

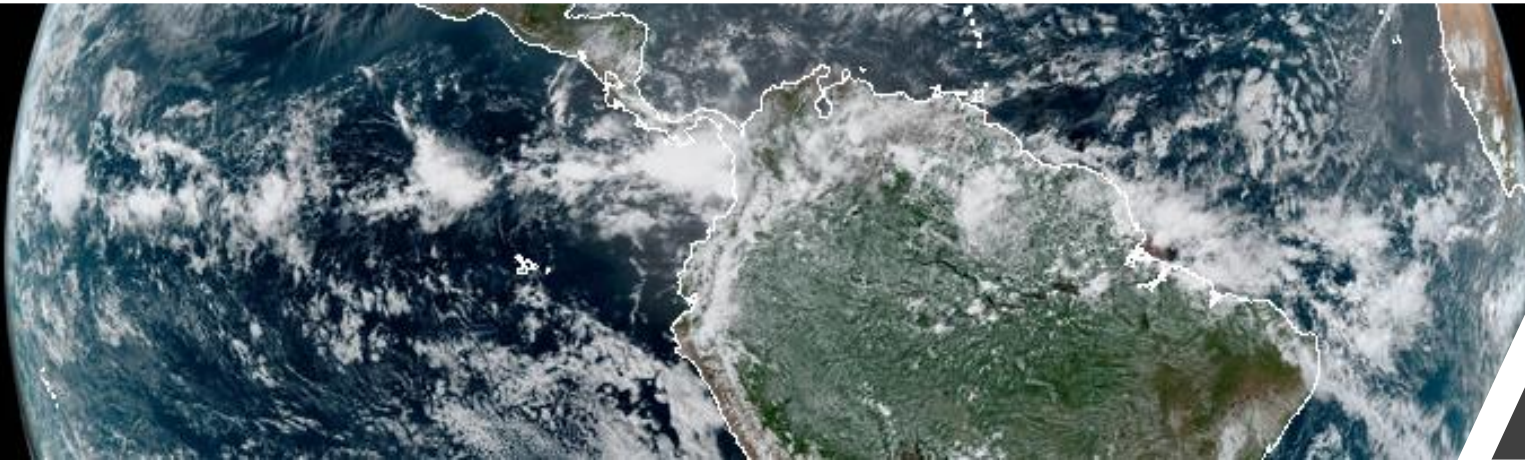


Northern Vermont
UNIVERSITY

Atmospheric Sciences at NVU-Lyndon

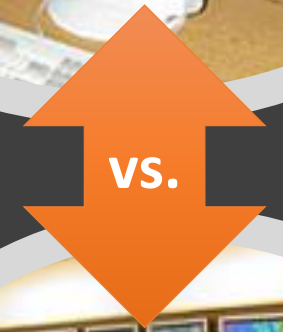
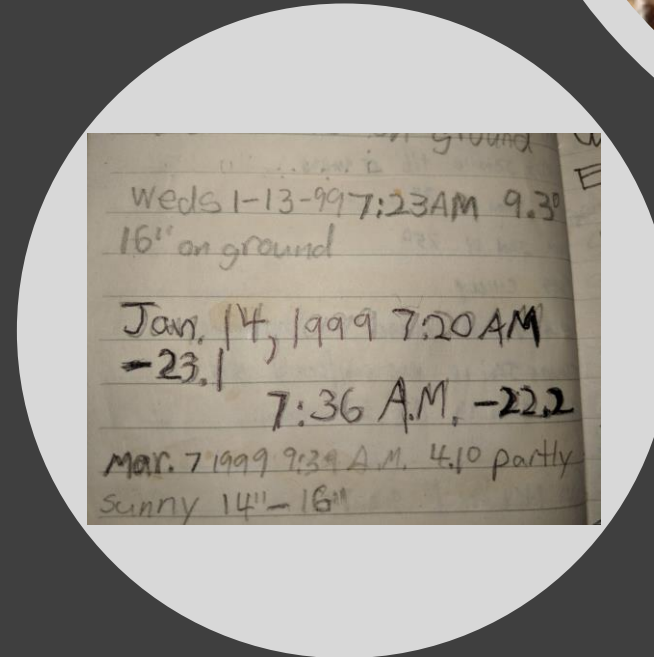
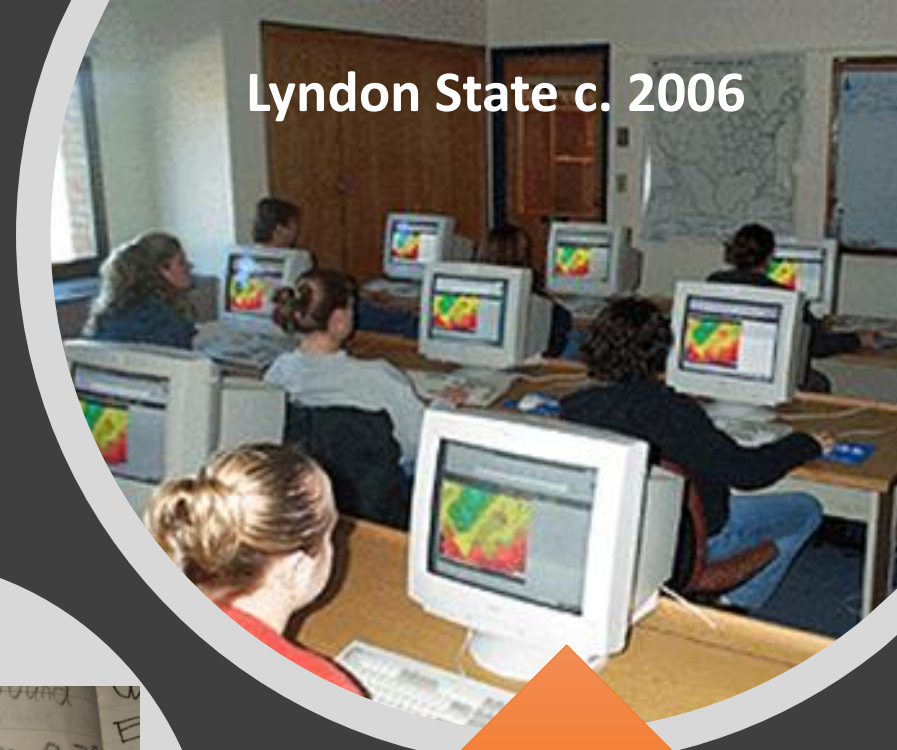
Jason Kaiser

Atmospheric Sciences Data Systems Administrator



About Me

- Native Vermonter, grew up in the Champlain Valley
 - Remember the Ice Storm of '98
 - Dad was interested in weather, shared his weather journal with me
- Visited Lyndon State and Plymouth State
 - Both strong reputations for meteorology
 - Decided on Plymouth because of additional musical opportunities
- Weather forecaster for a year in NJ
- Came to Lyndon in November, 2015





Northern Vermont

UNIVERSITY

Northern Vermont University is a haven for collaboration and exploration in pursuit of discovery, so that we empower curious, capable citizens who find personal success and contribute to community prosperity.

- Building on successes of Lyndon and Johnson
- Leading liberal arts institution in the region



Atmospheric Sciences Faculty & Staff

Jason Kaiser, Dr. Janel Hanrahan, Dr. Jay Shafer,
Dr. Ari Preston, Dr. David Siuta, and George Lorient



Atmospheric Sciences
Northern Vermont UNIVERSITY

Two bachelor's degrees:

Atmospheric Sciences & Climate Change Science

Builds on our 45-year history
"Traditional" meteorology degree



First climate change bachelor's degree
Started in 2017
Interdisciplinary
Climate risk management
Urban & natural resources planning

the **Rotarian**
ROTARY.ORG APRIL 2019

CLIMATE
SOLUTIONS
WITHIN
OUR REACH

Show of hands: who read this?

April 2019 Edition

https://rotarianmagazine-us.rotary.org/rotarian/april_2019/

Why should Rotarians care about climate change?

- The environment isn't one of Rotary's six areas of focus, but it's deeply intertwined with each of them.
- RI president: "We're people who care about our world. We want our world to be a better place, and it's not just about the six specific areas of focus. It's broader than that. We have to look at the world as a whole and how we can make it a better place. If we're losing countries due to sea level changes, if stronger storms are disrupting water supplies or destroying people's livelihoods, that's more people who are going to be disadvantaged. So caring about the environment goes toward our ultimate mission, and we should give it the importance it deserves. As a humanitarian organization, we're obligated to talk about it. We need to have the conversation."



What percentage of climate scientists agree on human caused global warming?

Text JASONKAISER999 to 22333 once to join, then A, B, C, D, E...

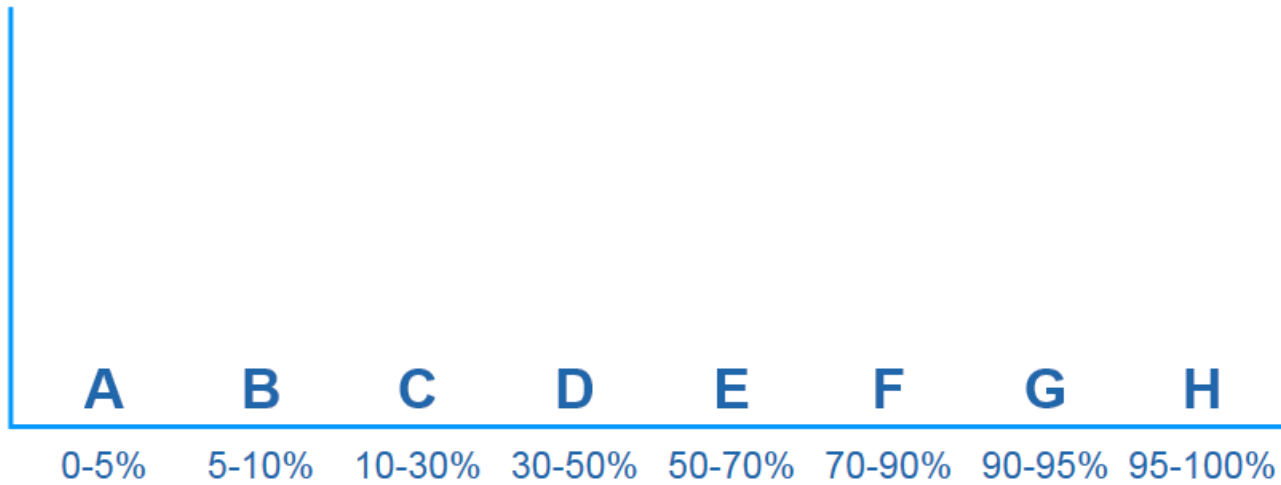
Visual settings /

Activate

Show results

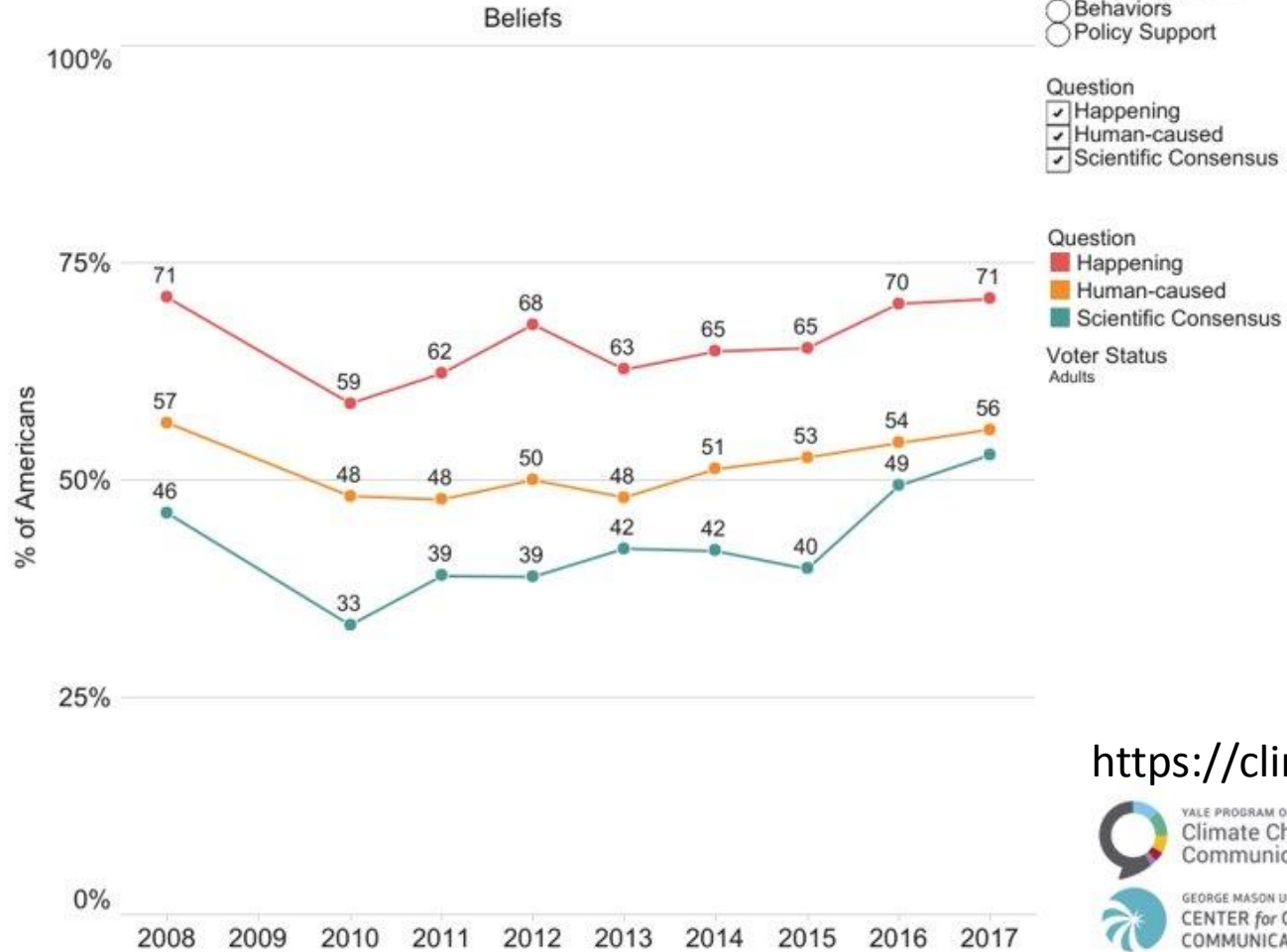
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Clear results



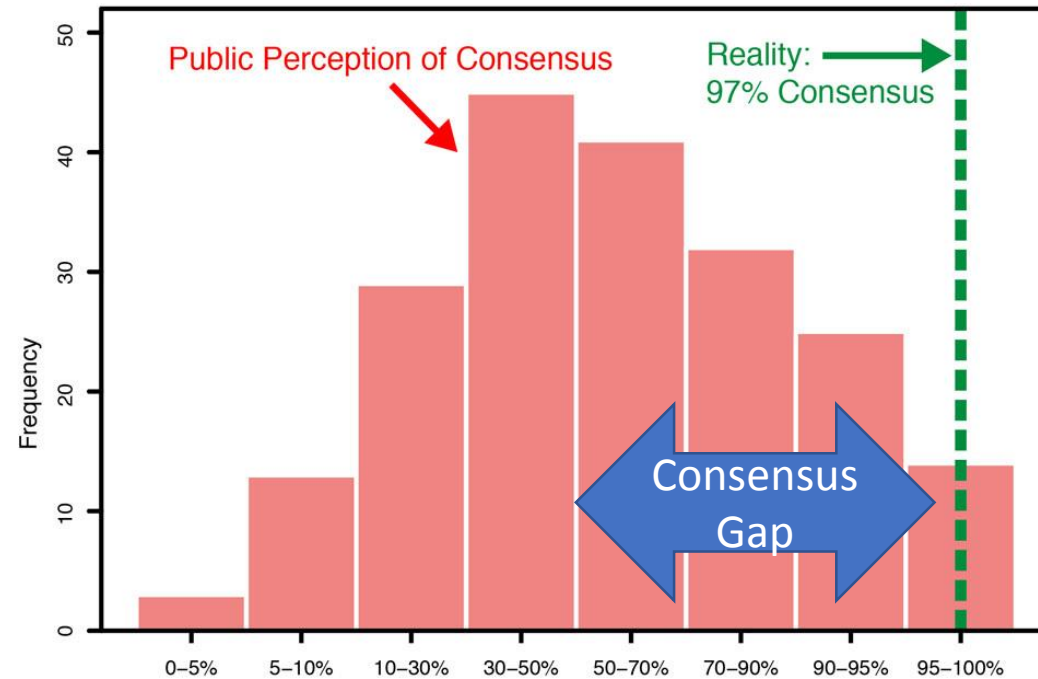
Climate Beliefs Over Time

Climate Views Over Time



<https://climatecommunication.yale.edu>

Research Motivation: What percentage of climate scientists agree on human-caused global warming?



Promoting Climate Change Outreach in an Undergraduate Atmospheric Sciences Program

- Atmospheric Sciences faculty research to be published soon by the American Meteorological Society
- Recent global warming attributed to human activities
- Consequences of unmitigated future climate change are enormous
- Consensus gap skepticalscience.com

ATM Research Motivation, Continued

- The well-documented discrepancy between experts and non-experts can have far-reaching consequences
- If humans do not have a clear understanding of their own role in the transformation of our climate system, they cannot construct a meaningful course of action to correct it
- Atmospheric Sciences Department (ATM) addressing this through undergraduate curricular changes (e.g. new Climate Change Science degree) and creating extracurricular opportunities for outreach

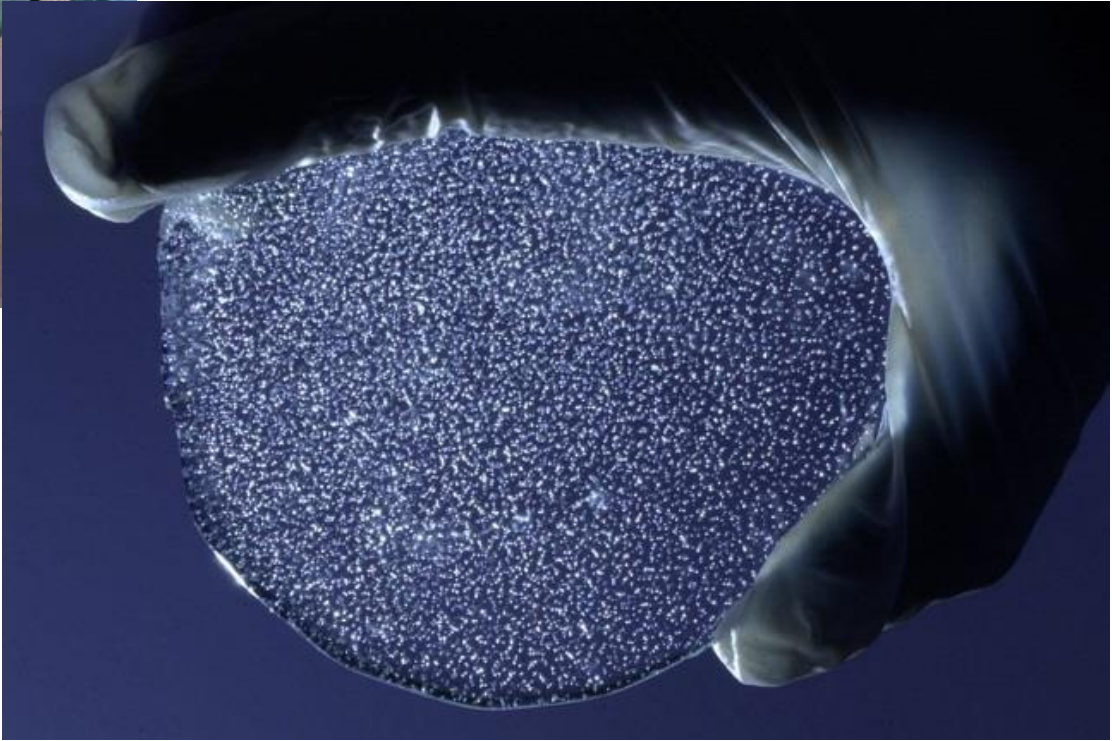
Does climate change pass the Four-Way Test?

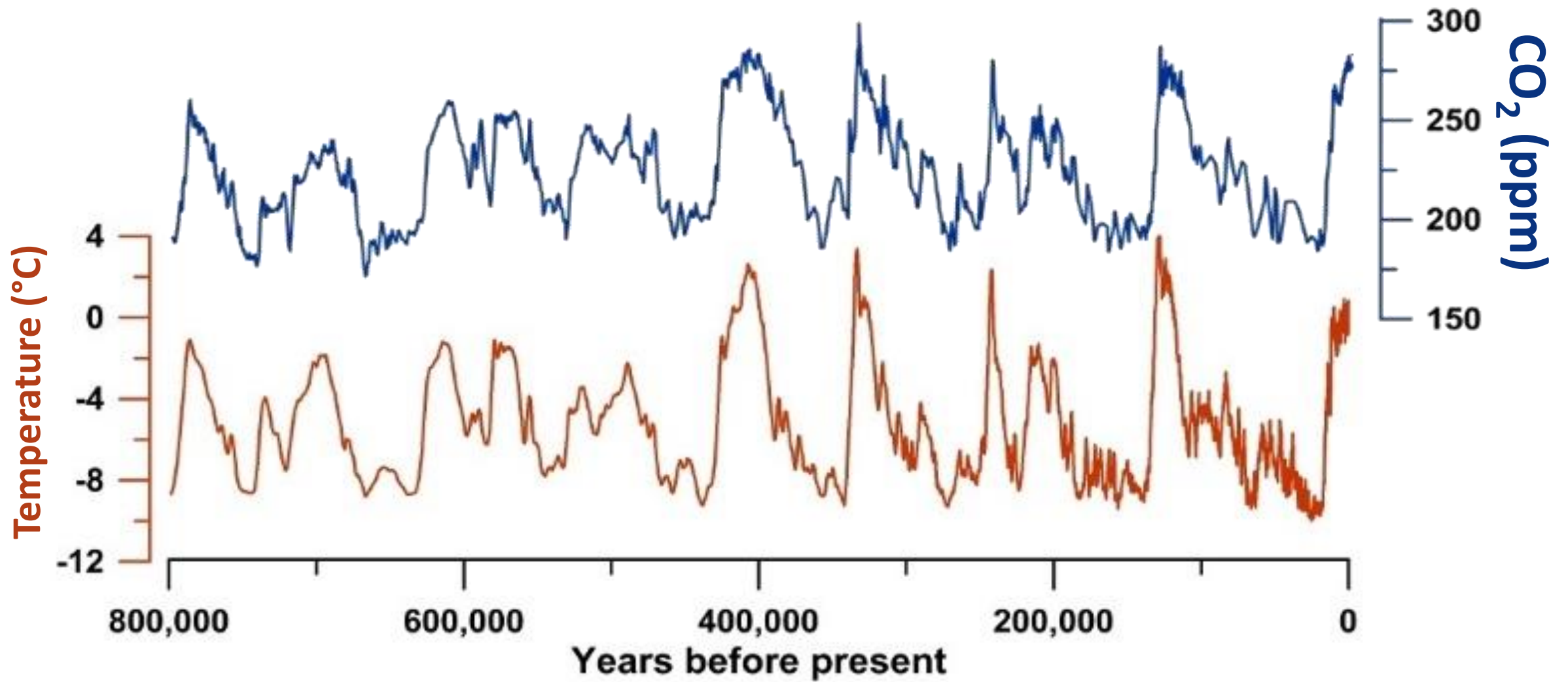
1. Is it the TRUTH?



Climate Science Crash Course

- What are Atmospheric Sciences students learning?
 - How scientists measure carbon dioxide levels from the past
 - How these carbon dioxide levels correlate with temperature
 - What's causing most of the carbon dioxide now?
 - What are the effects?
 - Where is all of this trapped heat going?



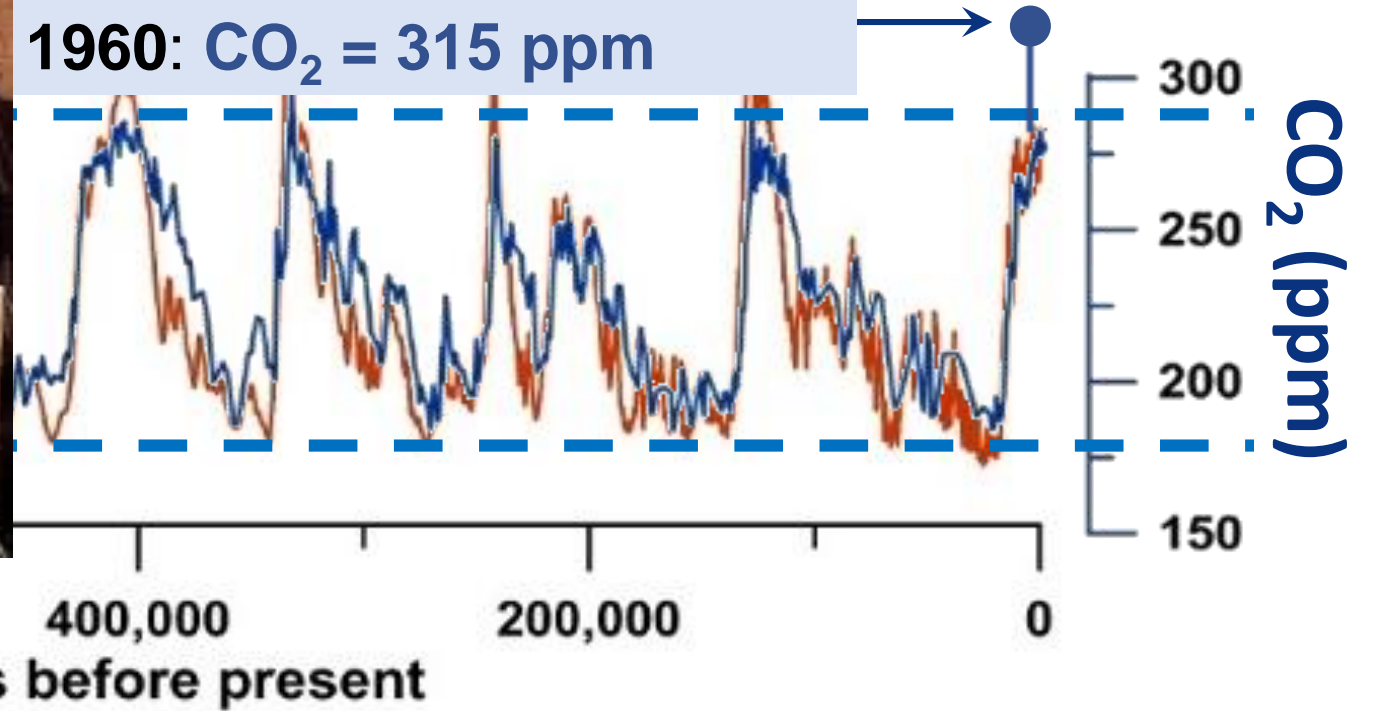


Temperature (°C)



The Time Machine

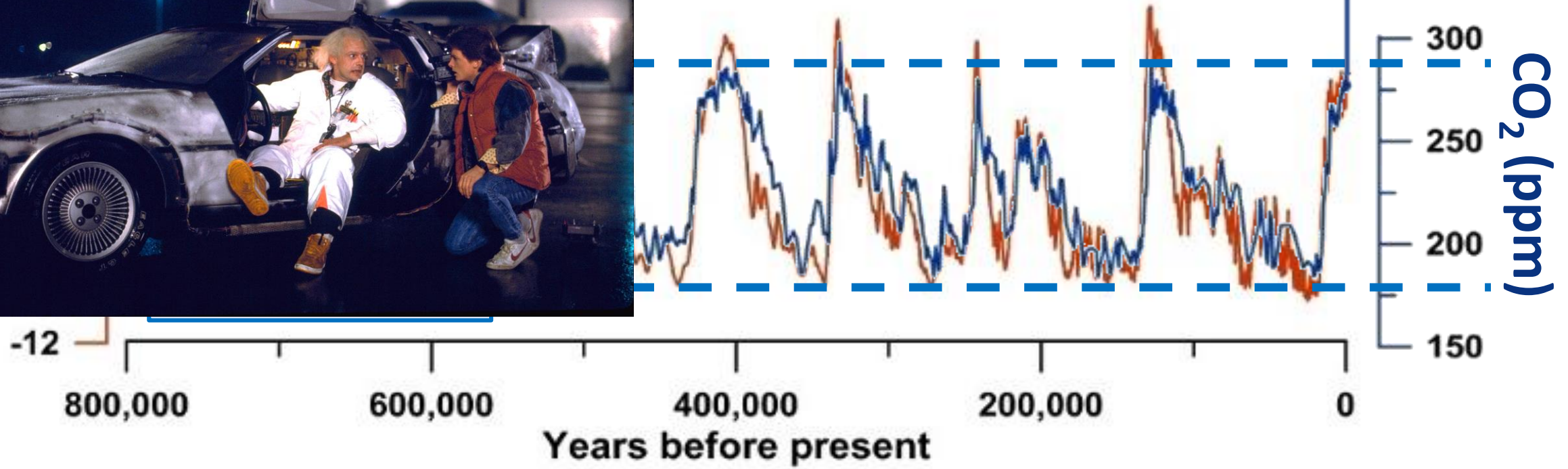
1960: CO₂ = 315 ppm





Back to the Future

1985: $\text{CO}_2 = 340 \text{ ppm}$



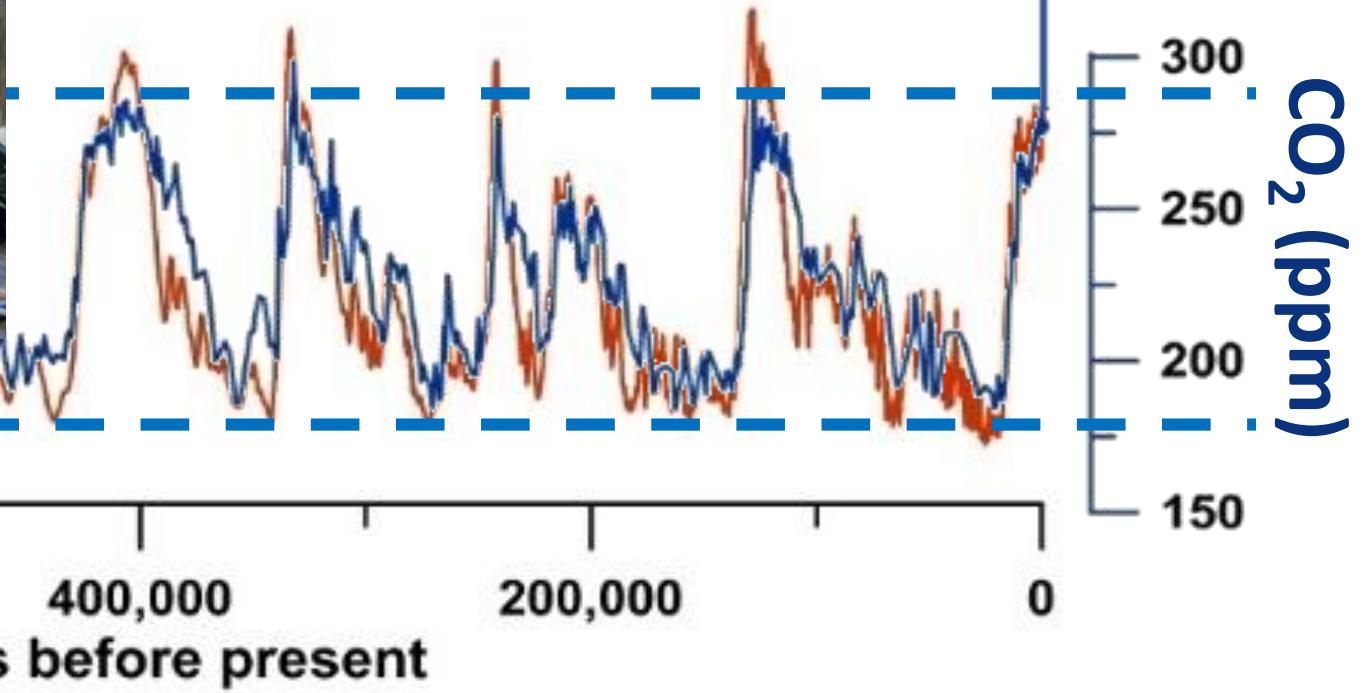


Hot Tub Time Machine
2010: CO₂ = 385 ppm



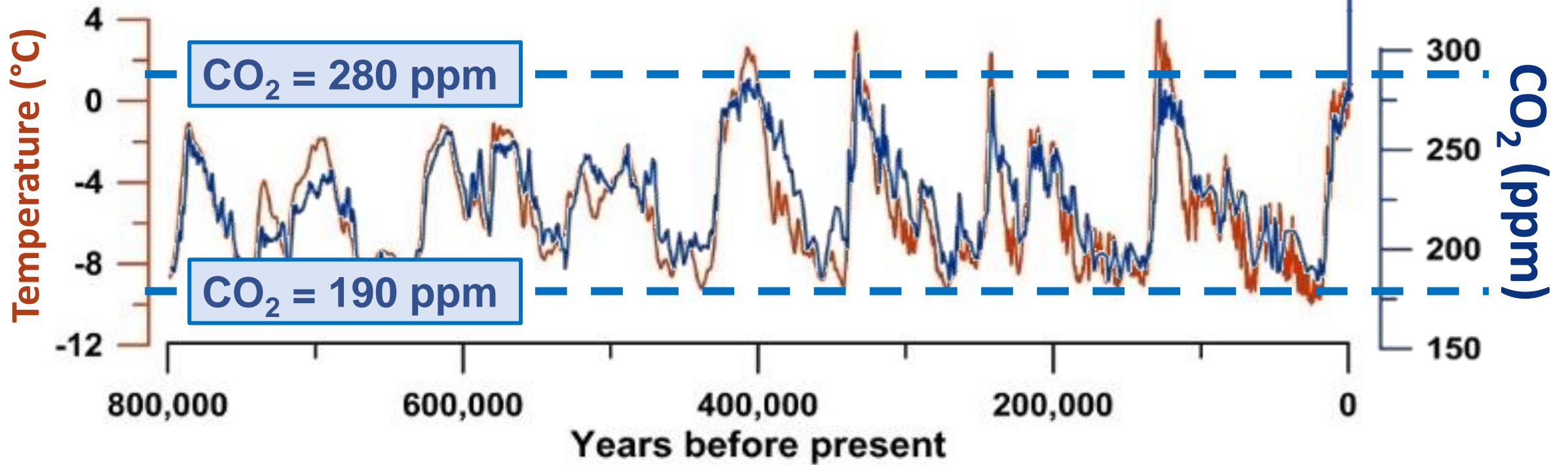
Temp

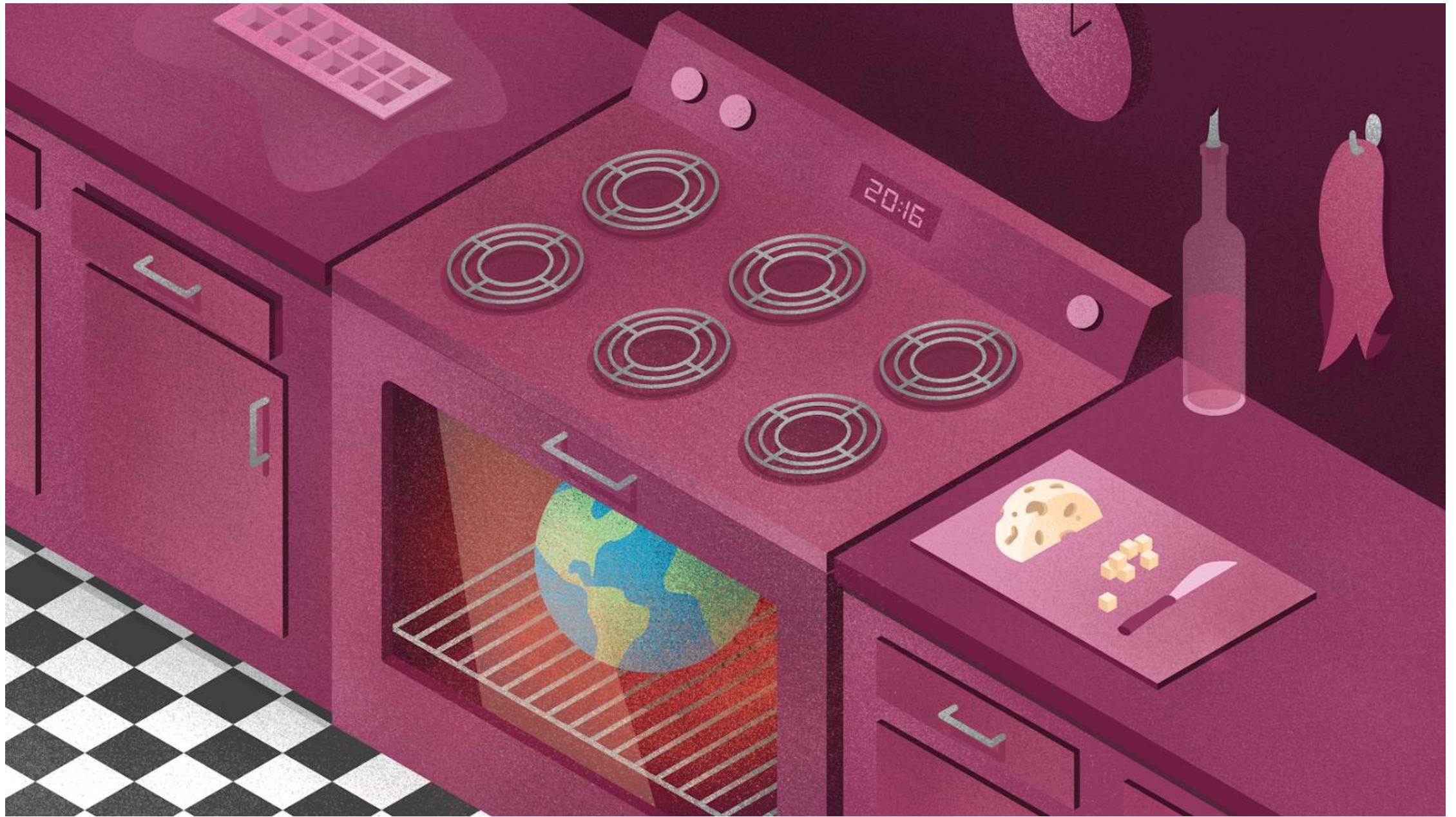
CO₂ = 190 ppm





Today: CO₂ = 410 ppm
↑ 95 ppm in 60 years





Global impacts of warming

- Rising temperatures
- More precipitation
- More drought
- More wildfires
- Sea level rise
- New weather patterns
- Stronger storms



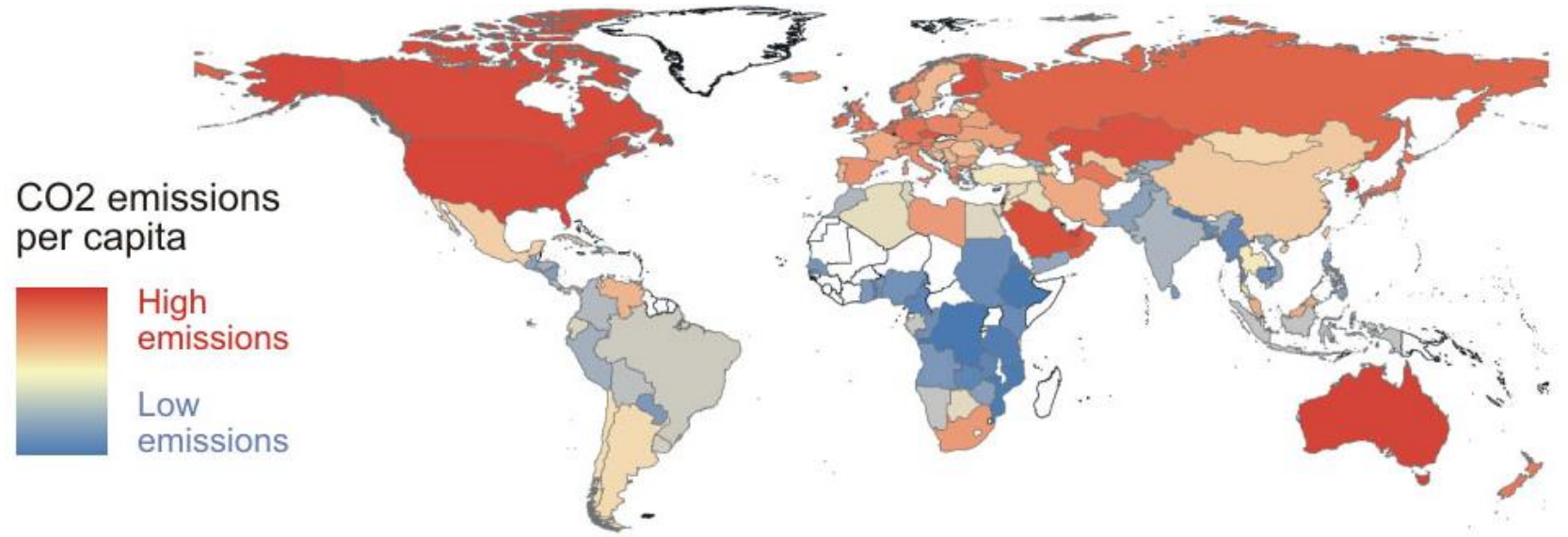
Does climate change pass the Four-Way Test?

1. Is it the TRUTH? YES
2. Is it FAIR to all concerned?

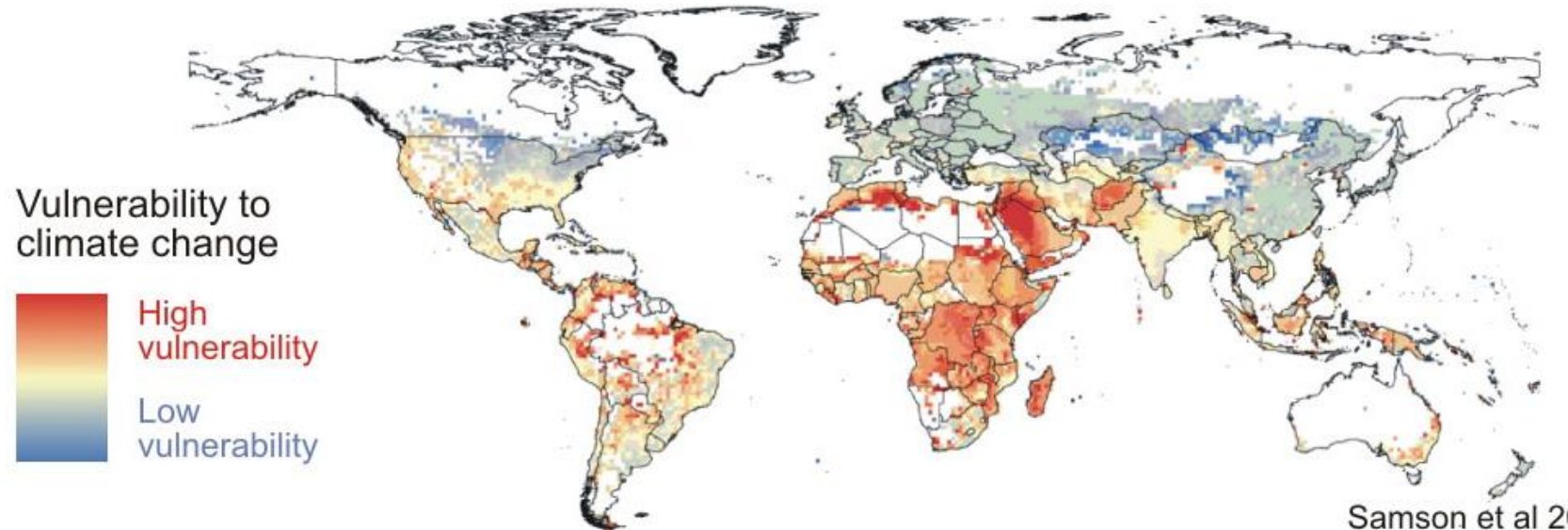


An unfortunate irony of climate change is that the poorest nations, which have contributed the least to the problem, will tend to experience the brunt of the effects.

Poorer nations lack the resources to easily adapt to rapid climate change, which poses something of an ethical dilemma for the wealthier nations.



Those who contribute the least greenhouse gases will be most impacted by climate change



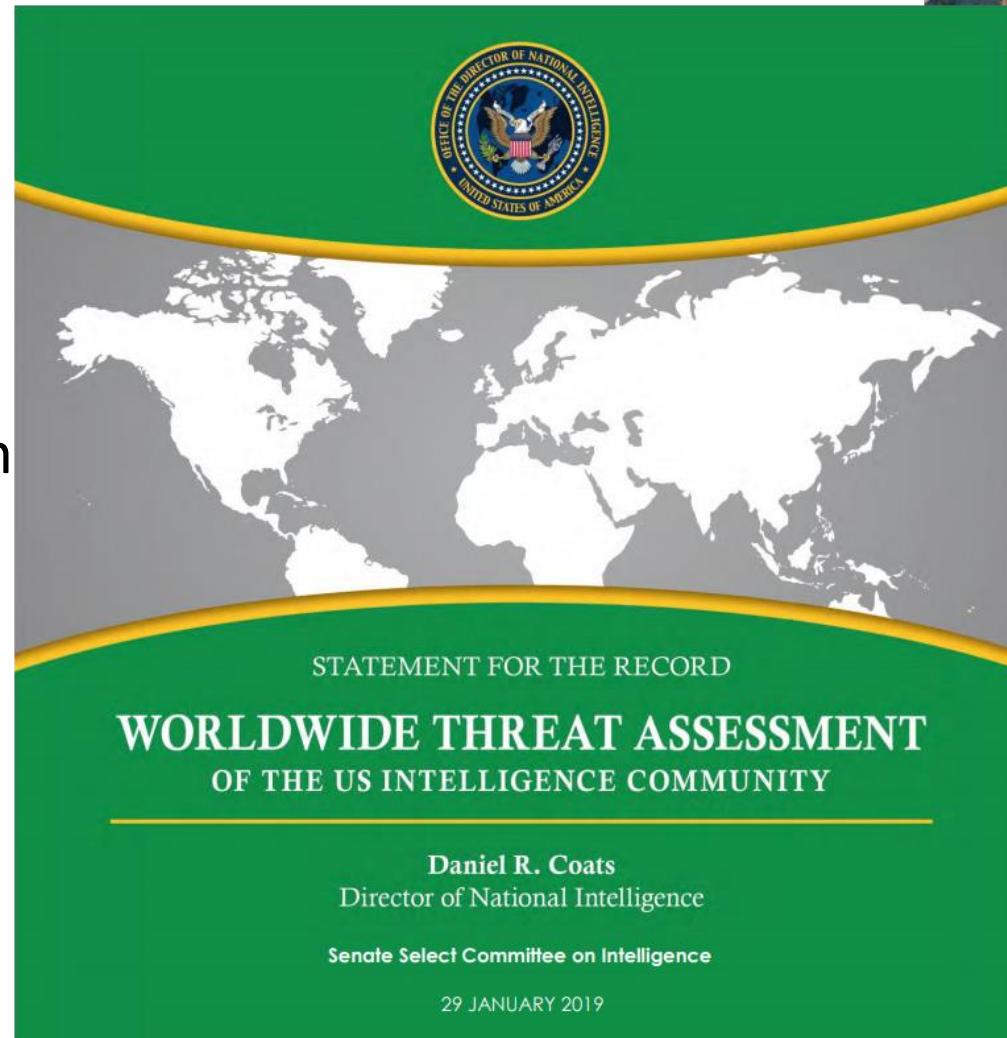
Does climate change pass the Four-Way Test?

1. Is it the TRUTH? YES
2. Is it FAIR to all concerned? NO
3. Will it build GOODWILL and BETTER FRIENDSHIPS?



Intelligence officials for three decades have warned of security risks from climate change.

2019: “climate change is an **urgent and growing threat** to our **national security**, contributing to increased natural disasters, **refugee flows**, and **conflicts** over basic resources such as **food and water**. These **impacts are already occurring**, and the scope, scale, and intensity of these impacts are **projected to increase over time**.”



Does climate change pass the Four-Way Test?

1. Is it the TRUTH? YES
2. Is it FAIR to all concerned? NO
3. Will it build GOODWILL and BETTER FRIENDSHIPS? NO
But working on mitigation & adaptation will.
4. Will it be BENEFICIAL to all concerned?



Positives & Negatives of Global Warming

- **Negative impacts of global warming on agriculture, health & environment far outweigh any positives.**
 - Agriculture depends on steady water supplies. Floods and droughts to disrupt those supplies
 - Warmer winters = fewer deaths. But vulnerability to additional heat = deaths attributable to heatwaves are expected to be approximately five times as great as winter deaths prevented. Warmer areas will encourage migration of disease-bearing insects like mosquitoes. Malaria is already appearing in places it hasn't been seen before.
 - Many parts of the world are low-lying and will be severely affected by modest sea rises. No proposed benefits to sea-level rise.

Does climate change pass the Four-Way Test?

1. Is it the TRUTH? YES
2. Is it FAIR to all concerned? NO
3. Will it build GOODWILL and BETTER FRIENDSHIPS? NO
But working on mitigation & adaptation will.
4. Will it be BENEFICIAL to all concerned? NO
But working on mitigation & adaptation will.



Stiles Pond
Waterford, VT

Bringing the Science Back Home



Latest National Climate Assessment,
Vermont Chapter
<https://nca2018.globalchange.gov>

Alan Betts, VT climate researcher
<http://alanbetts.com>

National Climate Assessment, Vermont Chapter

<https://statesummaries.ncics.org/chapter/vt/>

- **Extreme weather** events in Vermont can take the form of:
 - prolonged heavy snowstorms
 - flash floods
 - river floods (following snowmelt and heavy rains)
 - severe thunderstorms
 - droughts
 - temperature extremes

National Climate Assessment, Vermont Chapter

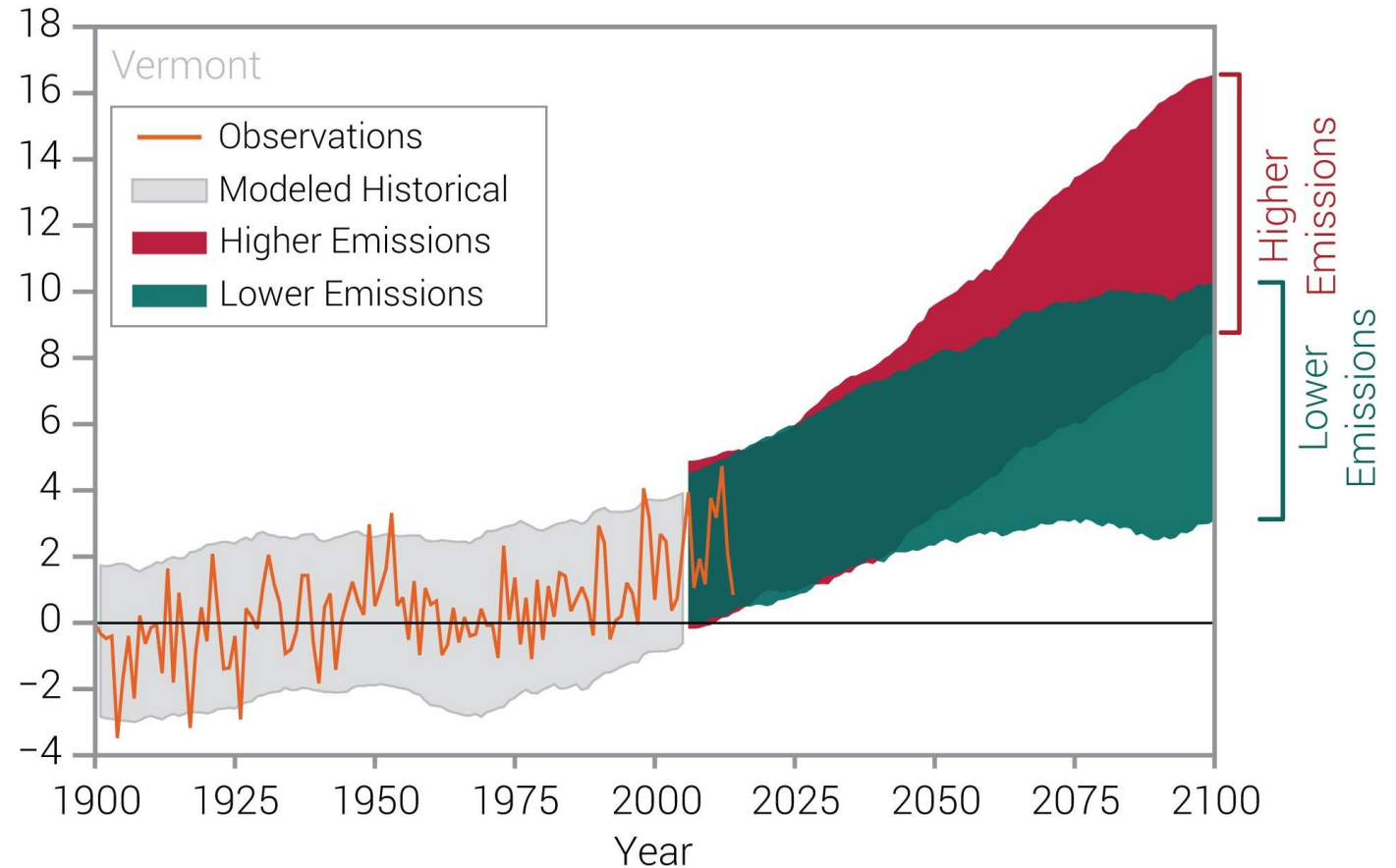
<https://statesummaries.ncics.org/chapter/vt/>

Observed and projected changes (compared to the 1901–1960 average) in near-surface air temperature for Vermont.

Temperatures in Vermont have increased more than 2°F since the beginning of the 20th century.

Observed data are for 1900–2014. Projected changes for 2006–2100 are from global climate models for two possible futures: one in which greenhouse gas emissions continue to increase (higher emissions) and another in which greenhouse gas emissions increase at a slower rate (lower emissions).

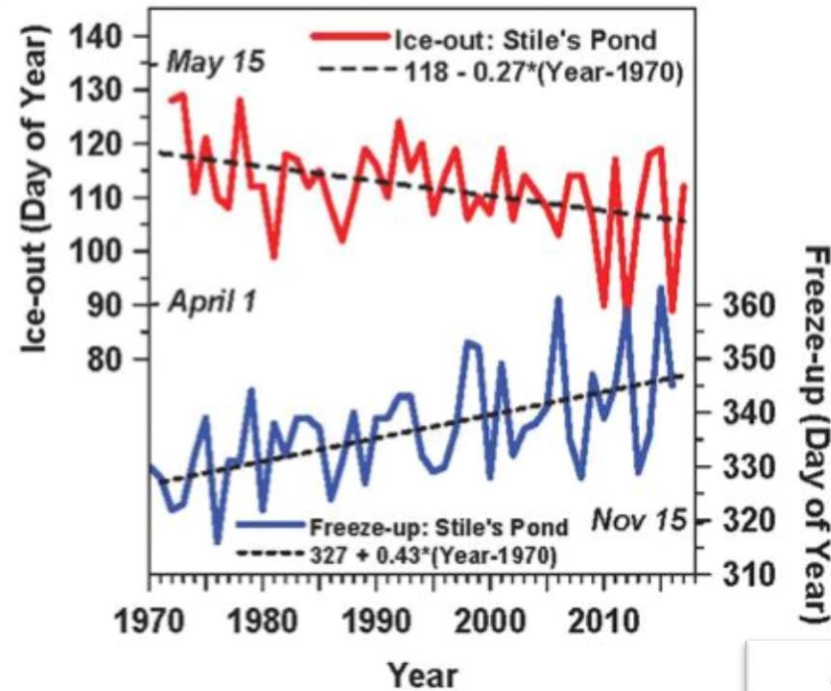
Observed and Projected Temperature Change



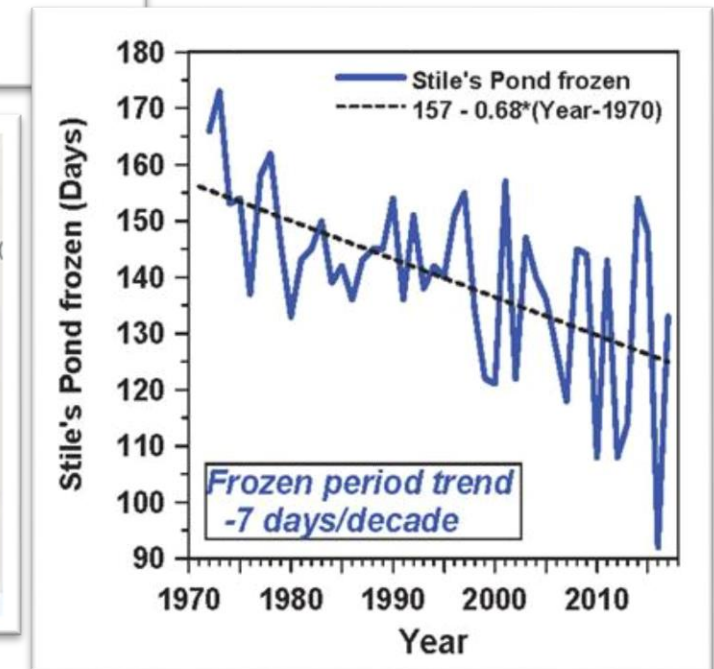
What is happening to Vermont's climate?

- As the global climate shifts towards a warmer state, the cold season in VT is getting shorter and the warm season longer.
- The freeze and ice-out dates for small lakes/ponds are good 'integrated' climate indicators for the length and severity of the cold season in Vermont.
- The freeze-up and ice-out dates for **Stile's Pond** in Waterford, VT have been recorded by an observer for the Fairbanks Museum since 1971.

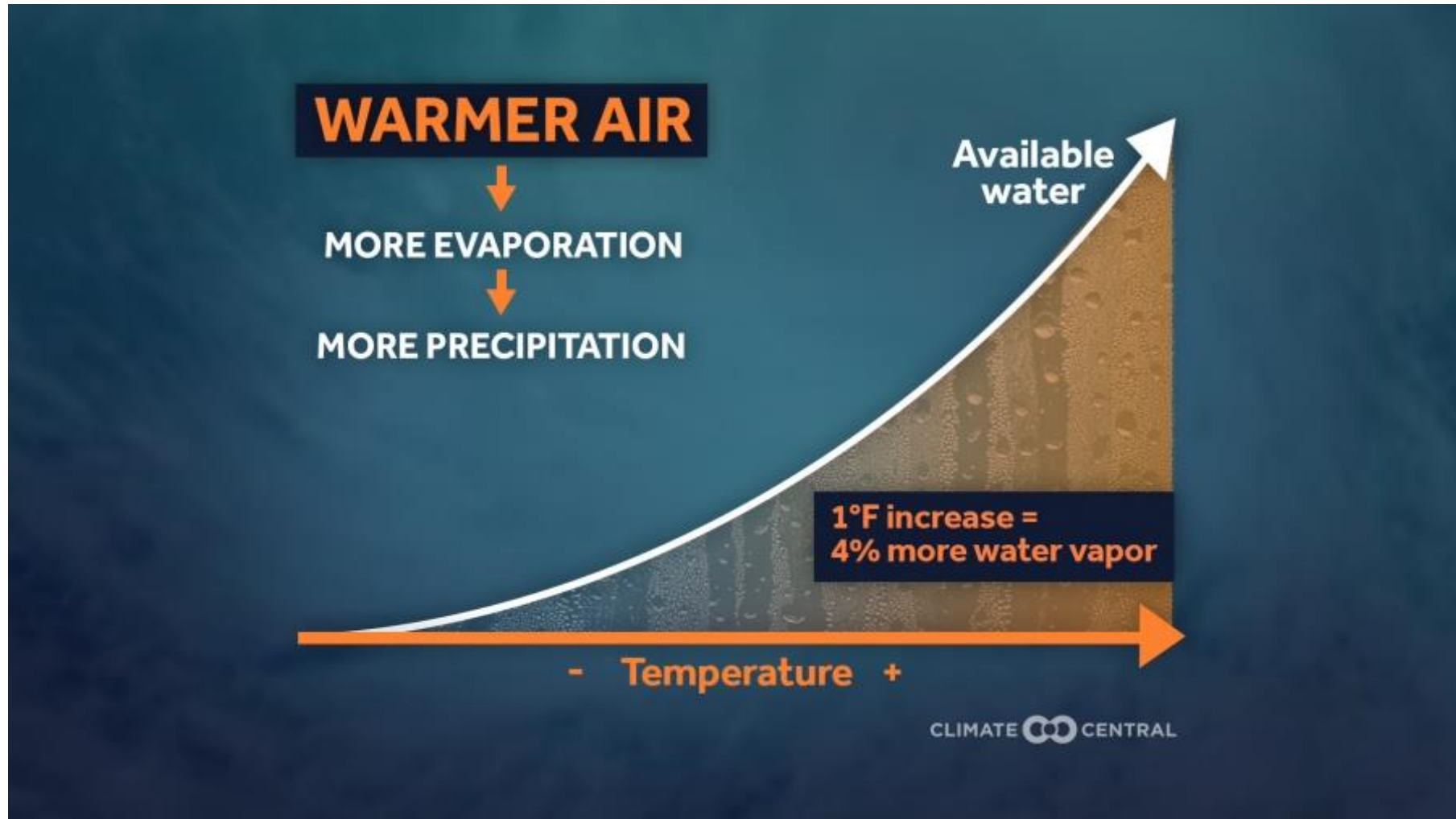
<http://alanbetts.com/understanding-climate-change/question/what-is-happening-to-vermont/>



Vermont Climate Change Indicator

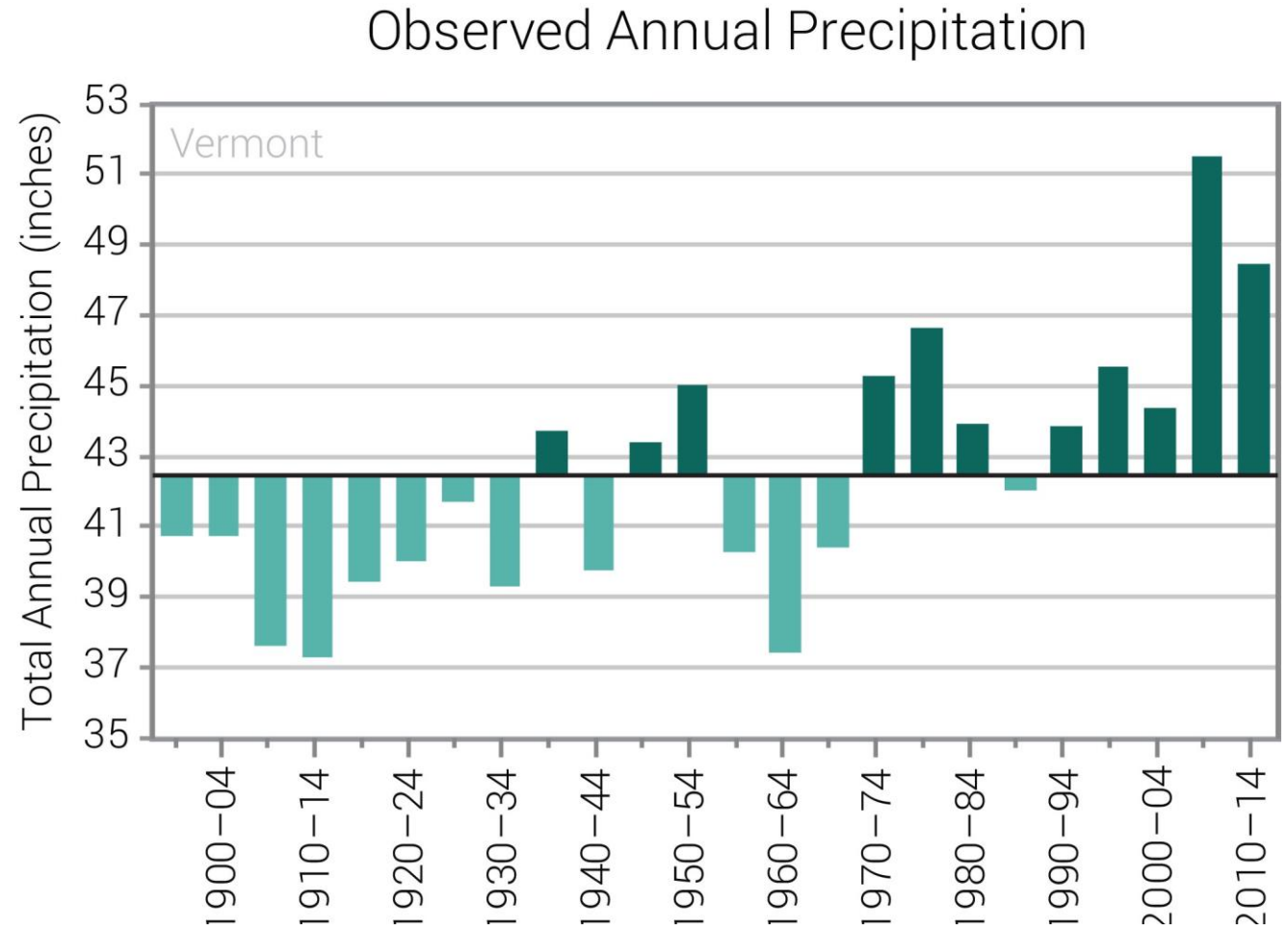


Warmer air causes...



How is precipitation changing in Vermont?

According to the latest National Climate Assessment, average annual precipitation in Vermont has increased nearly 6 inches since the early 20th century. Increased winter and spring precipitation is projected for the 21st century.



Too close for comfort

The Passumpsic River overflowed its banks in 2002, washing out roads and flooding homes in and around Lyndonville.

Photo courtesy VT Emergency Management

Dr. Hanrahan featured on VT Edition: Assessing VT's Flood Risk Seven Years After Irene

<https://www.vpr.org/post/assessing-vermonts-flood-risk-seven-years-after-irene>

**Observed river crest Passumpsic, VT gauge
19.28 ft on June 13, 2002 (this photo)
Compares to 17.25 ft on April 21, 2019**



What do I, personally, do?

Talk about it!





The Climate Consensus

Climate Consensus Group



Non-Violent Direct Action



Object of Rotary

- SECOND: High ethical standards in business
 - *Where do you put your money?*





Ethical

Exclude socially adverse industries like tobacco, alcohol, and weapons



ESG

Screen broadly for Environmental, Social, and Governance policies



Impact

Select investments that have a direct impact on positive social change

SOCIALLY RESPONSIBLE INVESTING

Socially Responsible Investing

Not a new phenomenon!

- Mature, well-established
- Grew from '60s social movements
- SRI funds competitive with conventional counterparts over the long term

Implemented June 2018

Plan for Reallocating 20% of Portfolio to Fossil Free Approach

- Replace 15% of the portfolio in the Russell 1000 Growth, Russell 1000 Value and the FTSE Developed Markets index tracking investments with like fossil free screened indices.
- Reallocate 5% of the portfolio from our separately managed account with Thomas Partners (50% of their mandate) into a fossil free screened version of this portfolio.
- Approximate value of changes is \$5,700,000.
- Makes a meaningful fossil free change within the portfolio and allows for monitoring of the impact of adjustments.



Partial Divestment from Fossil Fuels

Tobacco and Oil Industries Used Same Researchers to Sway Public

As early as the 1950s, the groups shared scientists and publicists to downplay dangers of smoking and climate change

Is this moral and ethical?

By Benjamin Hulac, ClimateWire on July 20, 2016

But why divest from fossil fuels?

Dr. Michael E. Mann: "The fossil fuel divestment movement asks colleges, universities and other institutions to divest of holdings in fossil fuel companies who, like Tobacco companies in the past, have used their **immense wealth and power to poison the public dialogue when it comes to the problems created by their product**—in this case, fossil fuels and dangerous planetary warming. Spearheaded by Bill McKibben's organization **350.org**, the divestment campaign has spread across college campuses. More than \$6 Trillion dollars in holdings have been pulled out by nearly a thousand institutions and more than 50,000 people."

What impact is divestment making?

Bill McKibben: "...it became clear that divestment was also squeezing the industry. ...analysts at ... Goldman Sachs said the "divestment movement has been a key driver of the coal sector's 60% de-rating over the past five years".

Now the contagion seems to be spreading to the oil and gas sector, where Shell announced earlier this year that divestment should be considered a "material risk" to its business. That's how oil companies across the world are treating it – in the US, petroleum producers have set up a website designed to discredit divestment.

...

Divestment by itself is not going to win the climate fight. But by weakening – reputationally and financially – those players that are determined to stick to business as usual, it's one crucial part of a broader strategy."

Why is Rotary uniquely able to have an impact?

- RI president: "Our strengths are that we're in 200-some countries and geographical areas around the world, and our members are people who are connected to the right people. You look at our polio eradication program: It's successful not because we've provided vaccines. It's because Rotarians were able to talk to the right people, to give the right support, to do the right thing. If we did that with the environment, governments would listen to us."



What else can Rotarians do?

RI president: "I've been asking Rotarians: What can you do in your region? In the Bahamas, for example, we can plant mangroves to make our coastlines more resilient to stronger storms."

"There are a whole lot of Rotarians who want to do something, but they aren't sure what to do. I think that's part of the dilemma. Rotarians are very solution-driven. If we know a village doesn't have water, we could bring them fresh water. We know how to do it, and we do it well. But climate change is a complex challenge. **How do we find a complex solution?**"



Is this Rotary's moment to make a difference in climate change?

RI president: "I think this is Rotary's moment to start the conversation. I don't think we're going to get much further than that at this point in time. One of our challenges as an organization is how complex we are and how much we do. Therefore, to get everybody rallied around something, you've got to focus. It probably will take a Rotary president who's going to make this the No. 1 focus. That will make a difference, and the world will rally around it. But if Rotary is going to be relevant, then we've got to be looking at the environment."



What solutions are Rotarians working on now?

A coalition of researchers and scientists led by environmentalist and writer Paul Hawken mathematically modeled the climatic and economic impact of potential global warming solutions to learn which ones would yield the best results for people and the planet. The list, compiled in a 2017 book called "Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming," included some surprising possibilities, such as educating girls, promoting family planning, and assisting farmers. As it happens, all of those align with Rotary's areas of focus.

NEW YORK TIMES BESTSELLER

DRAWDOWN
THE MOST COMPREHENSIVE
PLAN EVER PROPOSED TO
REVERSE GLOBAL WARMING
EDITED BY PAUL HAWKEN

Solutions by Rank

Rank	Solution	Sector	TOTAL ATMOSPHERIC CO2-EQ REDUCTION (GT)	NET COST (BILLIONS US \$)	SAVINGS (BILLIONS US \$)
1	Refrigerant Management	Materials	89.74	N/A	\$-902.77
2	Wind Turbines (Onshore)	Electricity Generation	84.60	\$1,225.37	\$7,425.00
3	Reduced Food Waste	Food	70.53	N/A	N/A
4	Plant-Rich Diet	Food	66.11	N/A	N/A
5	Tropical Forests	Land Use	61.23	N/A	N/A
6	Educating Girls	Women and Girls	59.60	N/A	N/A
7	Family Planning	Women and Girls	59.60	N/A	N/A
8	Solar Farms	Electricity Generation	36.90	\$-80.60	\$5,023.84
9	Silvopasture	Food	31.19	\$41.59	\$699.37
10	Rooftop Solar	Electricity Generation	24.60	\$453.14	\$3,457.63

- **Project Drawdown** ranks solutions from 1 to 80 based on their potential to avert or reduce greenhouse gas emissions. RI looked at those rankings alongside grant projects to see how Rotarians are already helping to fight climate change.

Drawdown Solutions

U.S. Rotary Clubs at Work – Reduced Food Waste

(Drawdown ranking #3)

- One-third of the fruits and vegetables, meat, and other food the world produces never gets eaten. Instead, it rots unharvested in fields, spoils in storage, or sits forgotten in the back of the refrigerator, only to end up in the garbage.
- The production of uneaten food squanders resources such as energy, land, and fertilizer. In landfills, **food waste** generates methane, a greenhouse gas.
- Centroabastos, a food wholesaler in Bucaramanga, Colombia, generates about 20 tons of organic solid waste per day. The Rotary clubs of **Bucaramanga Nuevo Milenio, Colombia, and Woodland Hills, California**, are working with the company's nonprofit arm to set up a center that will use the surplus produce to provide training in safe food handling and processing. The project is expected to reduce food waste by 15 percent while creating employment opportunities.



U.S. Rotary Clubs at Work – Rooftop solar

(Drawdown ranking #10)

- Homeowners and power utilities are beginning to replace or supplement fossil fuels with solar panels as a source of electricity. The more than 1 billion people in developing parts of the world who rely on kerosene lamps and diesel generators can now use affordable clean energy instead. That could make solar energy a powerful tool for eliminating poverty, even as it dramatically reduces greenhouse gas emissions.
- The Rotary clubs of **Leogane, Haiti, and Parker, Colorado**, led a global grant project to install a hybrid solar, diesel, and grid power system. The school saved \$4,000 a year in fuel costs and reduced air and noise pollution. The hybrid system also powers interior and exterior lighting, computers, fans, and educational tools. A new water distribution system, which uses the hybrid power, and a literacy program were also part of the grant.





What will you do?

Talk about climate change?

Use your networks?

Uplift those less fortunate?

Thank You!

Jason Kaiser

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<http://atmos.northernvermont.edu>