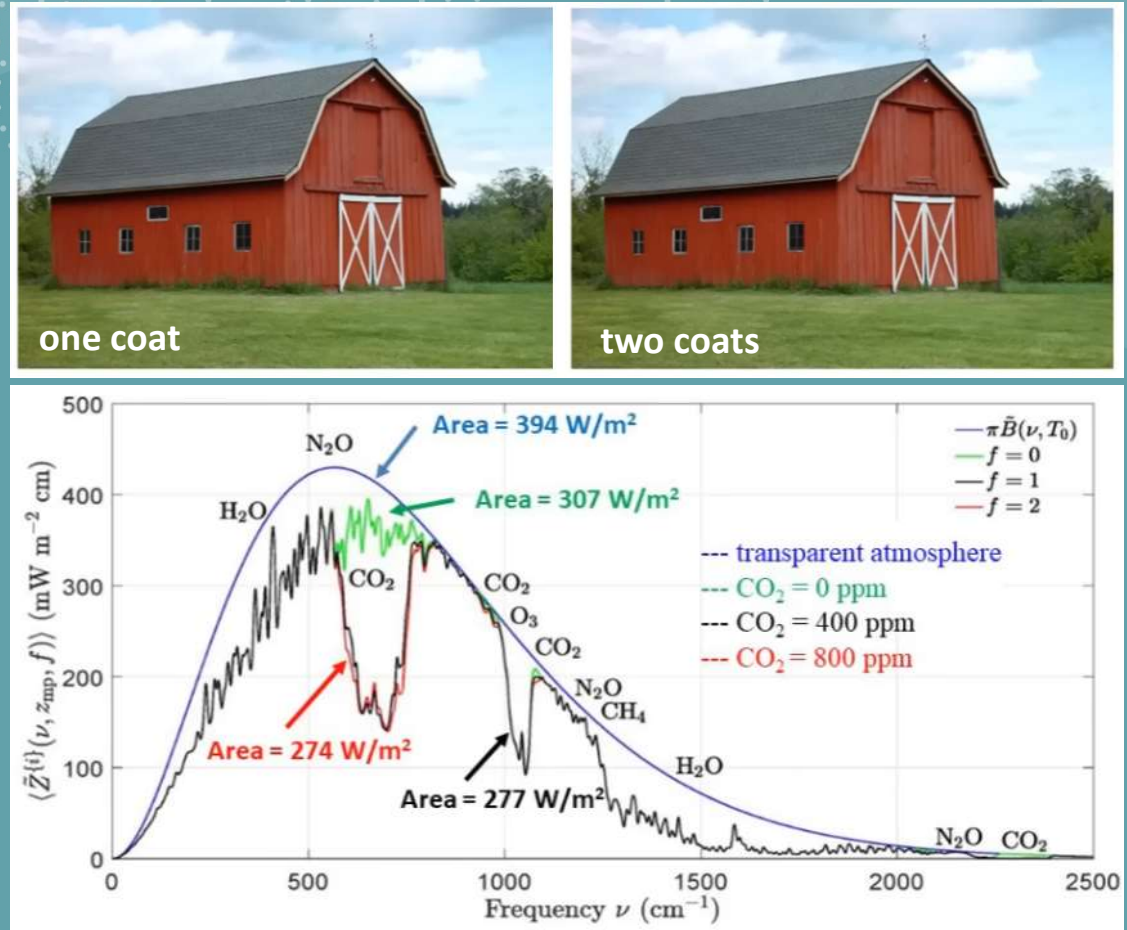


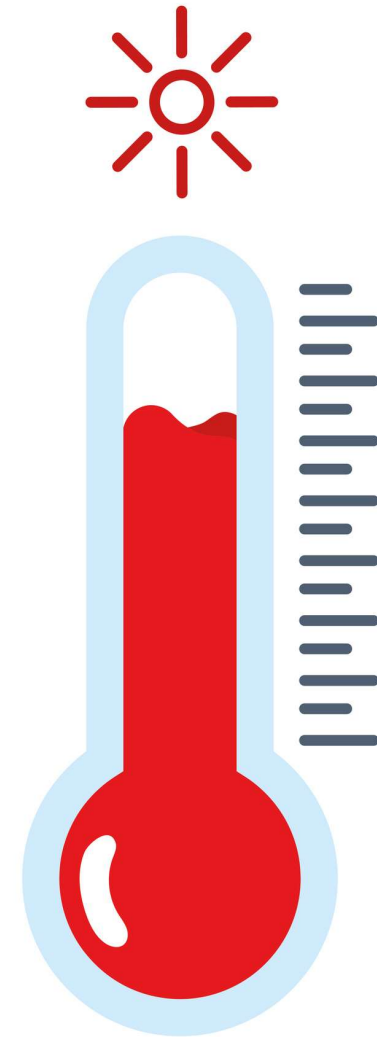
# CO<sub>2</sub> is mostly **impotent** in driving temperatures any further

- CO<sub>2</sub> effect very pronounced going from 0 to 400 ppm
- But diminishing returns beyond it (< 1 C for doubling)



Credit: Dr. W. Happer, Princeton U.

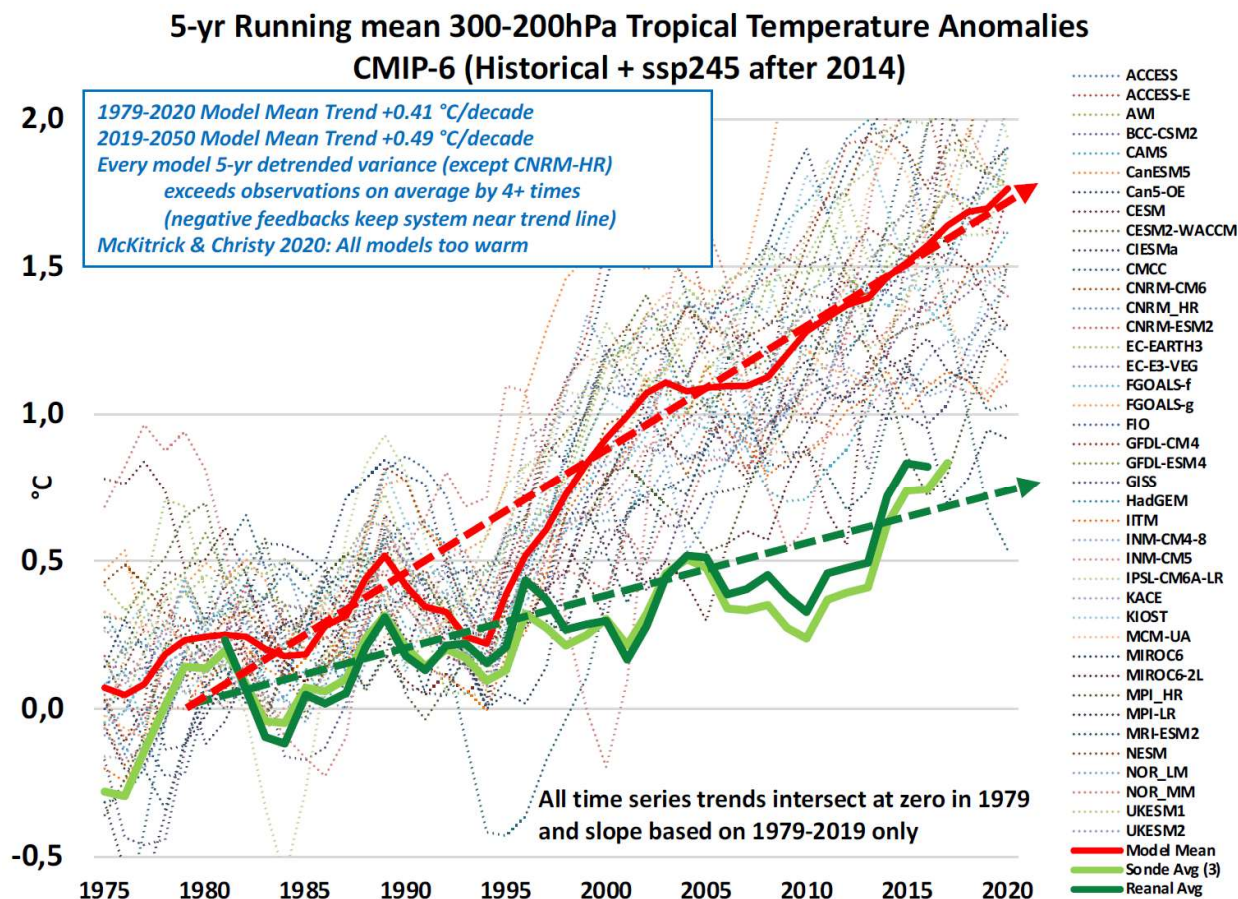
# So What Causes the Warming?



# Comparing Models with Real Climate Stability

The models are very wrong

- The slope is larger
  - Long term trend is nowhere near observed
- The oscillation amplitude is larger also
  - Indicates feedbacks are too positive



John R. Christy, The University of Alabama in Huntsville

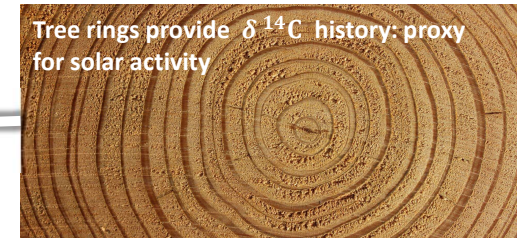
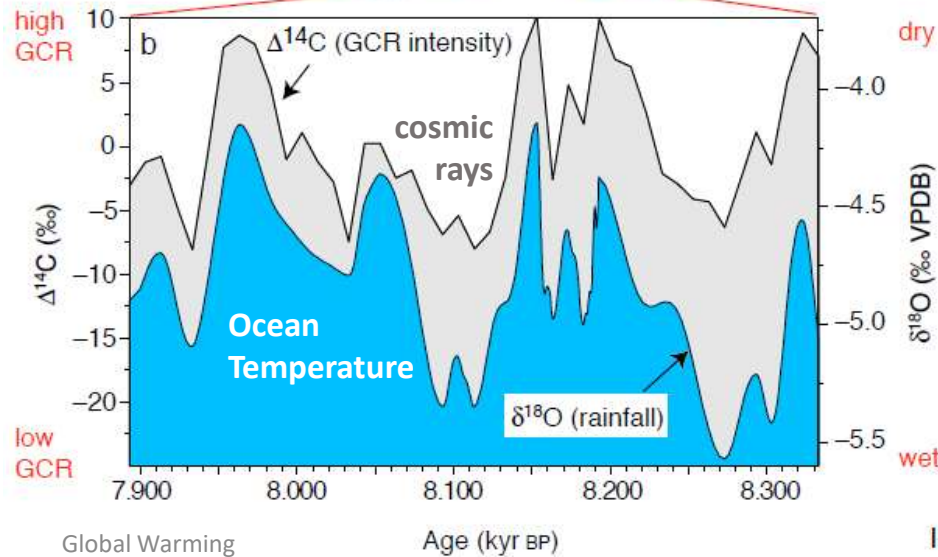
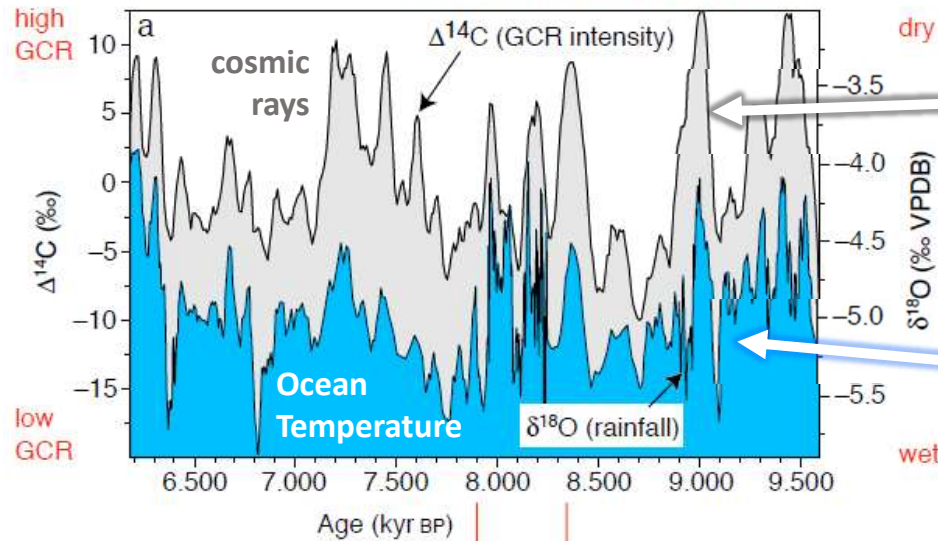
If CO<sub>2</sub> isn't the  
main driver,  
then what is?

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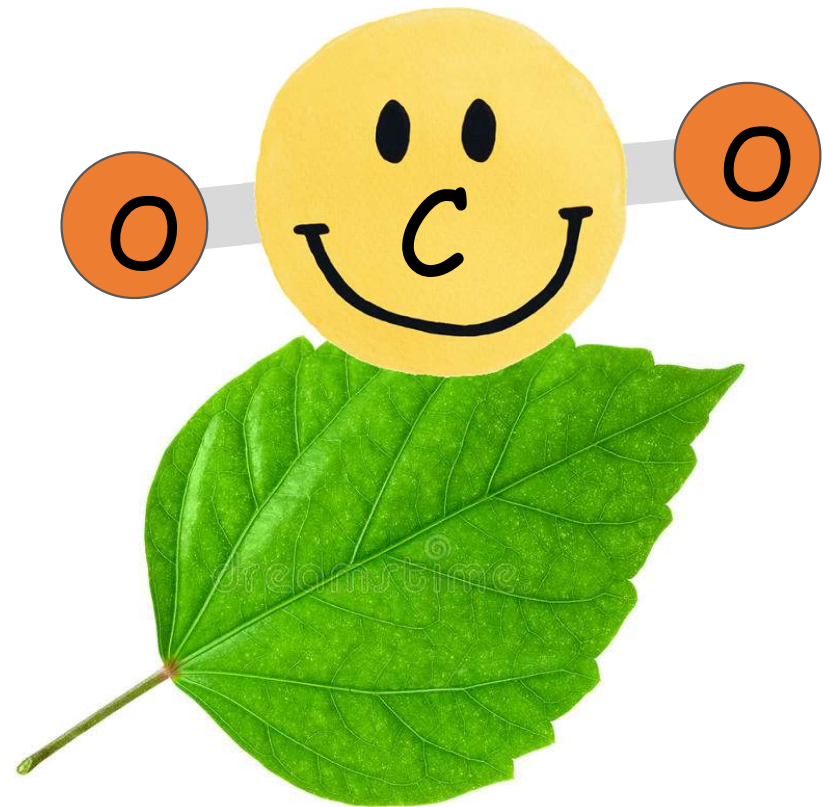


**A Clue:**  
**correlation**  
**between:**  
**cosmic rays**  
**and**  
**temperature**

U. Neff et al. (Nature 411, 2001)



3. Is (rising CO<sub>2</sub> and warming) bad?



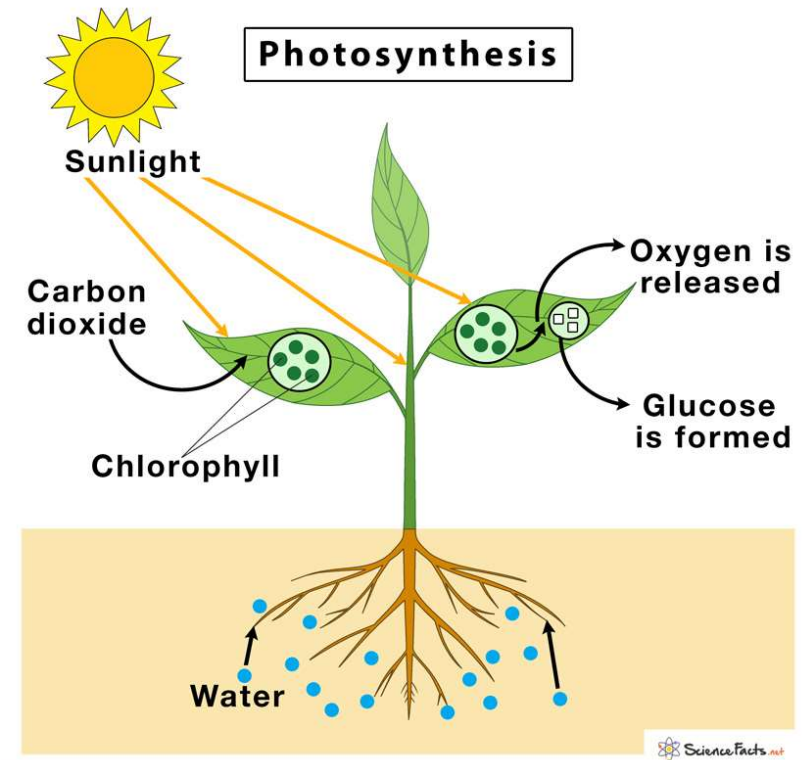
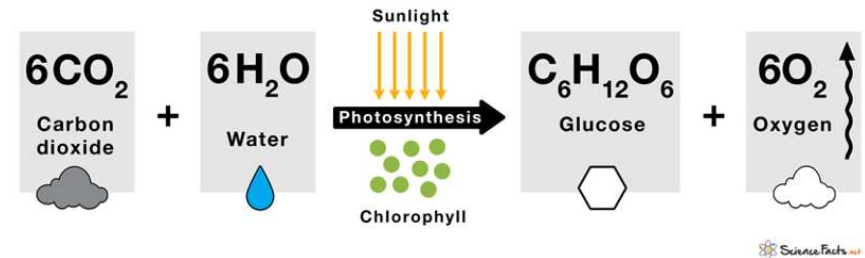


## Indispensable for life

*The plants and trees in  
this meadow get all their  
carbon from the  
atmosphere ...*

# CO<sub>2</sub> is needed for Photosynthesis

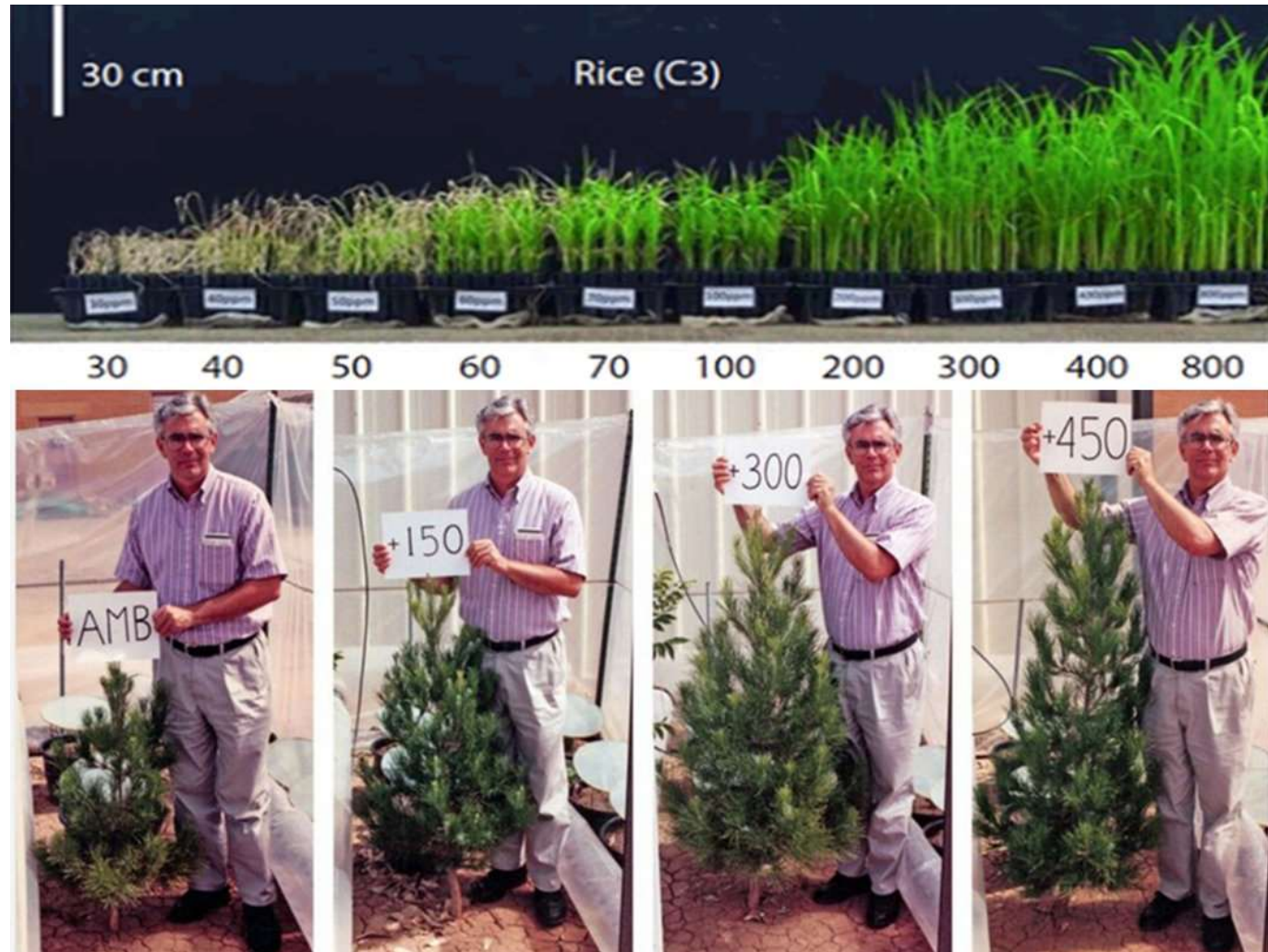
- Two-thirds of CO<sub>2</sub> is oxygen, released into the air we breathe through photosynthesis.
- This process supports all life on earth.



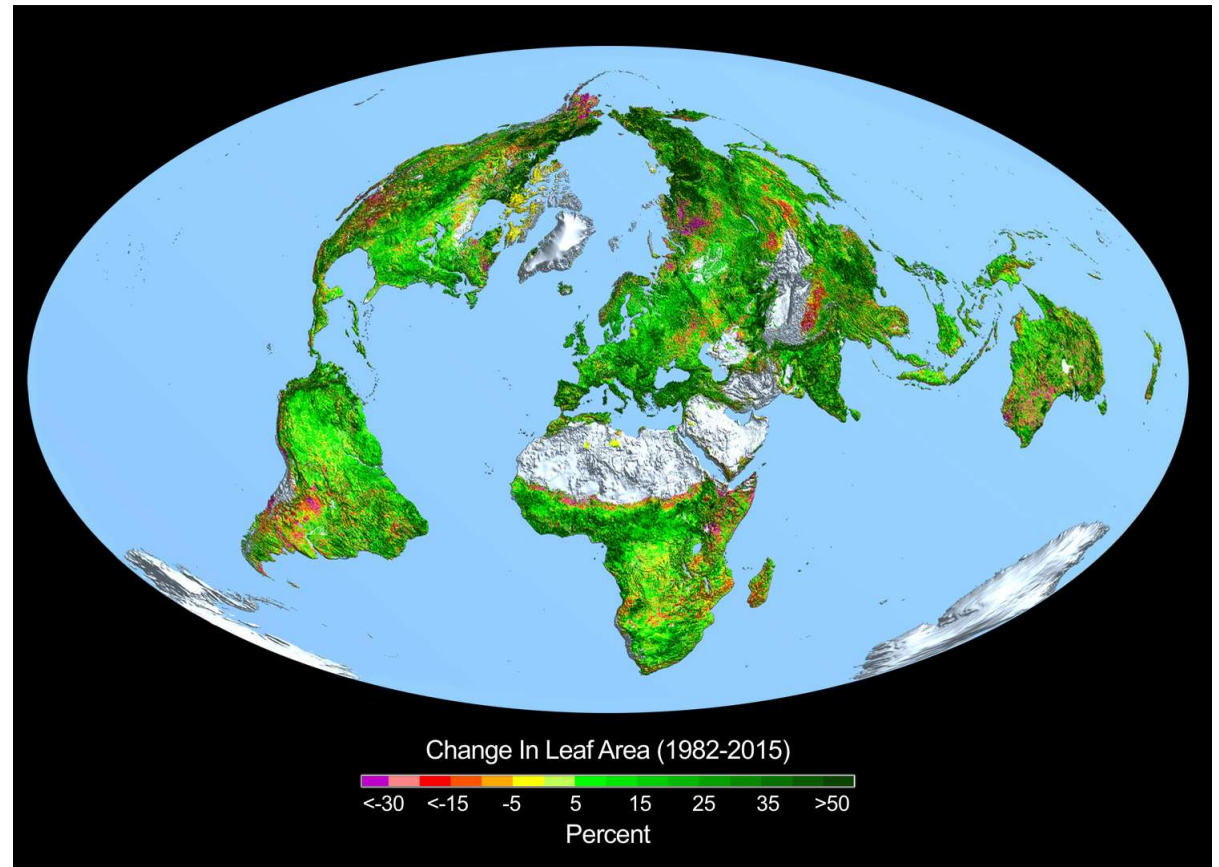
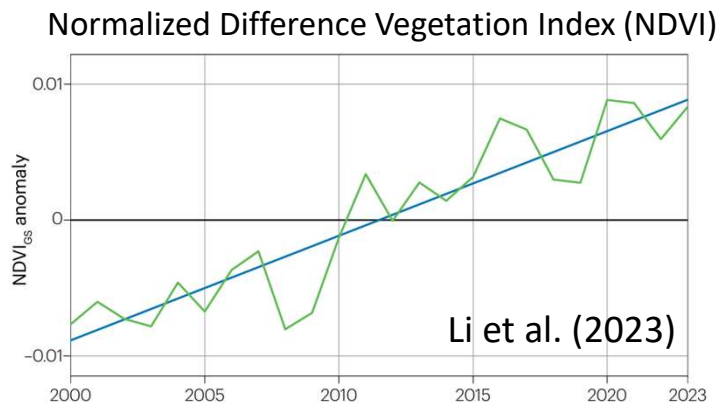


# CO<sub>2</sub> is Plant Food!

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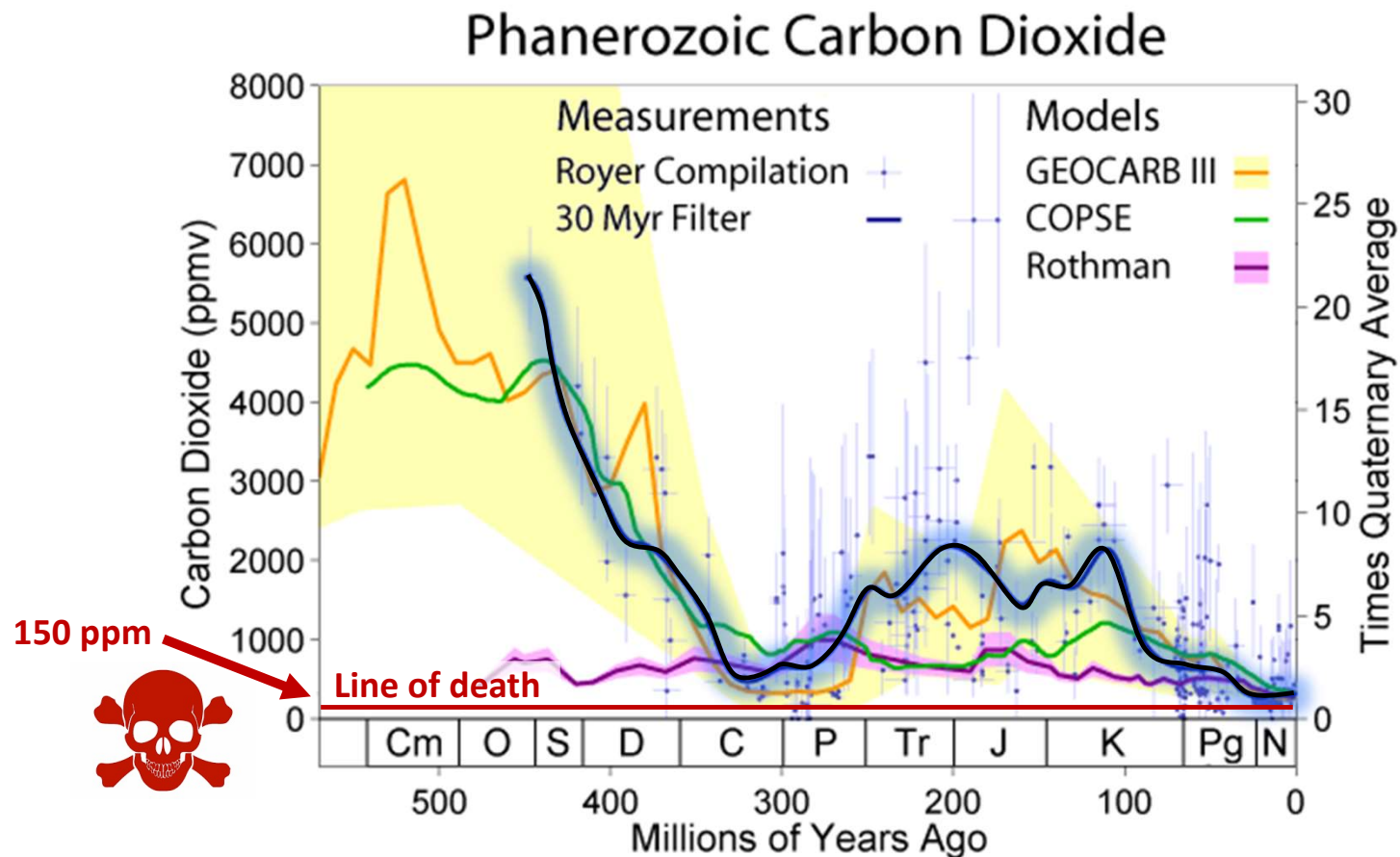
# Greening Earth!



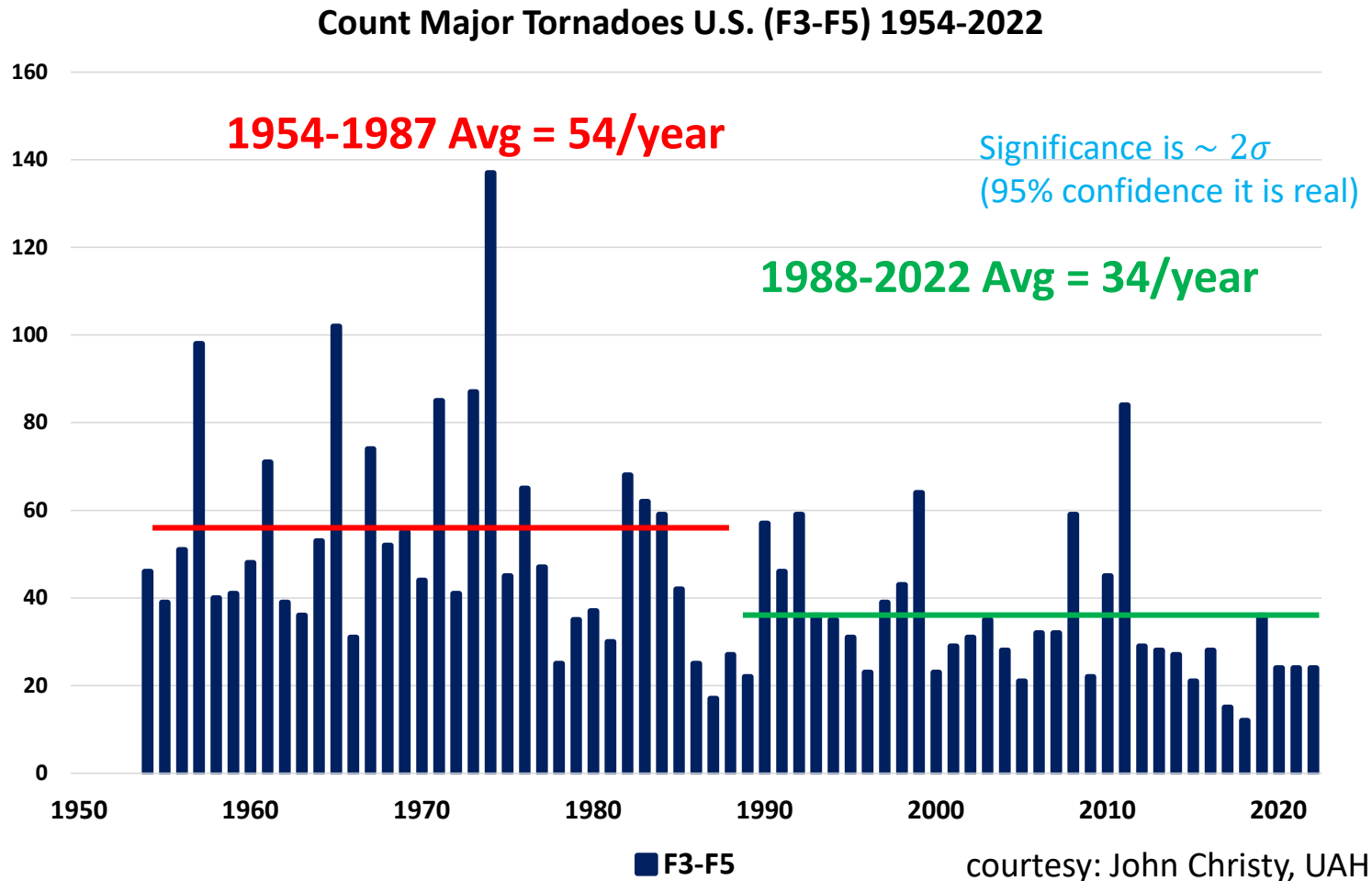
NASA study, Zhu et al. (2016) – and several others.

# Relative to Earth History, we are in fact CO<sub>2</sub>-starved...

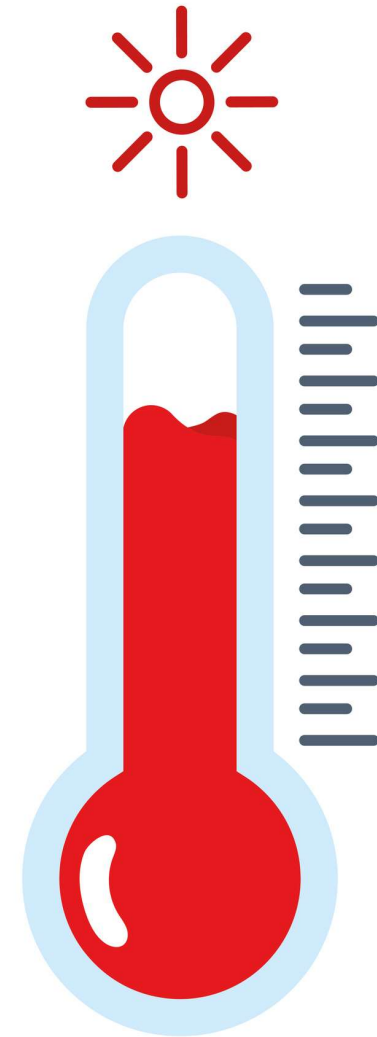
below 150 ppm **photosynthesis stops** on planet earth ... we are only at 410 ppm ...



# Major Tornadoes are *Less* Frequent



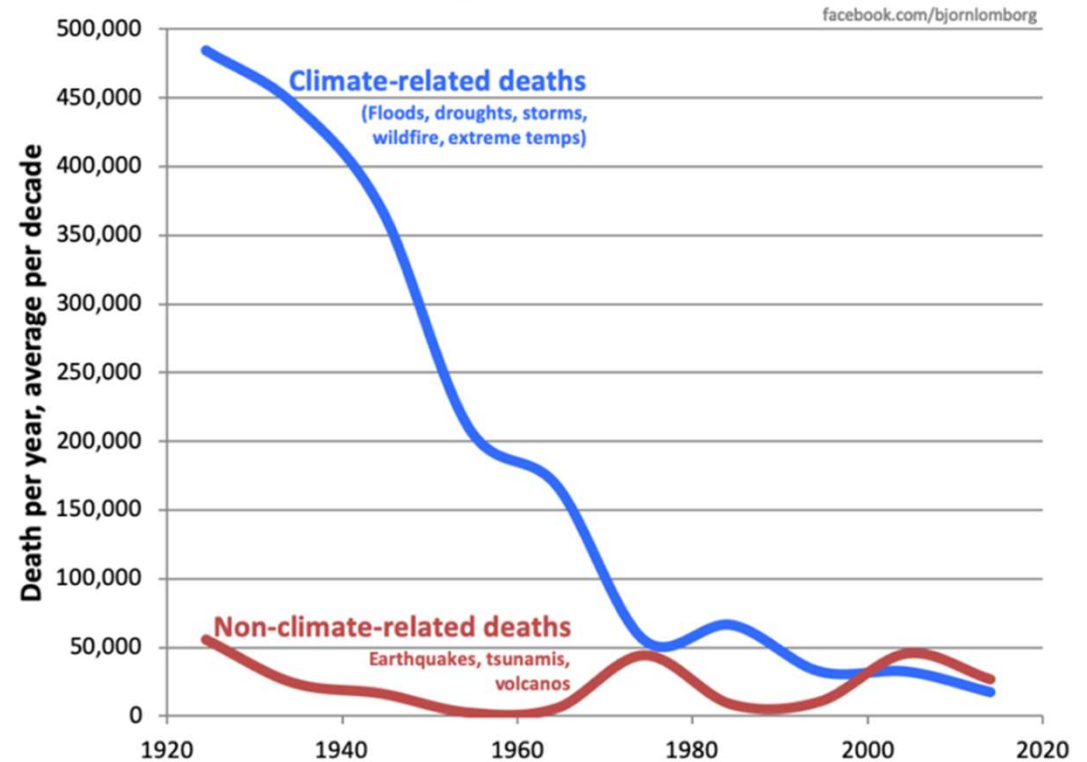
3b. What's the optimum global temperature?



# 3c. Are things getting worse?

Climate-related disasters down 99% over the last century.

## Deaths from Climate and non-Climate Catastrophes, 1920-2019



OFDA/CRED International Disaster Database, www.emdat.be, averaged over decades 1920-29, 1930-39, ..., 2010-2019

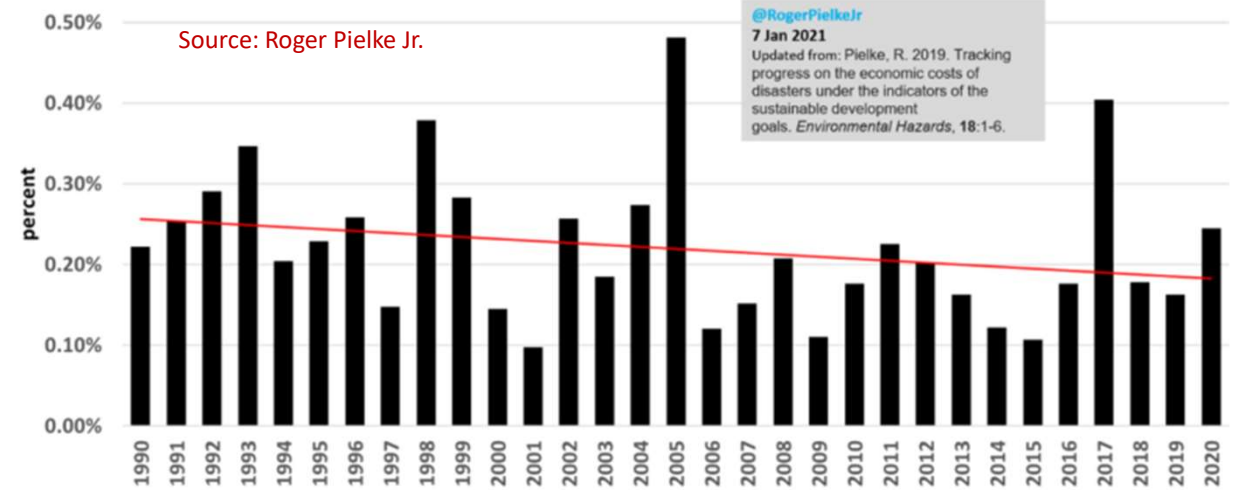
Lomborg, 2020

Are climate disasters getting more expensive?

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Global Weather Losses as Percent of Global GDP: 1990-2020  
(Sources: Munich Re, World Bank)



Source: Roger Pielke Jr.

@RogerPielkeJr  
7 Jan 2021  
Updated from: Pielke, R. 2019. Tracking progress on the economic costs of disasters under the indicators of the sustainable development goals. *Environmental Hazards*, 18:1-6.

# Wildfires

- wildfire burn acreage in the U.S. was 82.5% lower during the 2010s than it was in the 1930s
- Last year, burn acreage was the lowest in 25-years

U.S. Wildfire Burn Acreage  
1926 - 2023

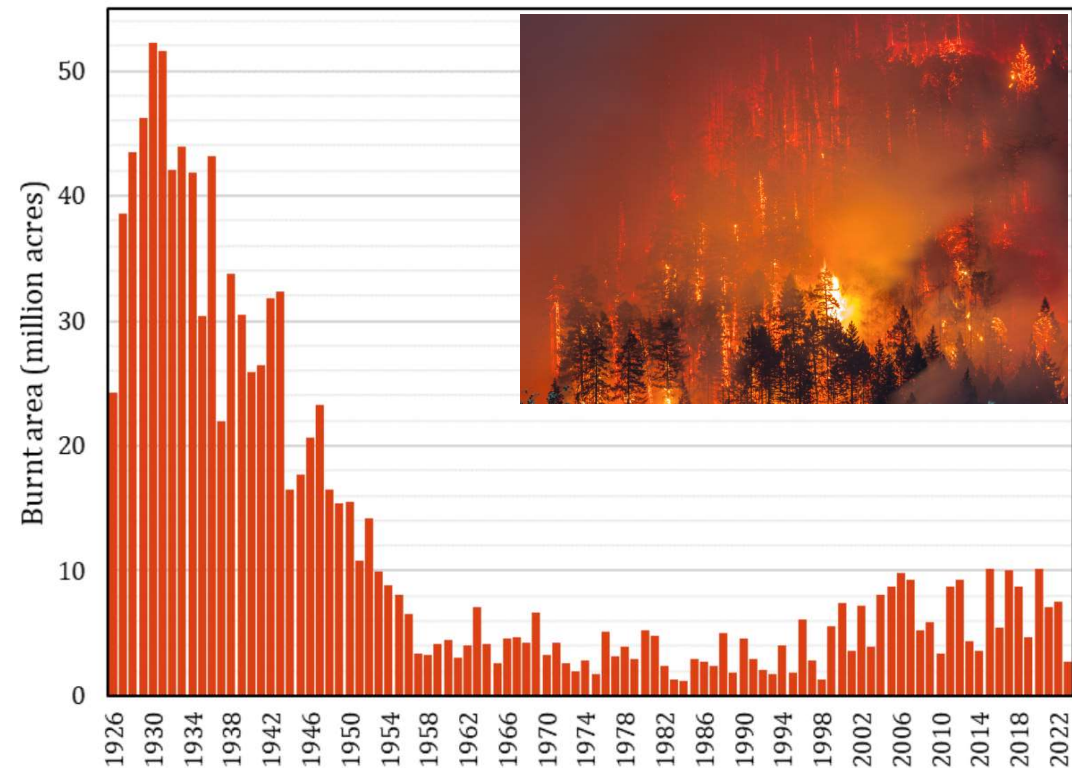
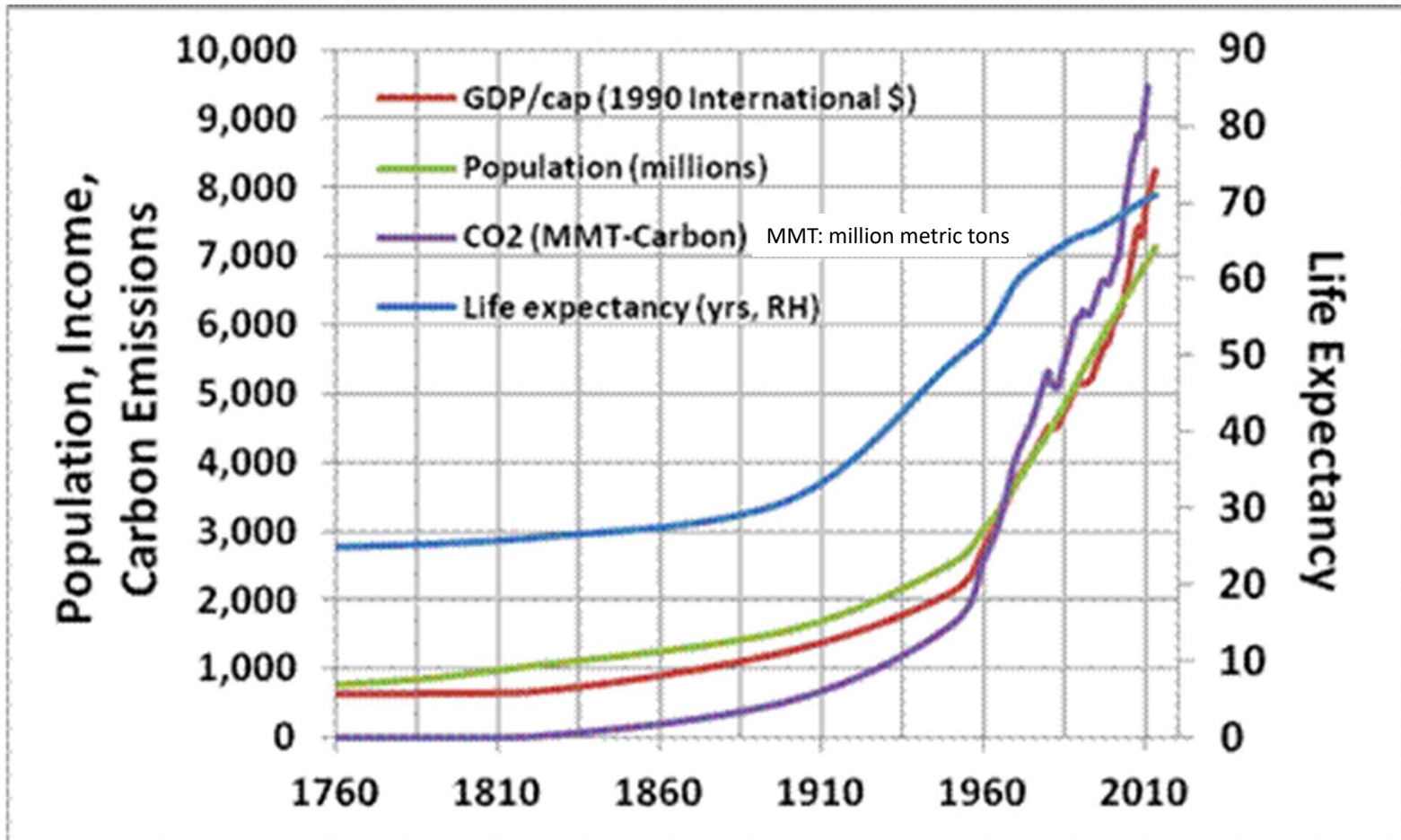


Chart: Chris Martz

Data: National Interagency Fire Center (NIFC), U.S. Department of Commerce "Historical Statistics of the United States, Colonial Times to 1970," L 48-55.



# Was 1900 Better than 2000?



4. Would the  
advised policies  
make any  
difference?

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**UNITED NATIONS**

# Net Zero

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**Speed & Scale** @speedandscale  
What's the TLDR on climate progress? We're making more of it than you think.

1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

**10 objectives.  
1 goal.  
Net zero by 2050.**

Speed & Scale

Explore the global climate tracker

# Net Zero

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- Goal: “net zero” emission of anthropogenic CO<sub>2</sub> by 2050.
- Cost for US ~ \$400 trillion.
- Need storage and backup for windless/cloudy stretches.
- Impossible – not enough copper, other mineral resources.

## Net Zero Averted Temperature Increase

R. Lindzen<sup>1</sup>, W. Happer<sup>2</sup>, and W. A. van Wijngaarden<sup>3</sup>

<sup>1</sup>*Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, U.S.A*

<sup>2</sup>*Department of Physics, Princeton University, U.S.A*

<sup>3</sup>*Department of Physics and Astronomy, York University, Canada*

June 11, 2024

### Abstract

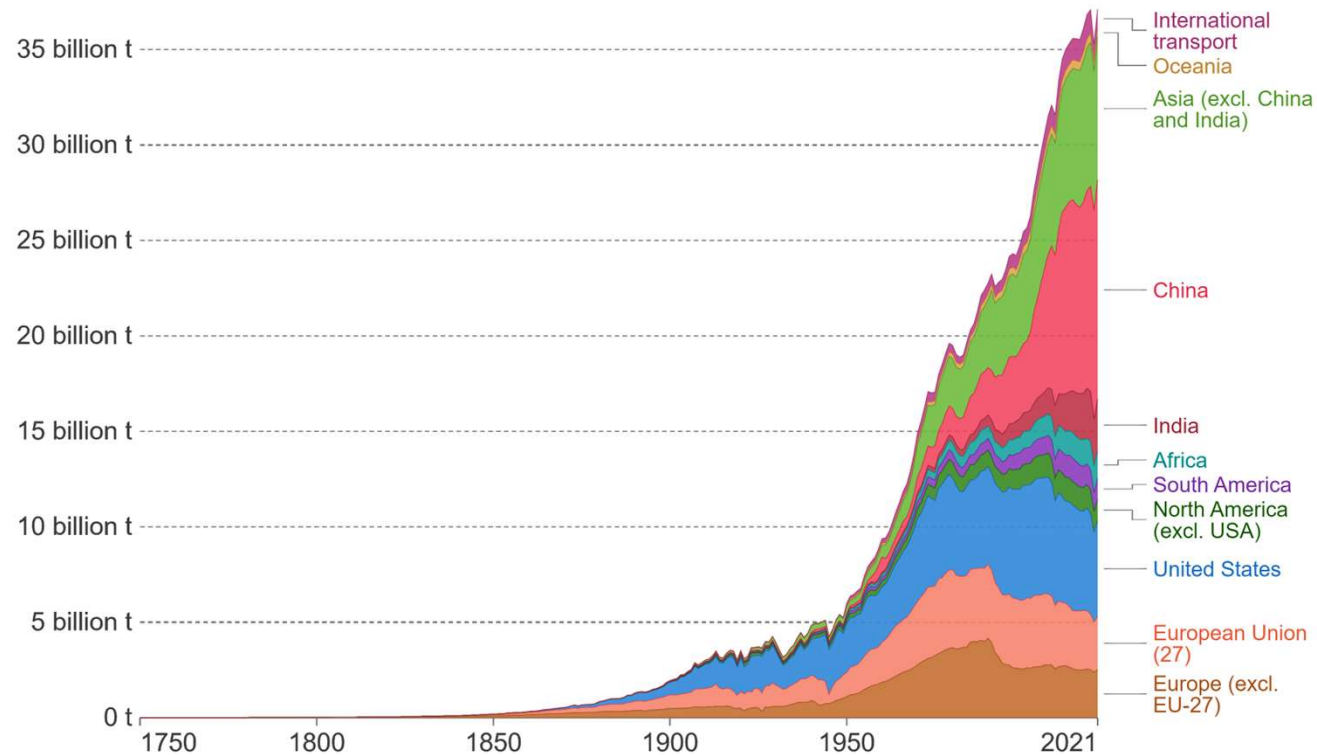
Using feedback-free estimates of the warming by increased atmospheric carbon dioxide (CO<sub>2</sub>) and observed rates of increase, we estimate that if the United States (U.S.) eliminated net CO<sub>2</sub> emissions by the year 2050, this would avert a warming of 0.0084 °C [0.015 °F], which is below our ability to accurately measure. If the entire world forced net zero CO<sub>2</sub> emissions by the year 2050, a warming of only 0.070 °C [0.13 °F] would be averted. If one assumes that the warming is a factor of 4 larger because of positive feedbacks, as asserted by the Intergovernmental Panel on Climate Change (IPCC), the warming averted by a net zero U.S. policy would still be very small, 0.034 °C [0.061 °F]. For worldwide net zero emissions by 2050 and the 4-times larger IPCC climate sensitivity, the averted warming would be 0.28 °C [0.50 °F].

Largest contribution comes from developing countries

## Annual CO<sub>2</sub> emissions by world region

This measures fossil fuel and industry emissions<sup>1</sup>. Land use change is not included.

Our World  
in Data

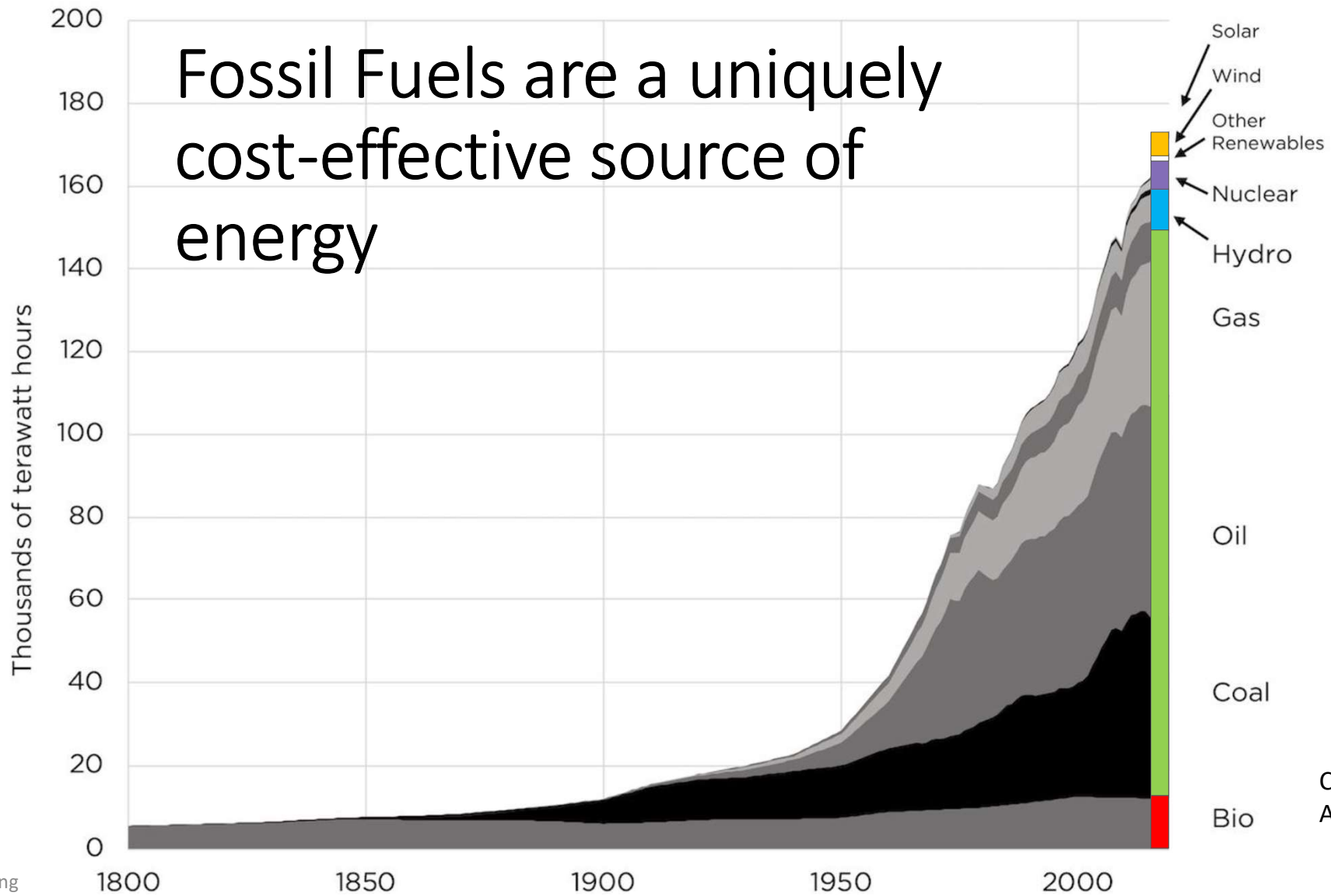


Source: Our World in Data based on the Global Carbon Project (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

**1. Fossil emissions:** Fossil emissions measure the quantity of carbon dioxide (CO<sub>2</sub>) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO<sub>2</sub> includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

Fossil Fuels are a uniquely cost-effective source of energy

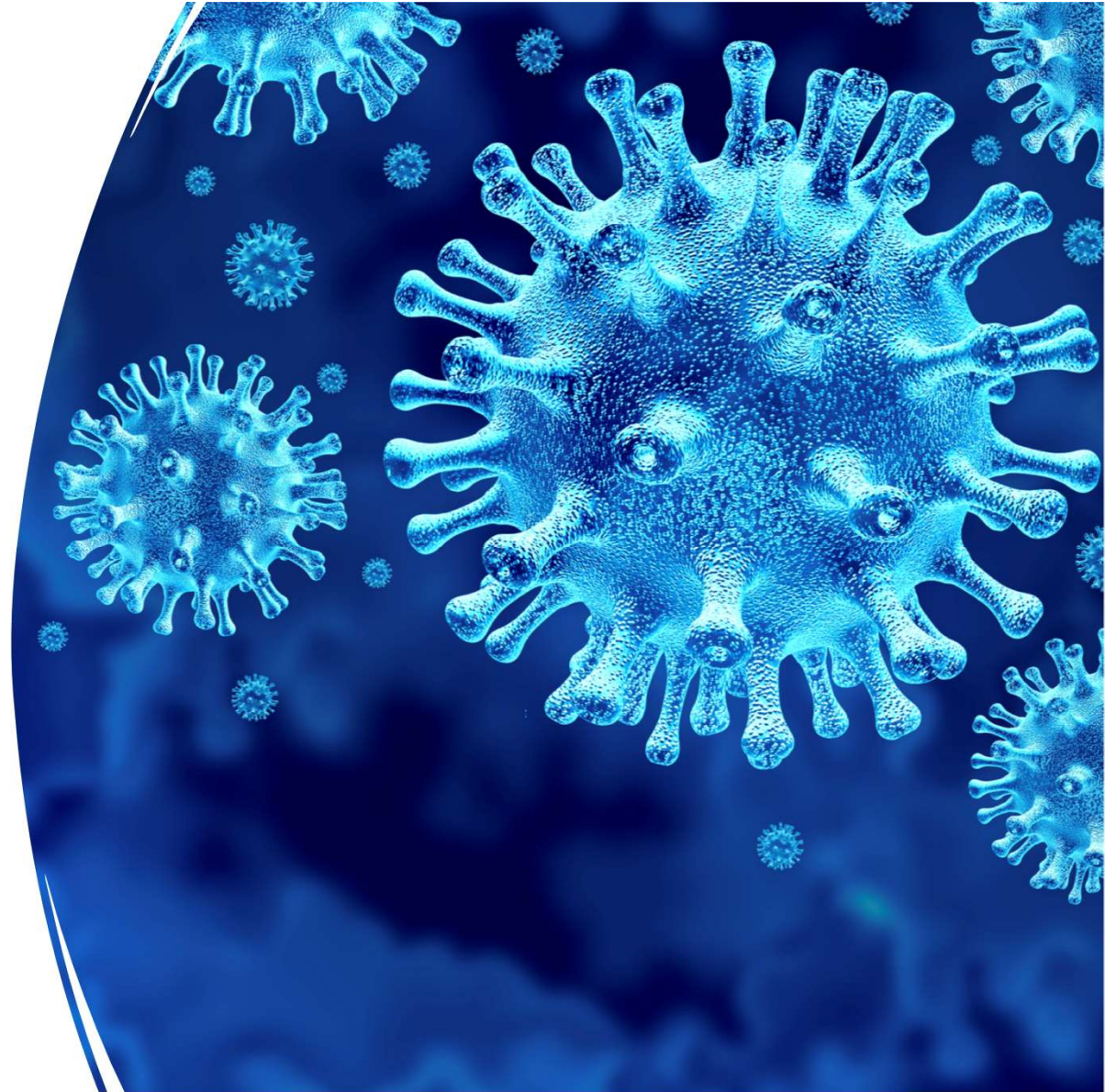


Courtesy of Alex Epstein

# Lesson from the Lockdowns

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Cost: trillions of dollars with no measurable decline in atmospheric CO<sub>2</sub>.



5. What  
should we  
do instead?

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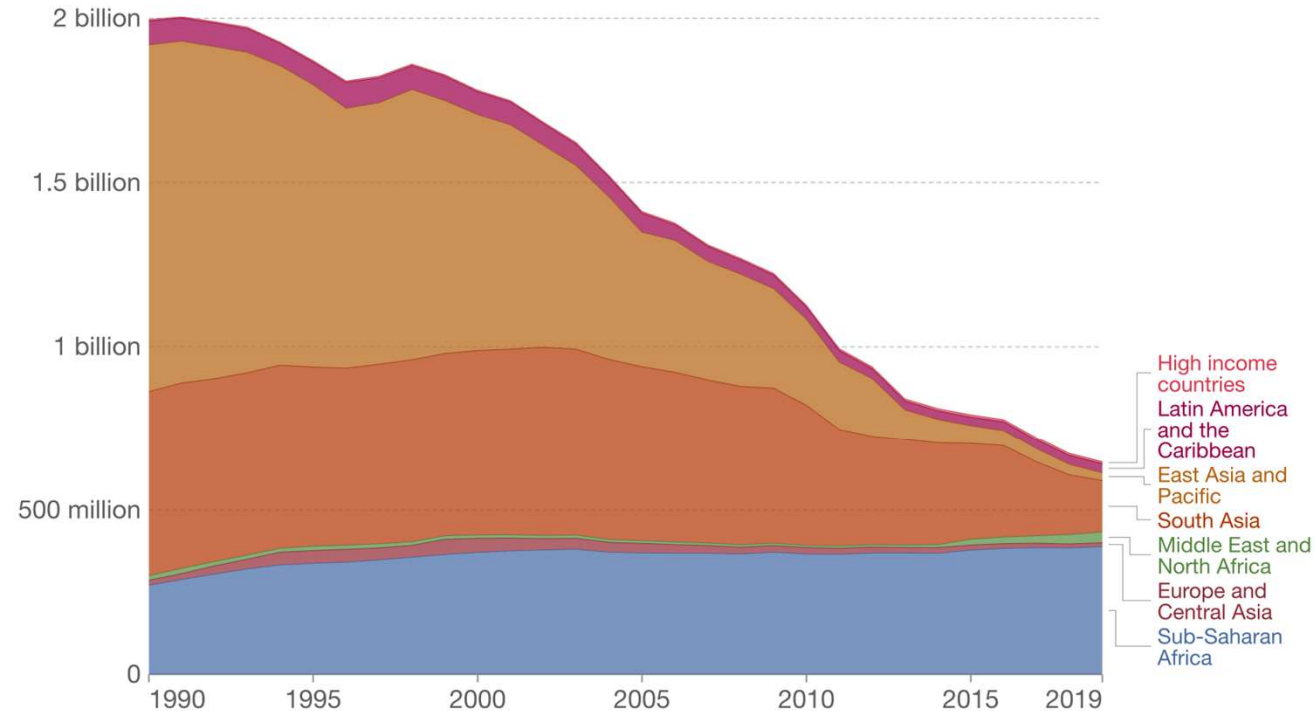


Help the  
poor  
become rich.

## Total population living in extreme poverty by world region

Extreme poverty is defined as living below the International Poverty Line of \$2.15 per day.

Our World  
in Data



Source: World Bank Poverty and Inequality Platform

OurWorldInData.org/poverty · CC BY

Note: This data is measured in international-\$<sup>1</sup> at 2017 prices to account for inflation and differences in the cost of living between countries. It relates to either disposable income or consumption per capita.

**1. International dollars:** International dollars are a hypothetical currency that is used to make meaningful comparisons of monetary indicators of living standards. Figures expressed in international dollars are adjusted for inflation within countries over time, and for differences in the cost of living between countries. The goal of such adjustments is to provide a unit whose purchasing power is held fixed over time and across countries, such that one international dollar can buy the same quantity and quality of goods and services no matter where or when it is spent. Read more in our article: What are Purchasing Power Parity adjustments and why do we need them?

# The Poor Need Clean, Affordable Need Energy

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“The African Dream is to develop, and that means affordable electricity.”

– James Shikwati, Kenyan  
economist



Adapt,  
don't  
mitigate

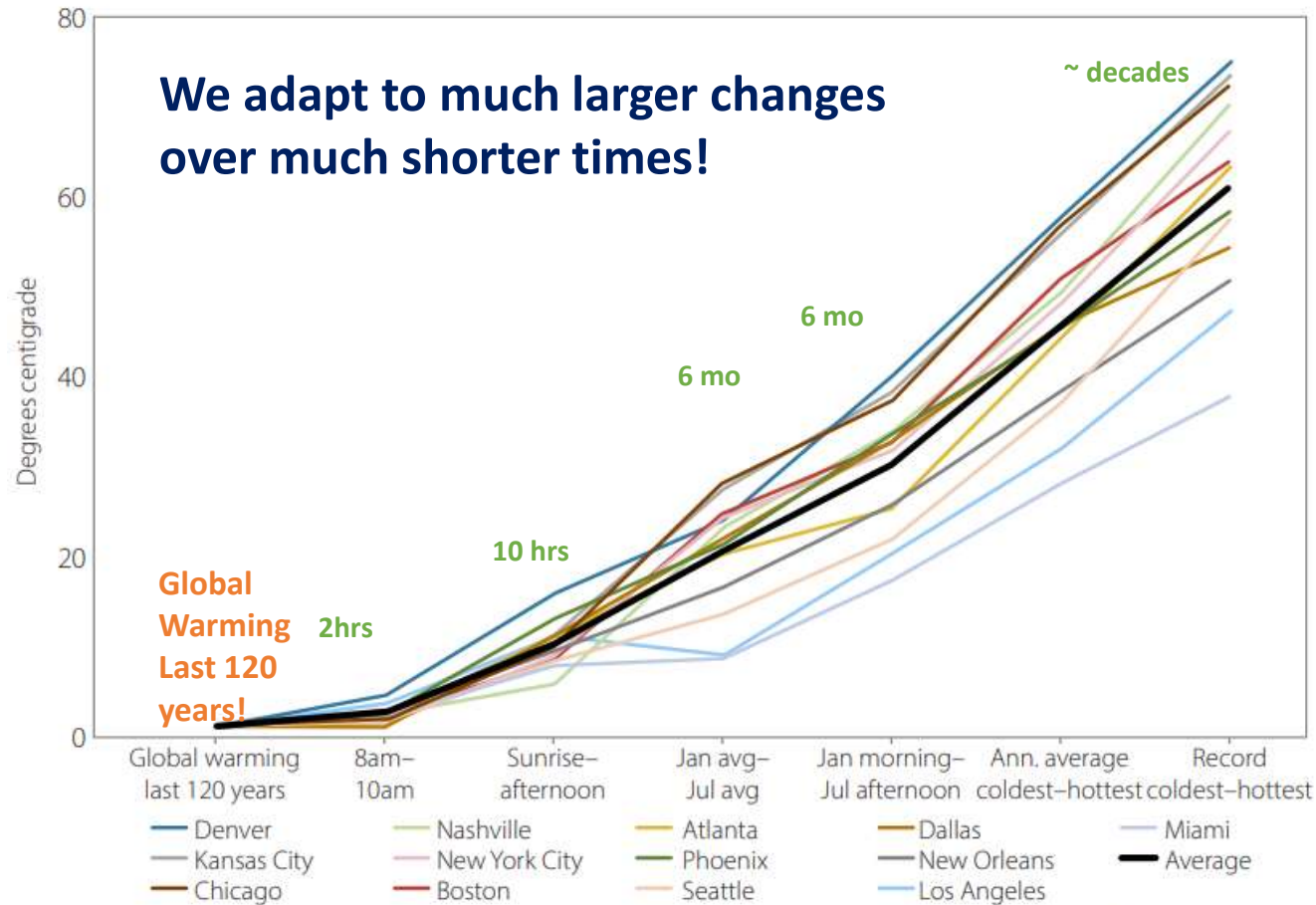


Figure 6: Various temperature changes that people and the rest of nature already deal with.



Global Warming

# Backup

# Internet resources ...



Marc Morano

**CLIMATE DEPOT**



Energy Talking Points  
by Alex Epstein



Alex Epstein  
Energy Talking Points

Start Here - Talking Points Overview

A screenshot of the Climate Depot website. At the top, there is a red navigation bar with a home icon, 'ABOUT', 'CLIMATE TV', 'BOOKS', 'EVERYTHING CLIMATE', and 'REFEREN'. Below the navigation bar, there is a main article titled 'Watts Up With That?' with a sub-headline 'The world's most viewed site on global warming and climate change'. To the right of the article is a large image of Anthony Watts with the text 'Anthony Watts' overlaid. Above the main article is a badge that says 'the 2008 weblog awards winner best science blog' and another badge that says 'THREE TIME WINNER HALL OF FAME HONOREE BEST SCIENCE BLOG weblog awards 2011, 2012, 2013 BLOGGIES'. Below the main article, there is a 'News Items' section with two items: 'Law Whispering is Dead, Long Live Law Whispering!' and 'Huge Green Mineral Lithium Deposit Discovered in Iran'. To the right of the news items is a book cover titled '#1 NEW RELEASE IN CLIMATOLOGY, EARTH SCIENCES, AND SCIENCE FOR KIDS'.

Global Warming