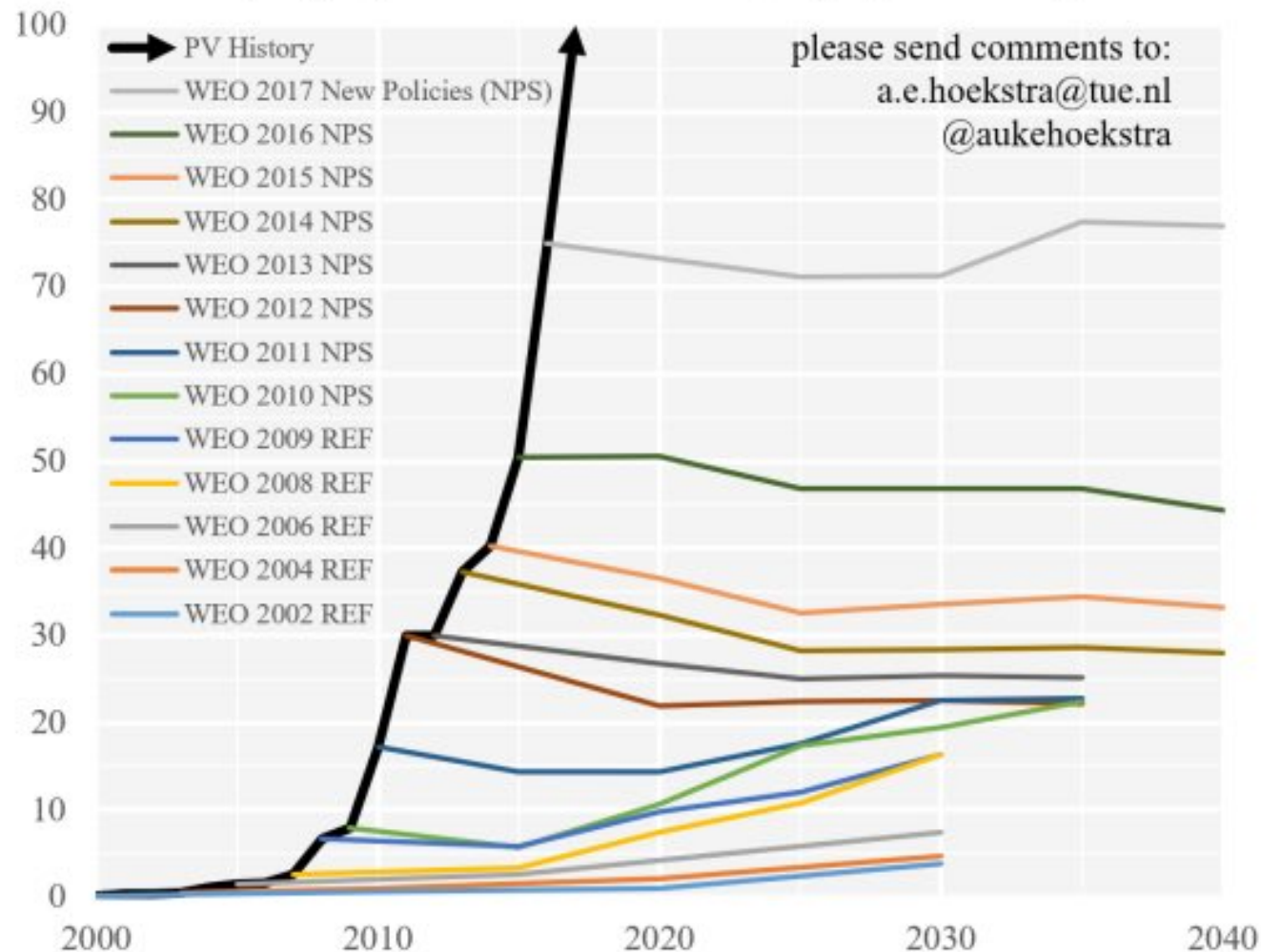
Planting a billion trees can help us curb the effects of climate change. It's a big number, but we know we can do it with your help.

PLANT YOUR TREE TODAY

The Nature Conservancy
Bastin et al., 2019

Annual PV additions: historic data vs IEA WEO predictions

In GW of added capacity per year - source International Energy Agency - World Energy Outlook



IEEFA update: Renewables surpass coal in U.S. power generation throughout the month of April 2020

Utility-scale solar, wind, and hydro exceeded coal-generated power every single day



<https://globalclimatestrike.net/>



<https://gfycat.com/oddballuniteddeviltasmanian-nature>



Thank you!

Ankur Desai

desai@aos.wisc.edu

<https://flux.aos.wisc.edu>

[@profdesai](#)

Photo: A. Desai