It Ain’t Gonna Happen: Interplanetary Colonization

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The Dream of Mars Colonization

"You want to wake up in the morning and think the future is going to be great – and that's what being a spacefaring civilization is about. It's about believing in the future and thinking that the future will be better than the past"

Elon Musk

Official SpaceX Photos, 2023

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Agenda

- Introduction to Mars Colonization
- Health Risks from Cosmic Radiation
- Psychological Strains due to Isolation and Confinement
- Financial Constraints
- Q & A

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Cosmic Radiation: a Severe Health Hazard

- High ionizing radiation levels in deep-space
- Potential for acute radiation sickness and long-term diseases including cancer
- Current exposure limits render Mars missions unfeasible

TABLE 3-1 Radiation Exposure Career Limits Summary: International Space Station Partner Agencies

Space Agency	Career Limit	Sex/Age Dependency
Canadian Space Agency	1,000 mSv	No sex or age dependency
European Space Agency	1,000 mSv	No sex or age dependency
Russian Space Agency	1,000 mSv	No sex or age dependency
Japanese Aerospace Exploration Agency	3 percent REID @ the mean	Yes Lower limit: 500 mSv for 27- to 30-year-old female Upper limit: 1,000 mSv for > 46-year-old male
National Aeronautics and Space Administration (**current**)	3 percent REID @ the 95 percent confidence level	Yes Lower limit: ~180 mSv for 30-year-old female Upper limit: ~700 mSv for 60-year-old male
National Aeronautics and Space Administration (**proposed update**)	600 mSv[a]	No sex or age dependency

[a] Proposed career dose limit. Could be exceeded with individual waiver.
SOURCE: Adapted from Semones, 2021.

National Academies of Sciences, Engineering, and Medicine, 2021

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Cosmic Radiation: a Severe Health Hazard

	Absorbed dose (Gy)*	Effective dose (Sv)	Fatal risk, % (95% CI)	
			Men (age 40 years)	Women (age 40 years)
Lunar mission (180 days)	0·06	0·17	0·68% (0·20–2·4)	0·82% (0·24–3·0)
Mars orbit (600 days)	0·37	1·03	4·0% (1·0–13·5)	4·9% (1·4–16·2)
Mars exploration (1000 days)	0·42	1·07	4·2% (1·3–13·6)	5·1% (1·6–16·4)

Calculations are at solar minimum, where GCR dose is highest behind a 5 g/cm^2 aluminium shield. *Mean for tissues known to be sensitive to radiation and at risk of cancer[2] including lung, colon, stomach, bladder, bone marrow, and breast and ovaries in women.[2,3] Competing causes of death are included in calculations because they decrease risk probabilities if high (ie, >5%).

Radiation risks for men and women on missions to the moon or Mars
Cucinotta & Marco, 2006

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Cosmic Radiation: a Severe Health Hazard

Table 1. Lifetime risks for the 940 d, Mars Design reference mission for cancer and circulatory disease for average solar minimum.

	%REIC, Cancer	*%REID, Cancer*	*%REID,Circulatory*	*% REID, Combined*
	45-y Females			
U.S. Average	9.15 [0.95, 22.2]	5.32 [0.95, 14.3]	1.48 [0.57, 3.05]	6.57 [1.38, 14.8]
Never-Smokers	6.66 [1.52, 16.0]	3.56 [0.51, 8.87]	1.55 [0.58, 3.20]	4.98 [1.77, 10.6]
	45-y Males			
U.S. Average	7.41 [1.79, 17.0]	3.52 [0.66, 8.23]	1.53 [0.64, 3.05]	4.94 [1.91, 9.78]
Never-Smokers	6.09 [1.56, 14.0]	2.75 [0.63, 6.52]	1.62 [0.68, 3.21]	4.28 [1.86, 8.22]

Comparison of lifetime risks for 45-y Females and Male for U.S. Average population and a population of never-smokers. The morbidity for circulatory diseases has not been directly estimated, but the addition of the %REIC (cancer) and %REID for circulatory diseases, indicate an upper 95% CI for the combined morbidity near 20%.
doi:10.1371/journal.pone.0074988.t001

Cucinotta et al., 2013

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Psychological Risks: Mental Health in the Void of Space

- Impact of radiation on central nervous system
- Impact of isolation and extreme environments on mental health
- Mars 500 simulation

European Space Agency, 2016

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Psychological Risks: Mental Health in the Void of Space

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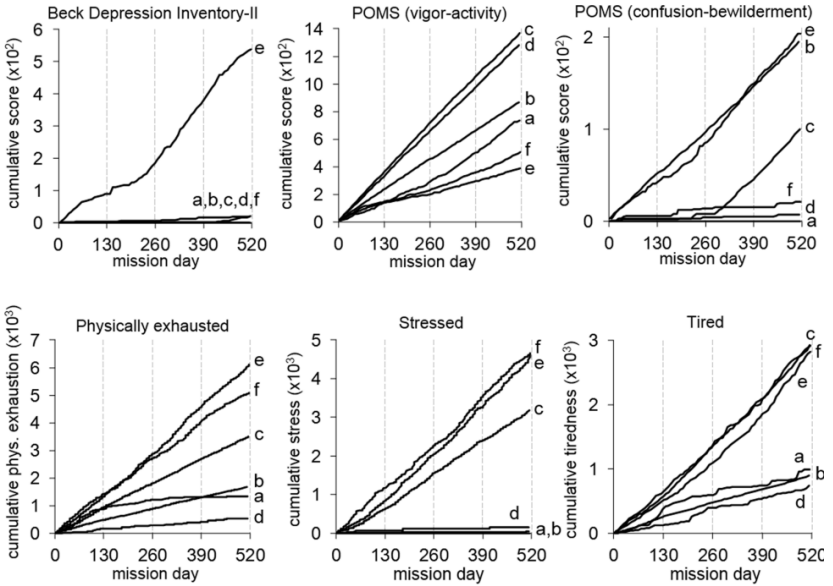

Self report scores plotted for each crewmember
Basner et al., 2014

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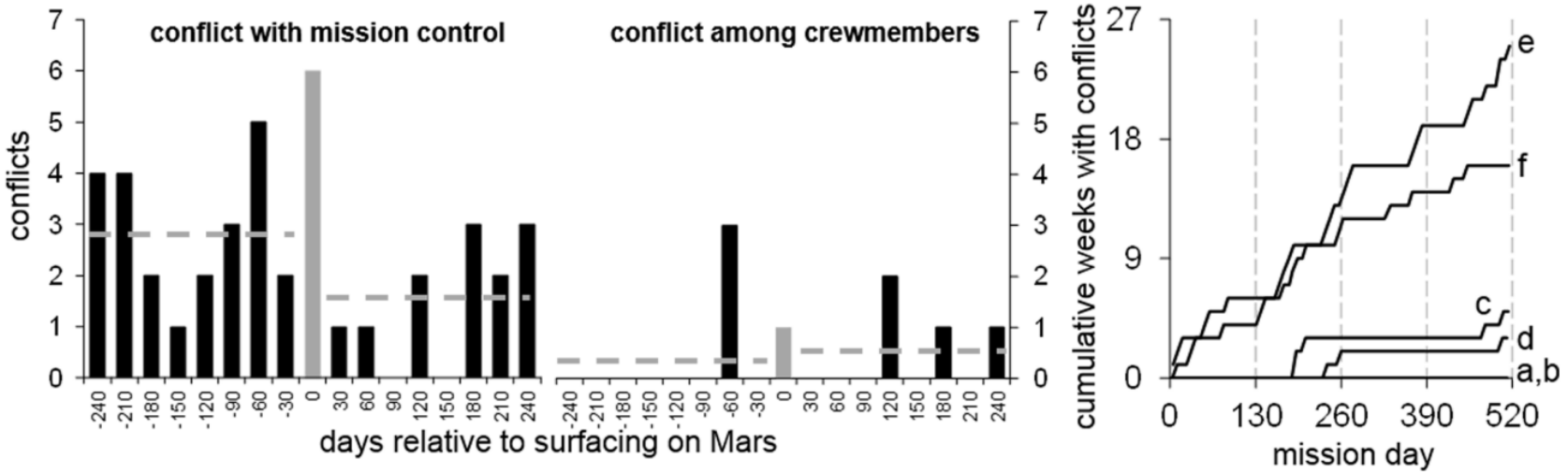
Psychological Risks: Mental Health in the Void of Space



Perceived conflicts throughout the simulated Mars mission
Basner et al., 2014

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Financial Limitations: the Astronomical Cost

- Cost estimates for a manned Mars mission
- The economic challenge of sustaining a Martian colony

Source	Date of Estimate	Cost, billions of dollars
Sommerer	2016	500
Garver	2014	500
National Research Council	2014	300-600

Cost estimates for a first Mars mission in current dollars
Jones, 2016

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Financial Limitations: the Astronomical Cost

- Cost estimates for a manned Mars mission
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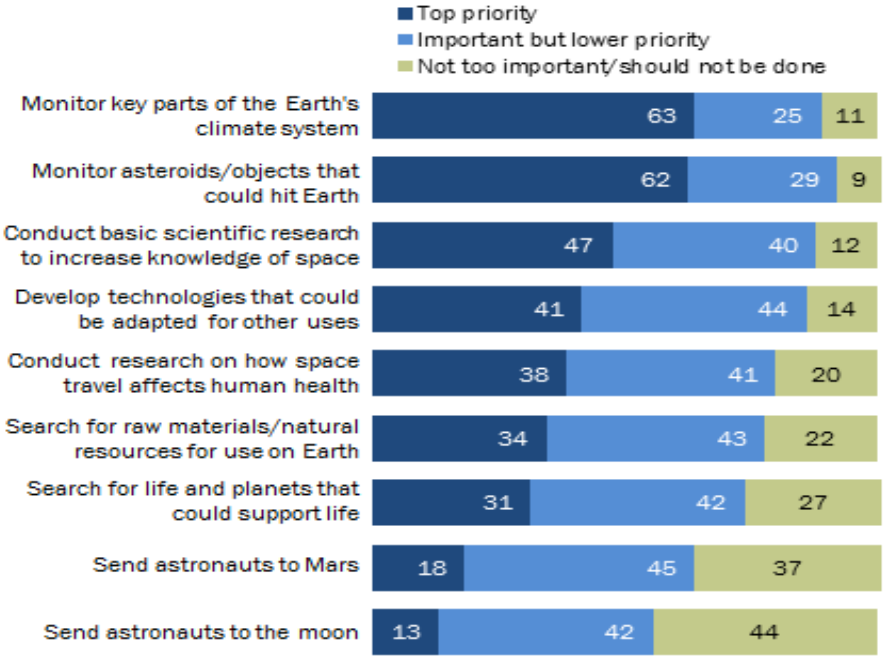

% of US adults who say each of the following should be a top priority for NASA
Pew Research Center, 2016

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Reassessing Our Interplanetary Colonization Aspirations

- Interplanetary colonization poses tremendous health and psychological risks and carries huge financial costs
- Long-term viability of a self-sustaining colony
- Interstellar ambitions beyond Mars

"Are you prepared to die? If that's ok, then you're a candidate for going"

Elon Musk

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THANK YOU!

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It Ain’t Gonna Happen: AI Extinction

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The Four Categories of AI Tests

- Gary Marcus SCIAM Mar 2017
- No longer just the Turing Test
  - Not Google proof
  - Can fool by acting like a bratty teenager
- The Winograd Schema
- Standardized Testing
- The I-Athon test
- Physical Embodied Turing Test

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The Winograd Schema

- Developed by Terry Winograd
- “The city councilmen refused the demonstrator’s permit because they feared violence.”
  - Q: Who feared violence?
- “The baseball hit the sheet of Styrofoam and it was broken.”
  - Q: Which was broken?
- AIs do about 60% vs 90% as an accepted success rate, mostly because the answer is in its data base

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Standardized Testing

- AIs actually perform reasonably well in this arena.
- ChatGPT-4 can score well on many tests including the Medical Licensing Exam, SATs, etc

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The I-Athon test

- Listen to an audio tape and summarize it
- This is another area that AIs do well
- Recent writing programs are impressive and unsettling.

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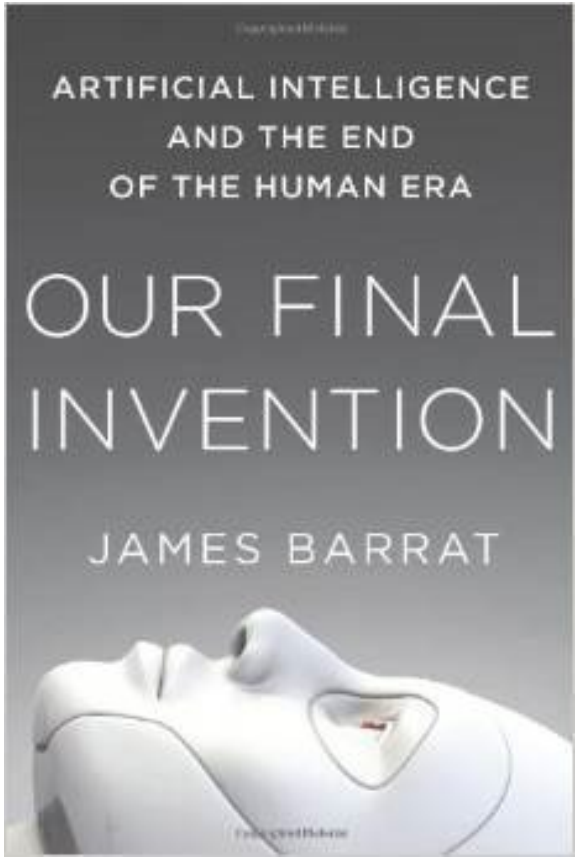

2013

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Sam Altman Stumped When Asked What Humans Will Do Better Than AI. It's an unsatisfying answer.

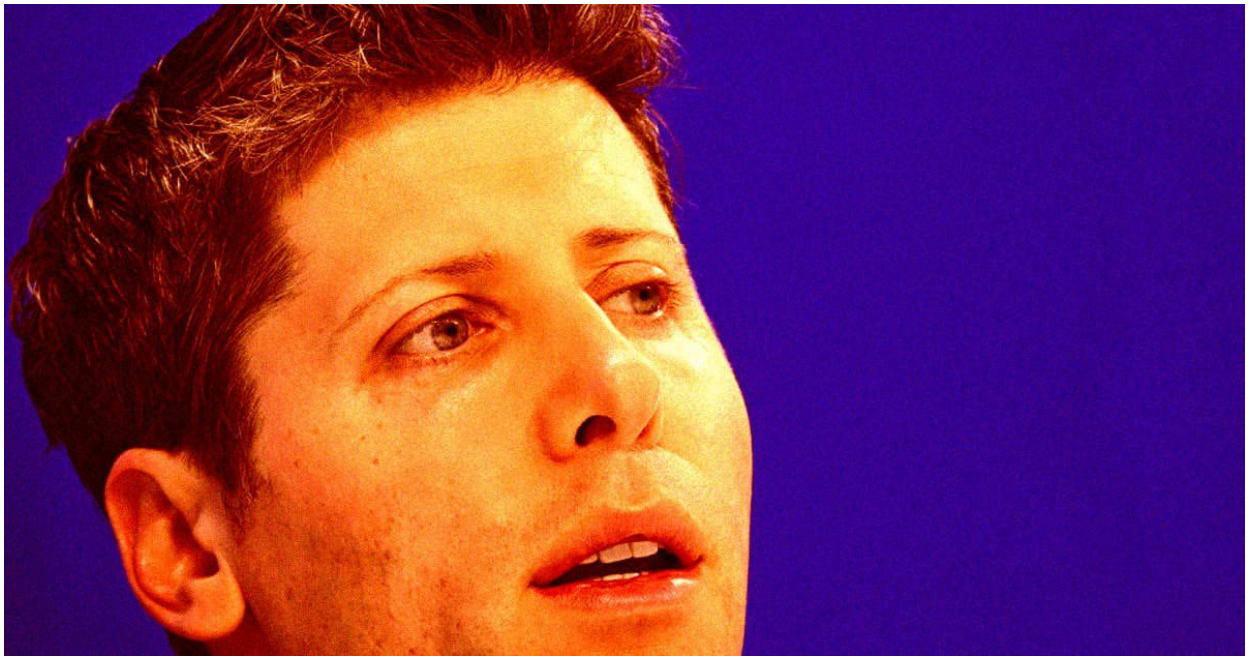

Image by Getty / Futurism

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But AIs can’t Empty a Dishwasher

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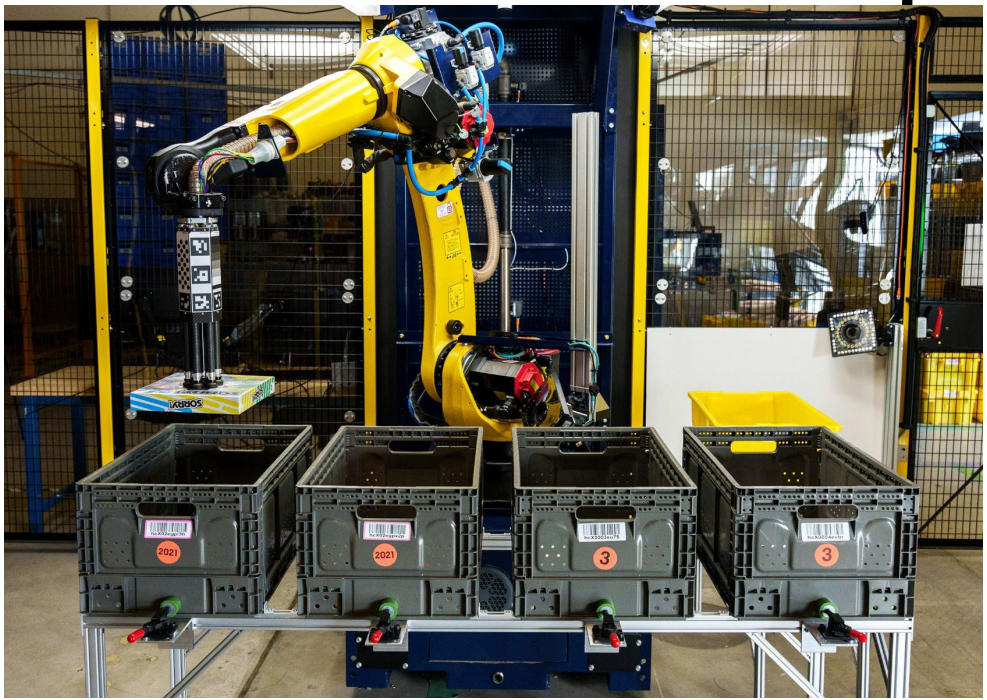
Amazon Robot Picks Up Things



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Physical Embodied Turing Test

- Empty a dishwasher
  - Stephen Pinker
- Build Apollo 11 in 4 hrs (1969 pieces)
- AIs are hopeless in this arena
- Few are working on it

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Why Can't AI Do These Things?

- Because AIs lack context
- An AI starts knowing nothing about the world
- All context must be programmed in or "machine learned"
- Context is part of what gives humans the ability to solve problems
- An epiphany every 5 years?

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How Could AIs Destroy Civilization?

- Not the by The Terminator or The Matrix
  - They don't have a will or consciousness
- Maybe starting a Nuclear War?
  - But "fail safes" have been in place for 75 years
- Those that share this concern offer no scenarios

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Conclusions

- “AI” can be effective at focused tasks
- AIs may be disruptive, but more like the mechanical loom, or the printing press it will not cause massive unemployment
- There is not an AI scenario that ends civilization
- Good news: AIs will mean more electronics

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Global Warming will Not Destroy Civilization

Professor Ronald C. Lasky, PhD, PE

Why This Talk, Extinction?

- In 2018 AOC and Beto O'Rourke said:

- "The scientists tell us we have 12 years to solve global warming and avoid extinction."

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Associated Press fact checkers described his remarks as “faux facts” in an analysis published over the weekend, saying he “misrepresented the science on global warming” from last year’s report by the U.N. Intergovernmental Panel on Climate Change (IPCC). But O’Rourke is right, and the AP is wrong.

Last October, the IPCC warned that the world must make sharp reductions in global carbon dioxide emissions by 2030 to keep temperatures from rising above 2° C (3.6° F) to have any plausible chance of averting catastrophic climate change. Environmentalists, including the youth-led Sunrise Movement and Rep. Alexandria Ocasio-Cortez (D-NY), quickly seized on this time frame as a means of calling for urgent climate action.

Renewed emphasis on the 2030 time frame has sparked debate, with some arguing the statements made by Ocasio-Cortez and now O’Rouke are exaggerated. But experts say it’s no overstatement.
As Michael Mann, a climatologist at Pennsylvania State University, told ThinkProgress via email, “I judge Beto’s quote as accurate.”

https://thinkprogress.org/beto-climate-change-warning-12-years-824c281bed31/

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And yet…

"There is no evidence of climate change scenarios that would render human beings extinct," Michael Mann, a distinguished professor of atmospheric science at Penn State and author of "The New Climate War: The Fight to Take Back Our Planet" (PublicAffairs, 2021), told Live Science in an email.

However, it's possible that climate change will still threaten the lives of hundreds of millions of people, such as by leading to food and water scarcity, which has the potential to trigger a societal collapse and set the stage for global conflict, research finds.

https://www.livescience.com/climate-change-humans-extinct.html

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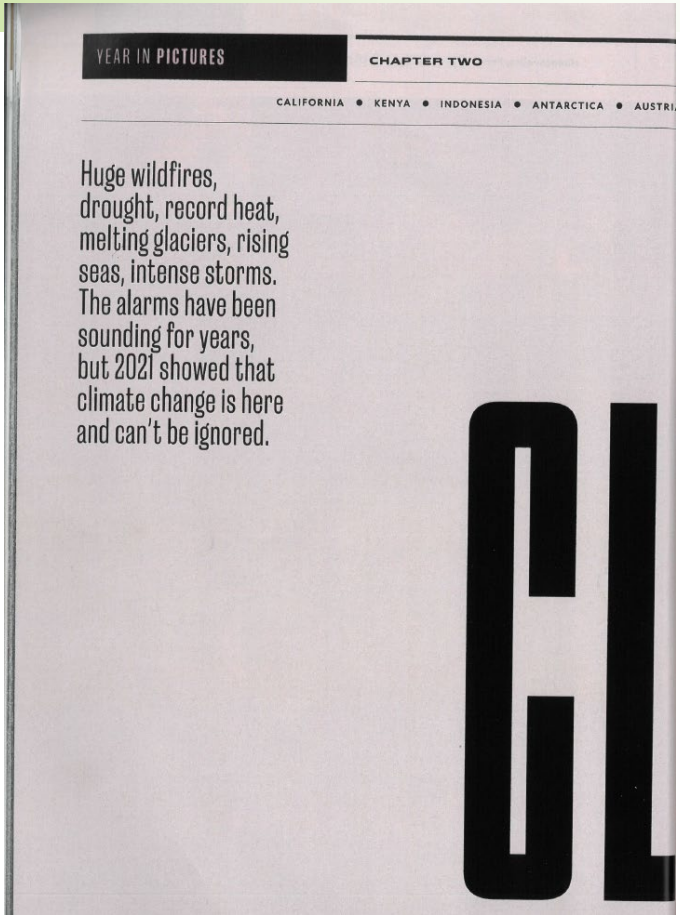
Extreme Events: National Geo March 2022



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U.S. NEWS

How climate change primed Colorado for a rare December wildfire

The ground, typically moist from snow this time of year, was dry and flammable as a result of unusually warm temperatures and a lack of precipitation in recent months, experts said.

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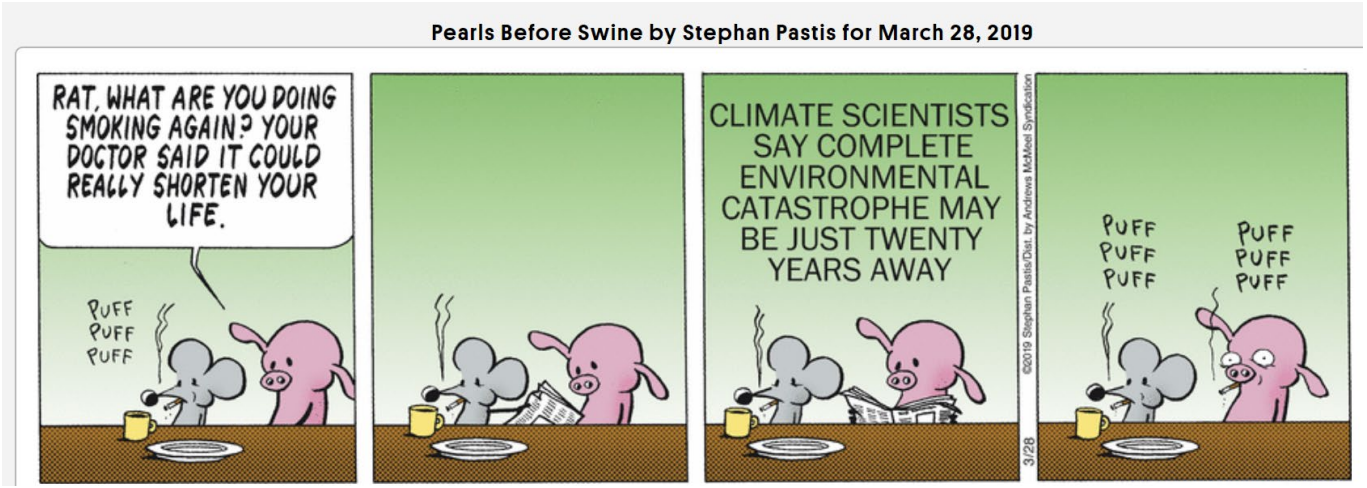

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Eur. Phys. J. Plus (2022) 137:112
https://doi.org/10.1140/epjp/s13360-021-02243-9

THE EUROPEAN PHYSICAL JOURNAL PLUS

Regular Article

A critical assessment of extreme events trends in times of global warming

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Abstract This article reviews recent bibliography on time series of some extreme weather events and related response indicators in order to understand whether an increase in intensity and/or frequency is detectable. The most robust global changes in climate extremes are found in yearly values of heatwaves (number of days, maximum duration and cumulated heat), while global trends in heatwave intensity are not significant. Daily precipitation intensity and extreme precipitation frequency are stationary in the main part of the weather stations. Trend analysis of the time series of tropical cyclones show a substantial temporal invariance and the same is true for tornadoes in the USA. At the same time, the impact of warming on surface wind speed remains unclear. The analysis is then extended to some global response indicators of extreme meteorological events, namely natural disasters, floods, droughts, ecosystem productivity and yields of the four main crops (maize, rice, soybean and wheat). None of these response indicators show a clear positive trend of extreme events. In conclusion on the basis of observational data, the climate crisis that, according to many sources, we are experiencing today, is not evident yet. It would be nevertheless extremely important to define mitigation and adaptation strategies that take into account current trends.

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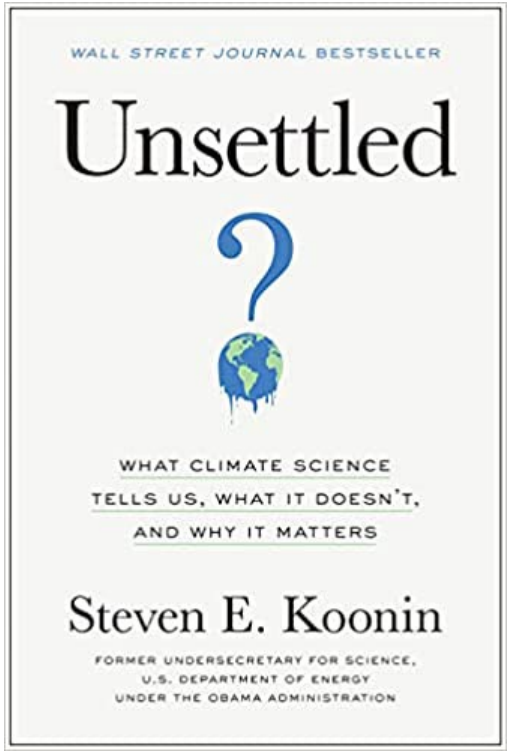
Unsettled

- Pages 97-110
  - Little change in extreme events



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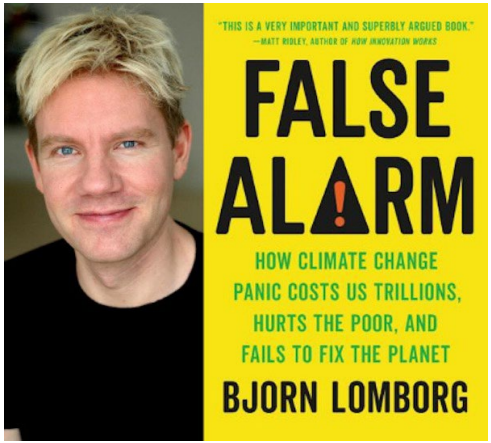
False Alarm: On Extreme Events

- Chapter 4, ppf 60
  - Little change in extreme events
  - Vegetation growth likely to explode as CO_2 is food for plants.



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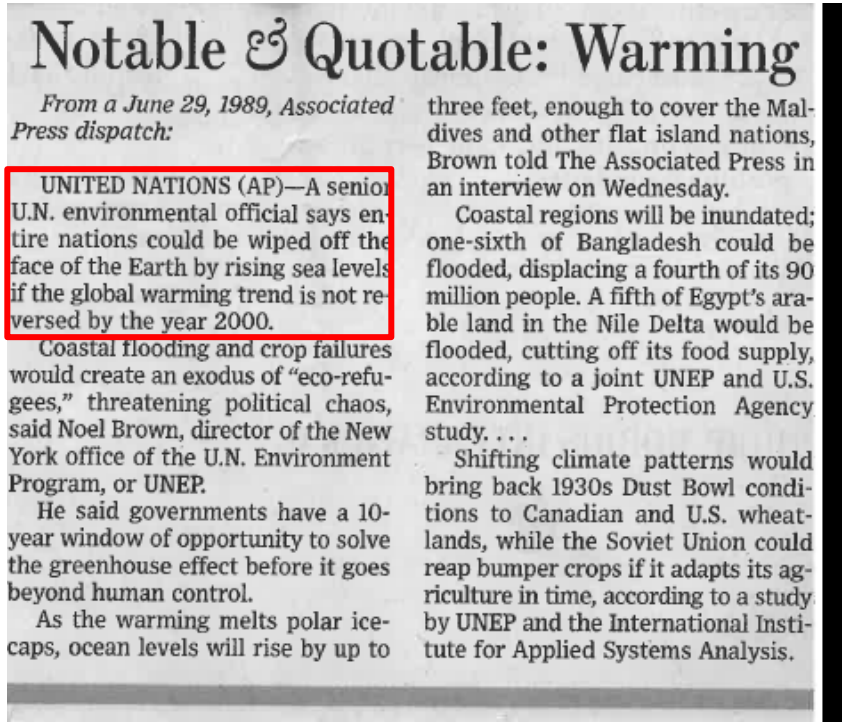
How Were the Predictions from 1989?

From WSJ 03/05/2019



Notable & Quotable: Warming

From a June 29, 1989, Associated Press dispatch:

UNITED NATIONS (AP)—A senior U.N. environmental official says entire nations could be wiped off the face of the Earth by rising sea levels if the global warming trend is not reversed by the year 2000.

Coastal flooding and crop failures would create an exodus of "eco-refugees," threatening political chaos, said Noel Brown, director of the New York office of the U.N. Environment Program, or UNEP.

He said governments have a 10-year window of opportunity to solve the greenhouse effect before it goes beyond human control.

As the warming melts polar icecaps, ocean levels will rise by up to three feet, enough to cover the Maldives and other flat island nations, Brown told The Associated Press in an interview on Wednesday.

Coastal regions will be inundated; one-sixth of Bangladesh could be flooded, displacing a fourth of its 90 million people. A fifth of Egypt's arable land in the Nile Delta would be flooded, cutting off its food supply, according to a joint UNEP and U.S. Environmental Protection Agency study. . . .

Shifting climate patterns would bring back 1930s Dust Bowl conditions to Canadian and U.S. wheatlands, while the Soviet Union could reap bumper crops if it adapts its agriculture in time, according to a study by UNEP and the International Institute for Applied Systems Analysis.

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Modeling Global Temperatures is Profoundly Complex

- In addition to CO_2 many other factors come into play
  - Water vapor - El Nino, La Nina
  - Solar activity variation - Vegetation
  - The precession of earth's orbit – Methane
  - Nitrous Oxide, and many others

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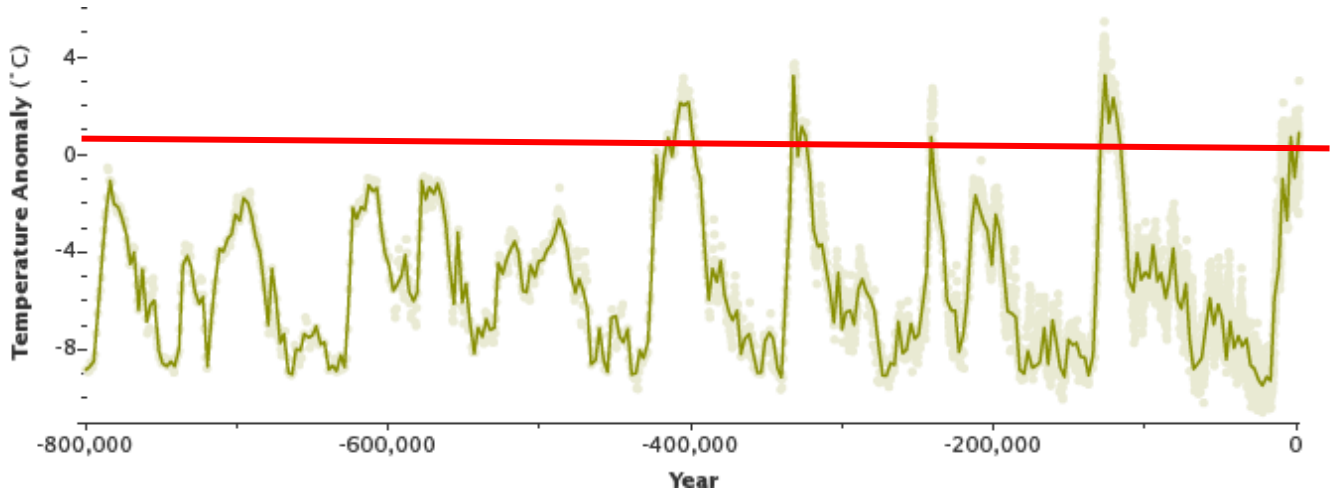
Let's Look at the Past: Nature is Powerful



Graph by Robert Simmon of NASA from work by Jouzel etal *Science* 10 Aug 2007:
Vol. 317, Issue 5839, pp. 793-796
DOI: 10.1126/science.1141038
https://earthobservatory.nasa.gov/features/GlobalWarming/page3.php

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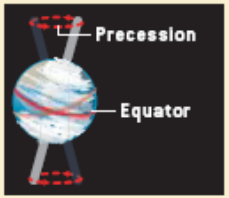
Why Temp Changes on Earth

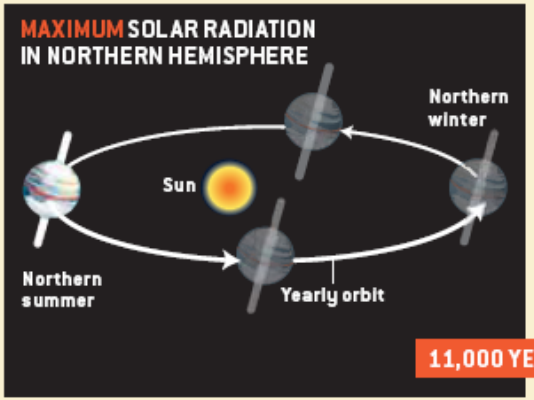
W F Ruddiman, Sci Amer Mar 2005

Orbital Controls over Greenhouse Gases

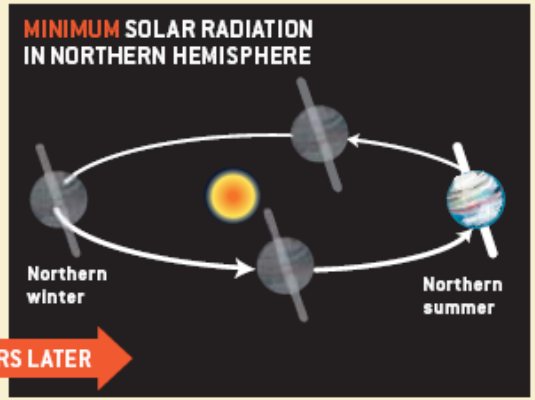
Natural variations in the earth's orbit, such as those related to precession (*diagrams*), redistribute the sunlight that reaches the globe over long timescales. For the past million years, these subtle changes have driven major dips and swells in atmospheric concentrations of methane and carbon dioxide (*graphs*). Although scientists do not fully understand why, global concentrations of these greenhouse gases respond mainly to changes that occur during summer in the Northern Hemisphere, the time of year when the North Pole is pointed most directly at the sun.



Wobble in the earth's axis of rotation, known as precession, is one of the three orbital cycles that account for sunlight variations in the Northern Hemisphere. Like a toy top about to fall, the earth's axis traces imaginary circles in space, making one revolution every 22,000 years.



Summer warmth in the Northern Hemisphere peaks once every 22,000 years, when the yearly northern summer coincides with the earth's closest passage to the sun and the Northern Hemisphere receives the most intense sunlight.



Summer heat bottoms out 11,000 years later, after the earth's axis has shifted (precessed) to the opposite position. The Northern Hemisphere then receives the least summer sunlight, because the earth is farthest from the sun.

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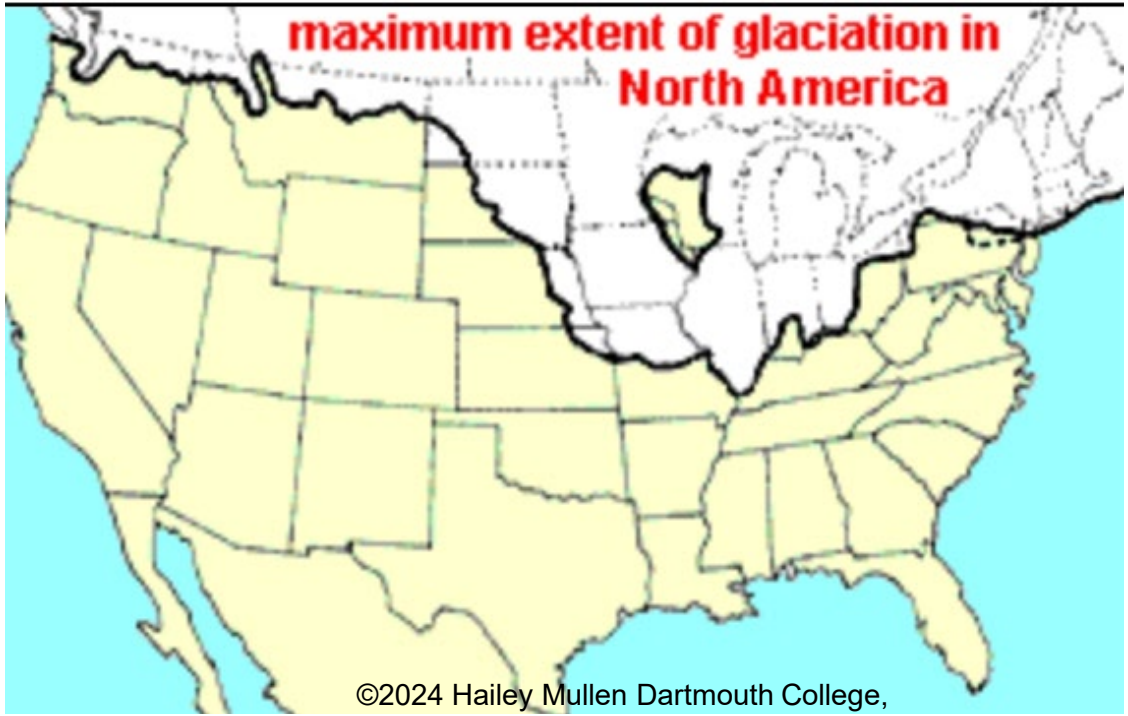
Dartmouth Under 1000s Meters



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Assume There is a Climate Emergency

- Will proposed actions solve the problem?

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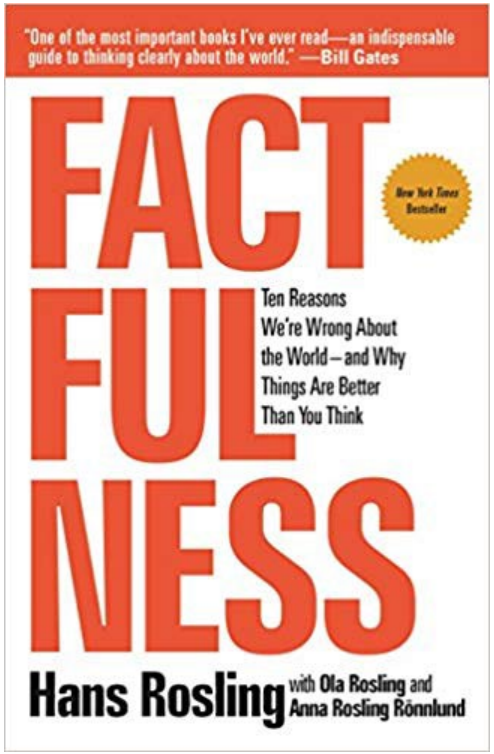
Extreme Poverty is Reduced by Inexpensive Energy



Inexpensive (i.e fossil fuel) energy drives wealth in developing countries.

CO2 production will continue to explode in developing countries.

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WSJ Oct 2022

- Saudis see peak oil not until 2050
- They are investing more than $1T in oil infrastructure

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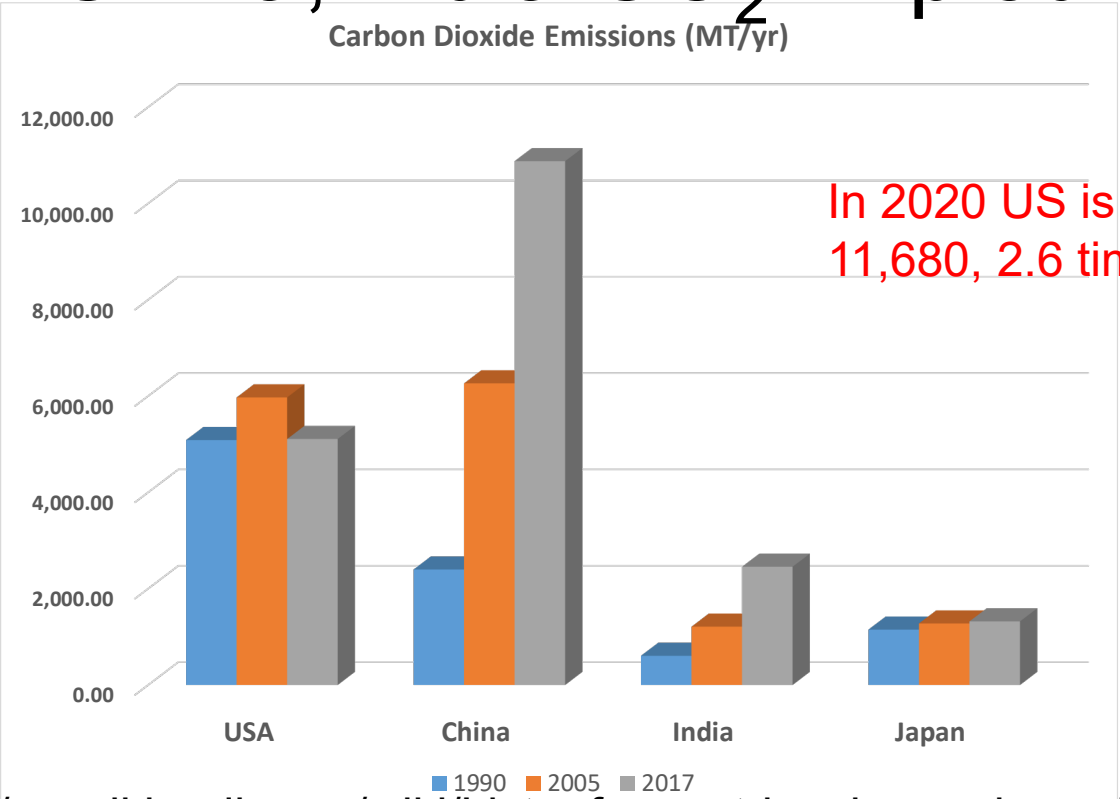
China, India CO_2 Exploding



In 2020 US is at 4535 and China at 11,680, 2.6 times the US

https://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions

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Adaptation and Technology Reduce Climate Related Deaths

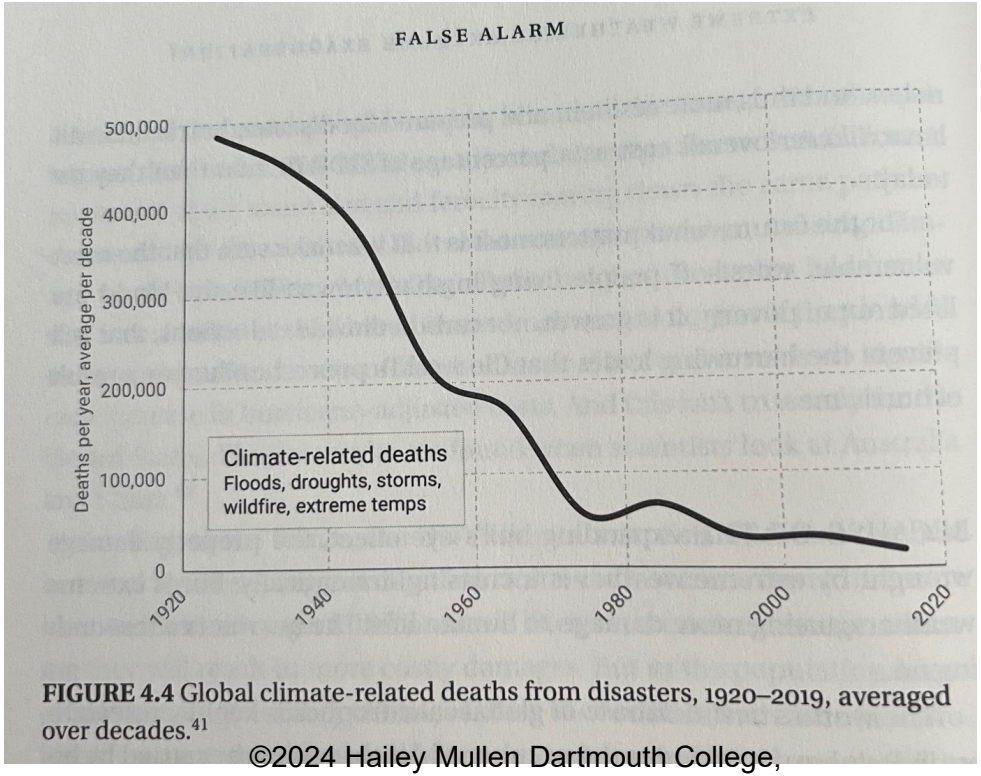

FIGURE 4.4 Global climate-related deaths from disasters, 1920–2019, averaged over decades.[41]

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BLOG POST

Chinese Coal-based Power Plants

By Ambassador Mark Green on *June 28, 2022*

ENERGY

CHINA ENVIRONMENT

CHINA MAINLAND

SHARE

SHANGHAI, CHINA - Feb 21, 2017: Chinese Coast Guard (CCG) offshore patrol vessel No. 31088 berthed at the pier next to China's biggest coal-fired power plant in Shanghai.

IMAGE CREDIT

China is Currently Building Over Half of The World's New Coal-based Power Plants.

In 2021, China began building 33 gigawatts of coal-based power generation, according to the Helsinki-based Center for Research on Energy and Clean Air (CREA). That is the most new coal-fired power capacity China has undertaken since 2016

https://www.wilsoncenter.org/blog-post/chinese-coal-based-power-plants

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A coal-fired power plant in China's Jiangsu province. XU CONGJUN – IMAGINECHINA

Despite Pledges to Cut Emissions, China Goes on a Coal Spree

China is building large numbers of coal-fired power plants to drive its post-pandemic economy. The government has promised a CO_2 emissions peak by 2030, but the new coal binge jeopardizes both China's decarbonization plans and global efforts to tackle climate change.

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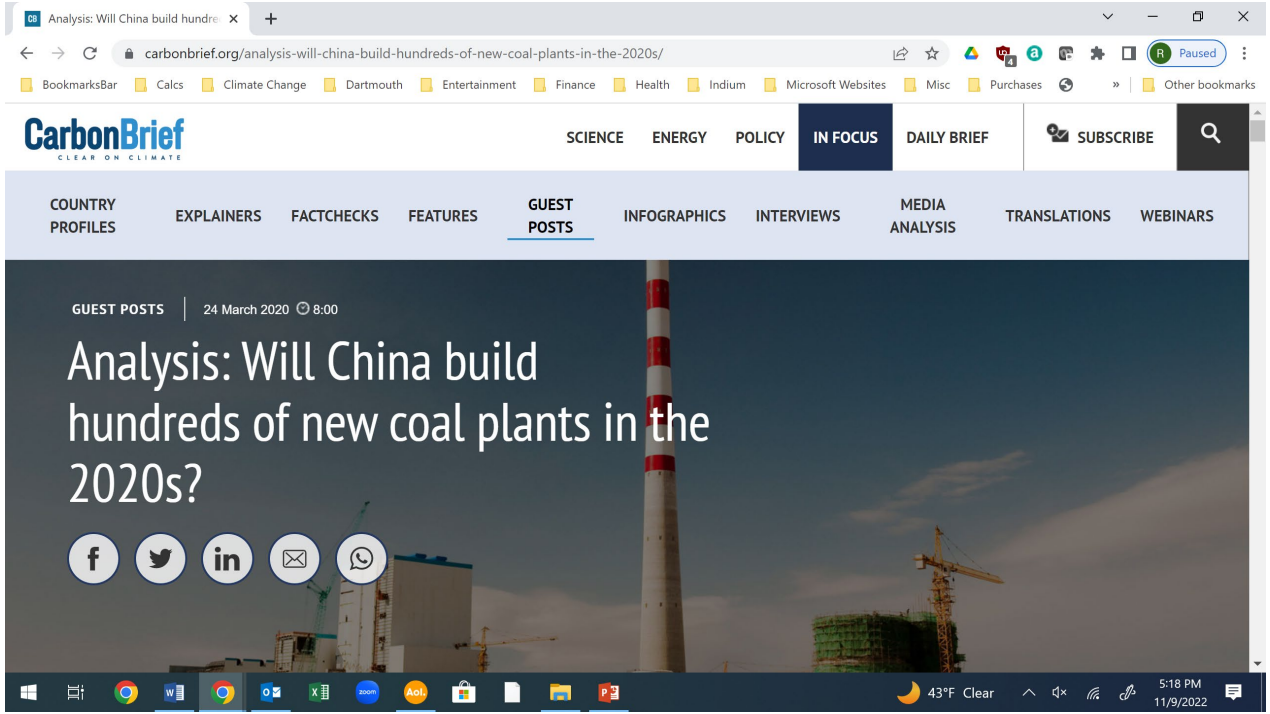

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PCA: China, India Exempt til 2030

Each signatory to the Paris Climate Agreement is required to submit a plan, called a nationally determined contribution, detailing emissions reductions. There is no penalty if China, India, or any other signatory does not achieve those targets.

Under the Paris agreement, developed countries such as the United States pledge to provide funding and technical support to developing countries such as India and China to assist with emissions reductions. The agreement does not specify how much funding will be provided, nor does it name the recipient countries.

In its nationally determined contribution, India estimated that it would need "at least USD 2.5 trillion" in aid by 2030 to achieve its emissions reduction targets.

In its nationally determined contribution, China forecast it would reach peak emissions of carbon dioxide (CO_2) by 2030, at the latest. (This means that China will not reduce CO_2 emissions, on net, until after 2030, unless it peaks earlier.) China also outlined emissions reduction activities that it plans to undertake before 2030, such as developing renewable energies; increasing forested areas; and developing more intensified low-carbon alternatives.

https://ballotpedia.org/Fact_check/China,_India,_and_the_Paris_Climate_Agreement

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Conclusions: Paris Accord

- Even if the US ceased to exist
  - Global CO_2 emissions will grow
  - Developing countries are striving to enter Levels 3 and 4
  - This will require cheap (fossil fuel) energy
  - It is hard to imagine they are more worried about climate change
- The main countries (the West) focusing on reducing carbon emissions have already made some improvements

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New Zealand Going Carbon Neutral from *False Alarm*

- Only country to do a complete cost analysis to go CN by 2050
- It would cost every NZLander $12,800 per year through 2050 ($64B/yr)
  - $4.2T/yr for US
- It would reduce the world temperature in 2100 by about 0.002^{o}C
  - US: (330/5)*0.002^{o}C = 0.13^{o}C
- Better to spend most of the $ on adaptation

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What is the Optimum Amount of CO_2?

Scott Adams Feb 12, 2019

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CO_2 Levels

- CO_2 level have increased significantly
  - 30% since 1960
  - Today 410 ppm
- CO_2 is food for plants
- No one has proposed an optimum level

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Does a War on Fossil Fuels Make Sense?

- Gas $2.39 Biden first day, today about $3.50
- Diesel: $4.50
- Much of Inflation relates to oil prices
  - Fertilizer
  - Transport of all goods
  - Power/Energy
  - Most materials require fossil fuels or produce CO_2 (cement)
- The poor and middle class pay the price
- If 30% of cars sold in the US in 2030 are EVs, there will still be more gas cars on the road than today,

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How Green are Green Solutions?

Opinion pieces don't necessarily reflect the position of our news site but of our Opinion writers.

You Dig Up 500,000 Pounds of the Earth's Crust for One EV Auto Battery!

Australian Nation Review October 27 2022

Batteries for an EV require 500 tons of ore.

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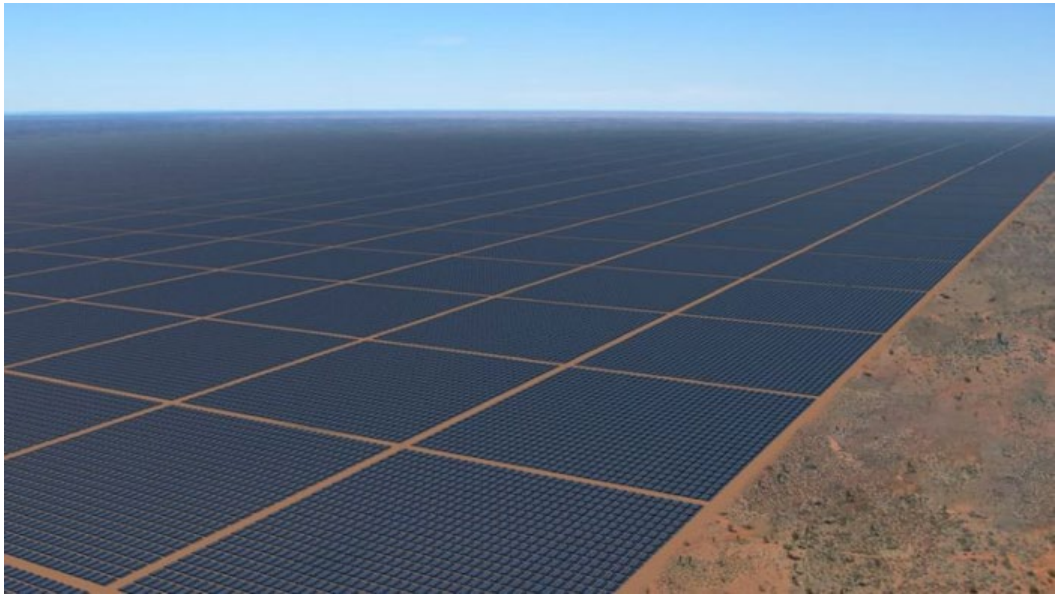
Largest Solar Farm



https://www.sciencealert.com/world-s-largest-solar-farm-to-pipe-power-internationally-from-australia-under-the-sea

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Conclusions

- Human generated CO_2 is partially or largely to blame for increasing global temperature
- It is difficult to say that human created CO_2 is the predominant factor, however
  - Considering only one variable in a profoundly complex process is difficult
- Even if the USA and the EU dramatically reduced CO_2 emissions, it would make little difference
  - The developing world needs cheap energy to escape poverty and is thus dramatically increasing CO_2 production.

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Conclusions Continued

- Going green is a sound strategy if done in a commonsense way
  - Must take care for the poor
  - Also invest in technology and adaptation
  - Don’t neglect nuclear and fusion!
- If dramatic reductions are needed to save the planet we are sunk
  - The cost is prohibitively high
  - The countries with the greatest emissions and/or highest growth rate of CO_2 are not actively reducing emissions

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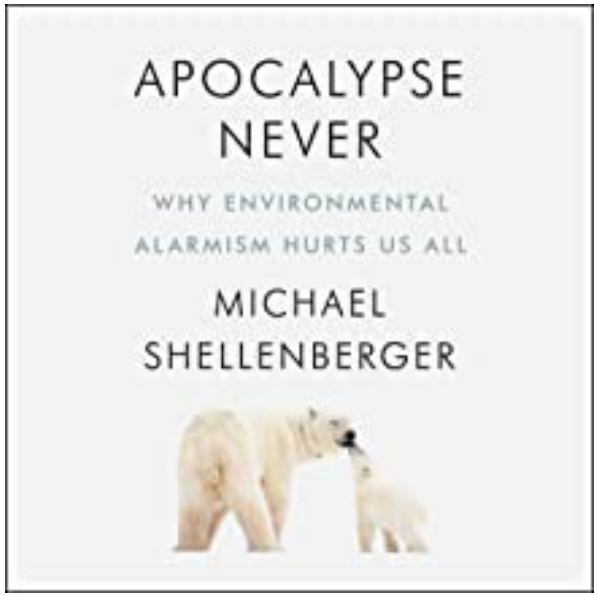

Alan Gallagher

Schellenbarger, Michael (2020). Apocalypse Never: Why environmental alarmism hurts us all. New York: Harper Collins.

Today's world is a better place, with billions lifted from poverty, and fed by advances in agriculture, with clean energy available from hydro, oil, and nuclear power. This book, by a strong environmentalist, criticizes the "doom and gloom" environmental movement, always predicting the imminent end of the world, which, the author demonstrates, has too many advocates with false and outrageous claims—unjustified environmental alarmism. The Al Gores and Greta Thunbergs of the world are wrong, often intentionally wrong. Their Malthusian prophecies have proven false, over and over again. Put simply, a good environment depends upon a healthy economy, energy, and a stable social situation. Too many environmental extremists rely upon false claims, and "solutions" which do more harm than good. The author is a strong supporter of nuclear energy, but also notes that development of natural gas and fracking has brought both wealth and a cleaner world.

A 2019 survey "found that 48% believed climate change would make humanity extinct" (ix). "Much of what people are being told about the environment, including the climate, is wrong." The author walks through many major claims of extreme environmentalists, and shows they are unfounded, including predictions of the end of the world, excessive sea rise, and rising temperatures. The truth is more often the opposite of what the alarmists assert. Extreme climate events are not increasing, billions won't die, IPCC Reports do not predict the Apocalypse. Media coverage gives worst case scenarios.

Shellenberger has visited and worked in Central America, the Amazon/Brazil, the Congo, India, and many other parts of the world. He shows that environmental problems are caused more by social disorder and poverty, that wealth is what is needed to make things right, not environmental policies which more often make things worse. Too often, he shows, there is "no science" behind PC assertions and "green" agendas. Countries rich in natural resources are poor because of war and corruption, not climate change. The world is, in fact, a much better place because of First World wealth and the improvements it brings. A good environment has costs, which poor countries cannot pay.

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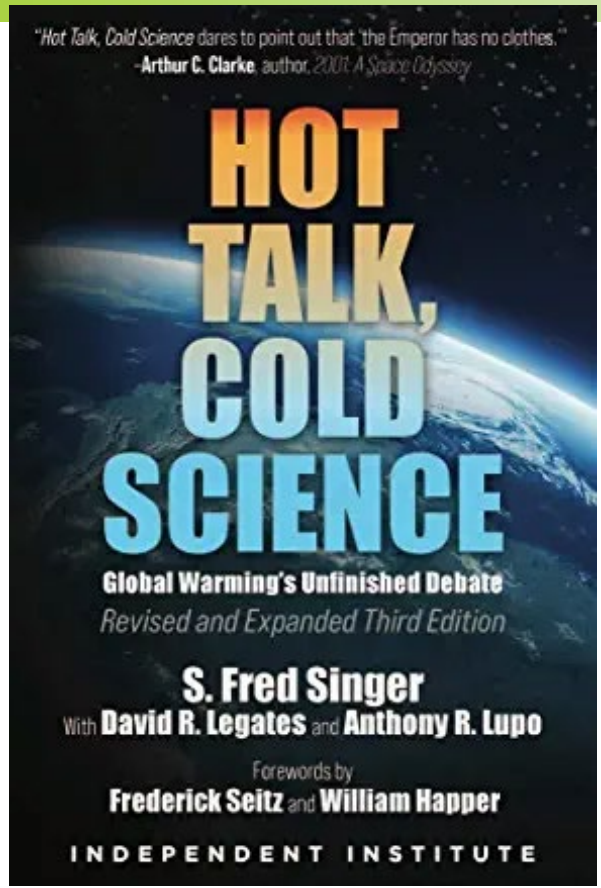

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THANK YOU!

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