

Build for Resilience: A Plan to **Drive** **Value** and Tackle the **Climate Crisis***

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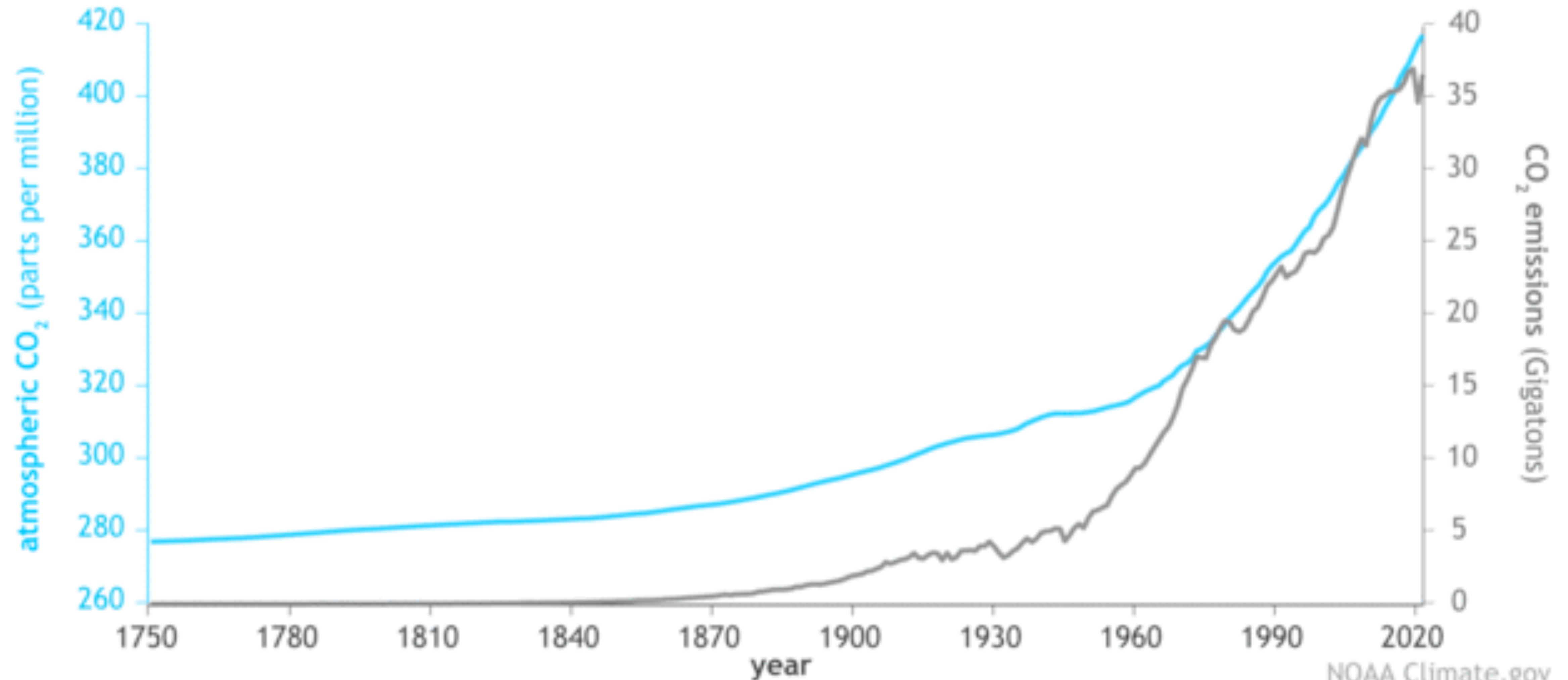
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Grateful acknowledgements also to Hardeep Singh and Emily Mediate

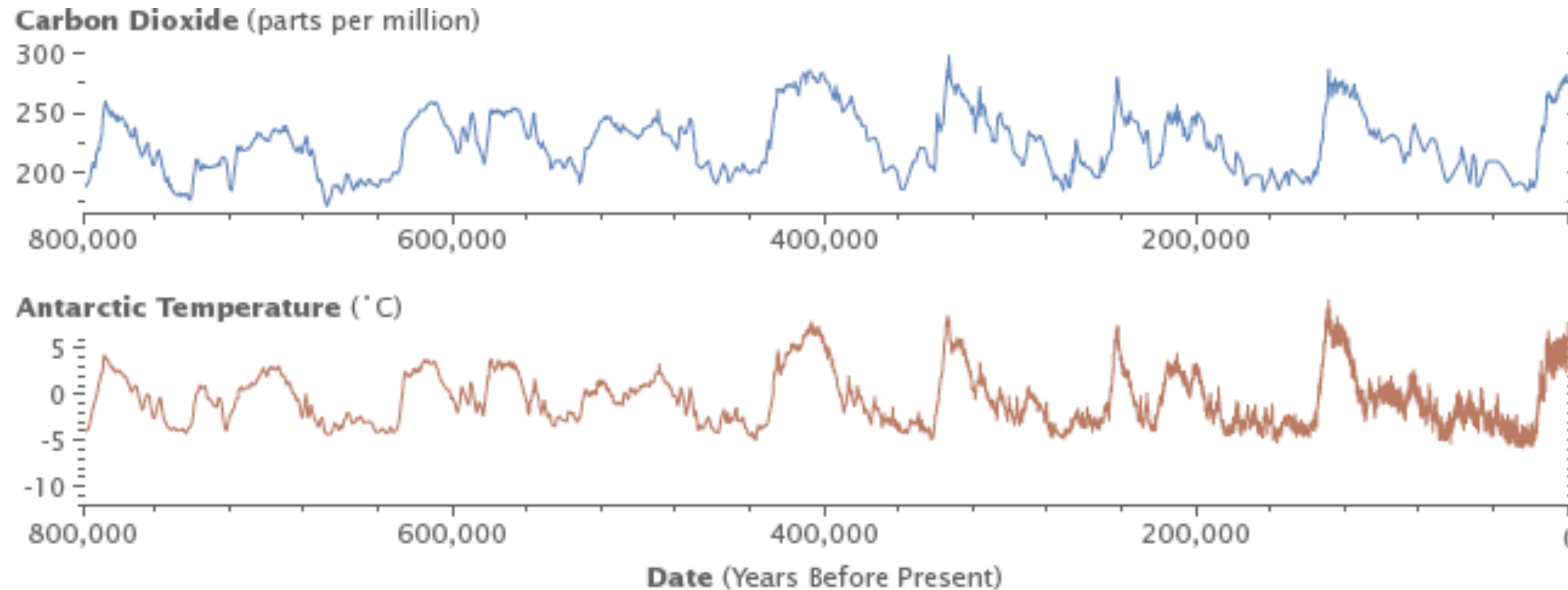
Emissions & Atmospheric CO₂

Atmospheric carbon dioxide amounts and annual emissions (1750-2021)



NOAA Climate.gov
Data: NOAA, ETHZ, Our World in Data

Atmospheric CO₂ & Temperature



<https://earthobservatory.nasa.gov/features/CarbonCycle/page4.php>

Levels of carbon dioxide in the atmosphere have corresponded closely with temperature over the past 800,000 years. Although the temperature changes were touched off by variations in Earth's orbit, the increased global temperatures released CO₂ into the atmosphere, which in turn warmed the Earth. Antarctic ice-core data show the long-term correlation until about 1900. (Graphs by Robert Simmon, using data from [Lüthi et al., 2008](#), and [Jouzel et al., 2007](#).)

Unprecedented

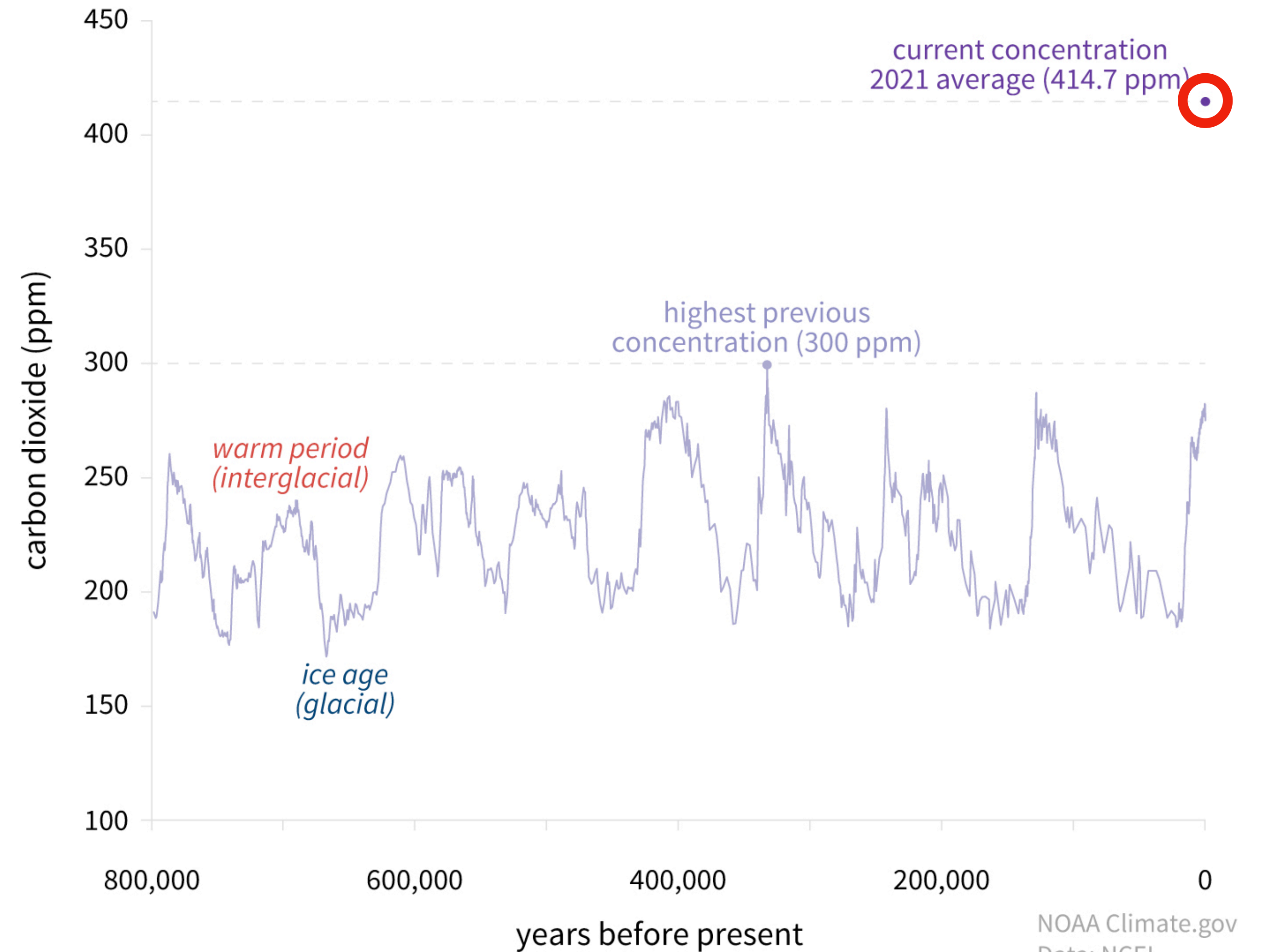
2022

~~2021~~ was the 6th warmest on record

Over the past 100 years, global temperatures have risen **~1°C (1.8°F)**

Sea level response to that warming totals about **160-210 mm (6 to 8 in)**.

CARBON DIOXIDE OVER 800,000 YEARS



NOAA Climate.gov
Data: NCEI

Preparing to Support our Communities

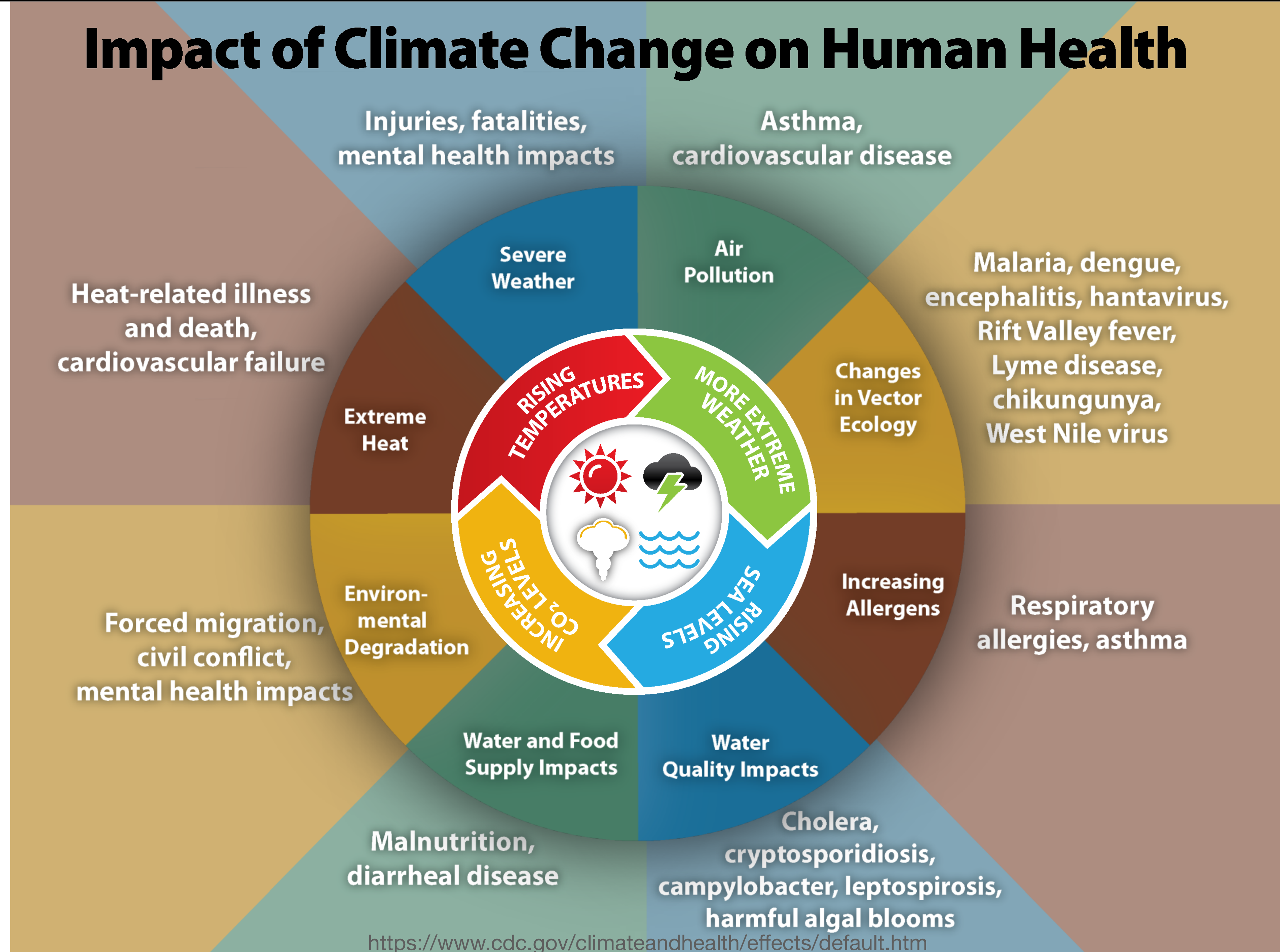
- Strengthening infrastructure
 - Utilities, especially electricity
 - Communications
 - Transportation
- Supply chain
- Employees & their families
- Financial stability
- AND also care for our communities who face the health consequences

The New York Times

U.S. Hospitals Wrestle With Shortages of Drug Supplies Made in Puerto Rico



Impact of Climate Change on Human Health



Heat

- Heat exhaustion/Heat stroke
- Dehydration exacerbates asthma, COPD, HF, DM
- Harder to think (school, work)
- Higher mortality due to organ failure
 - 1980 heat wave: 5300 excess US deaths
 - 1995 heat wave 2800 excess US deaths
- Risks in pregnant women
- Especially susceptible: elderly, young children

Heat Exhaustion	Heat Stroke
ACT FAST <ul style="list-style-type: none">• Move to a cooler area• Loosen clothing• Sip cool water• Seek medical help if symptoms don't improve	ACT FAST CALL 911 <ul style="list-style-type: none">• Move person to a cooler area• Loosen clothing and remove extra layers• Cool with water or ice
<i>Dizziness</i> <i>Thirst</i> <i>Heavy Sweating</i> <i>Nausea</i> <i>Weakness</i>	<i>Confusion</i> <i>Dizziness</i> <i>Becomes Unconscious</i>
<i>Heat exhaustion can lead to heat stroke.</i>	<i>Heat stroke can cause death or permanent disability if emergency treatment is not given.</i>

Stay Cool, Stay Hydrated, Stay Informed!

Air

- Ground-level ozone (smog)
- Wildfires & PM
- More pollen, longer season

Days added to ragweed pollen season, 1995-2009

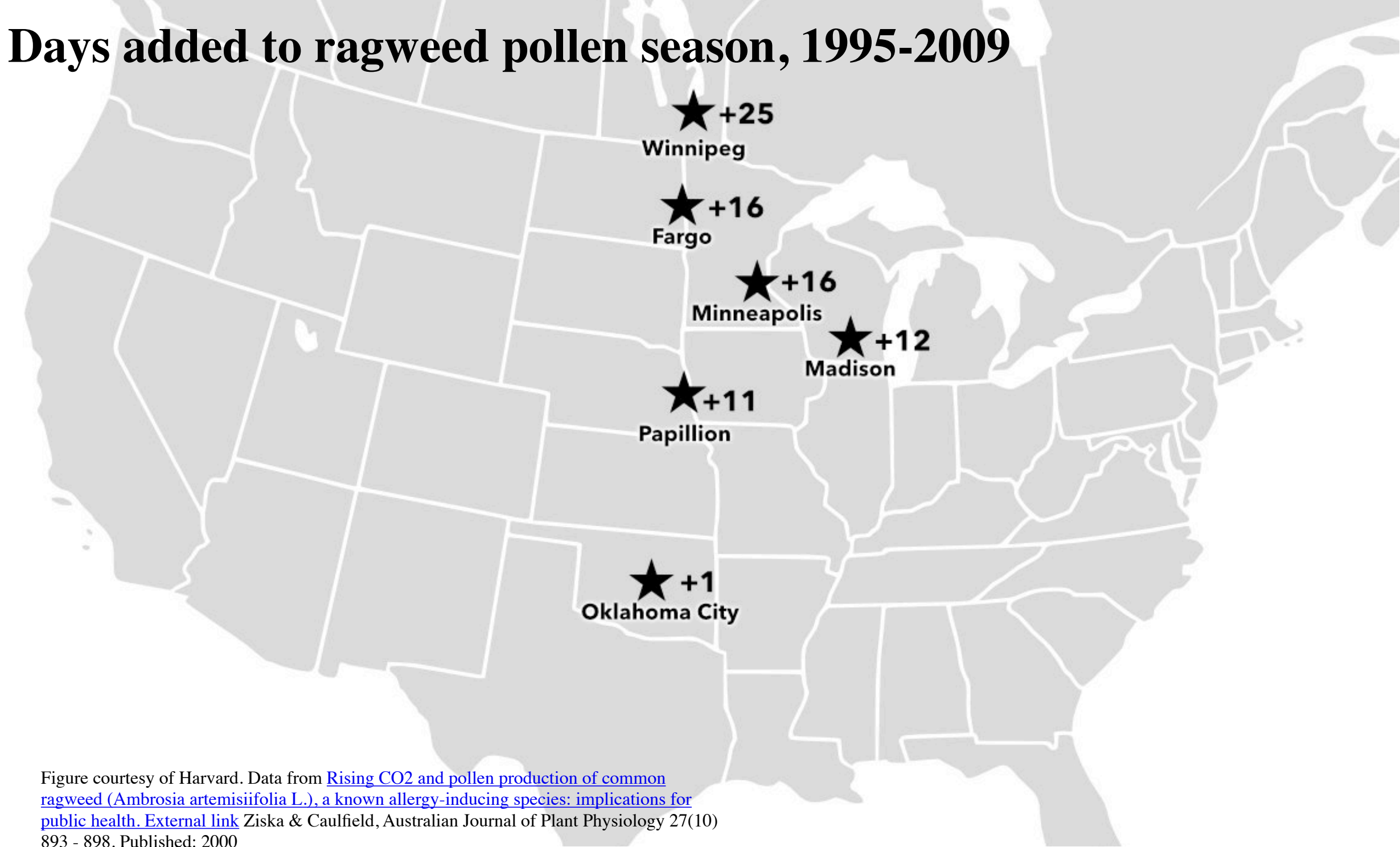


Figure courtesy of Harvard. Data from [Rising CO2 and pollen production of common ragweed \(Ambrosia artemisiifolia L.\), a known allergy-inducing species: implications for public health](#). External link Ziska & Caulfield, Australian Journal of Plant Physiology 27(10) 893 - 898. Published: 2000

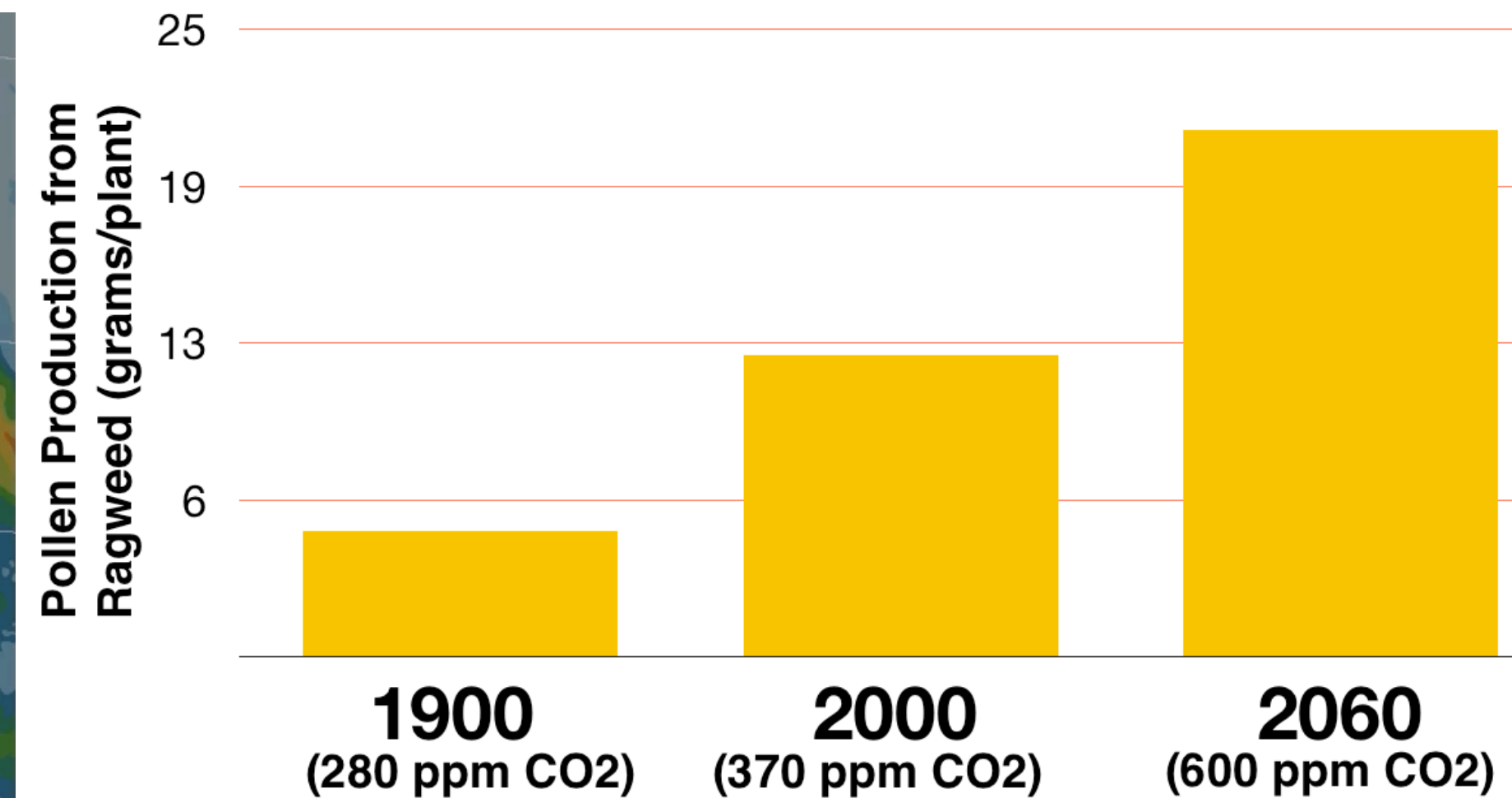
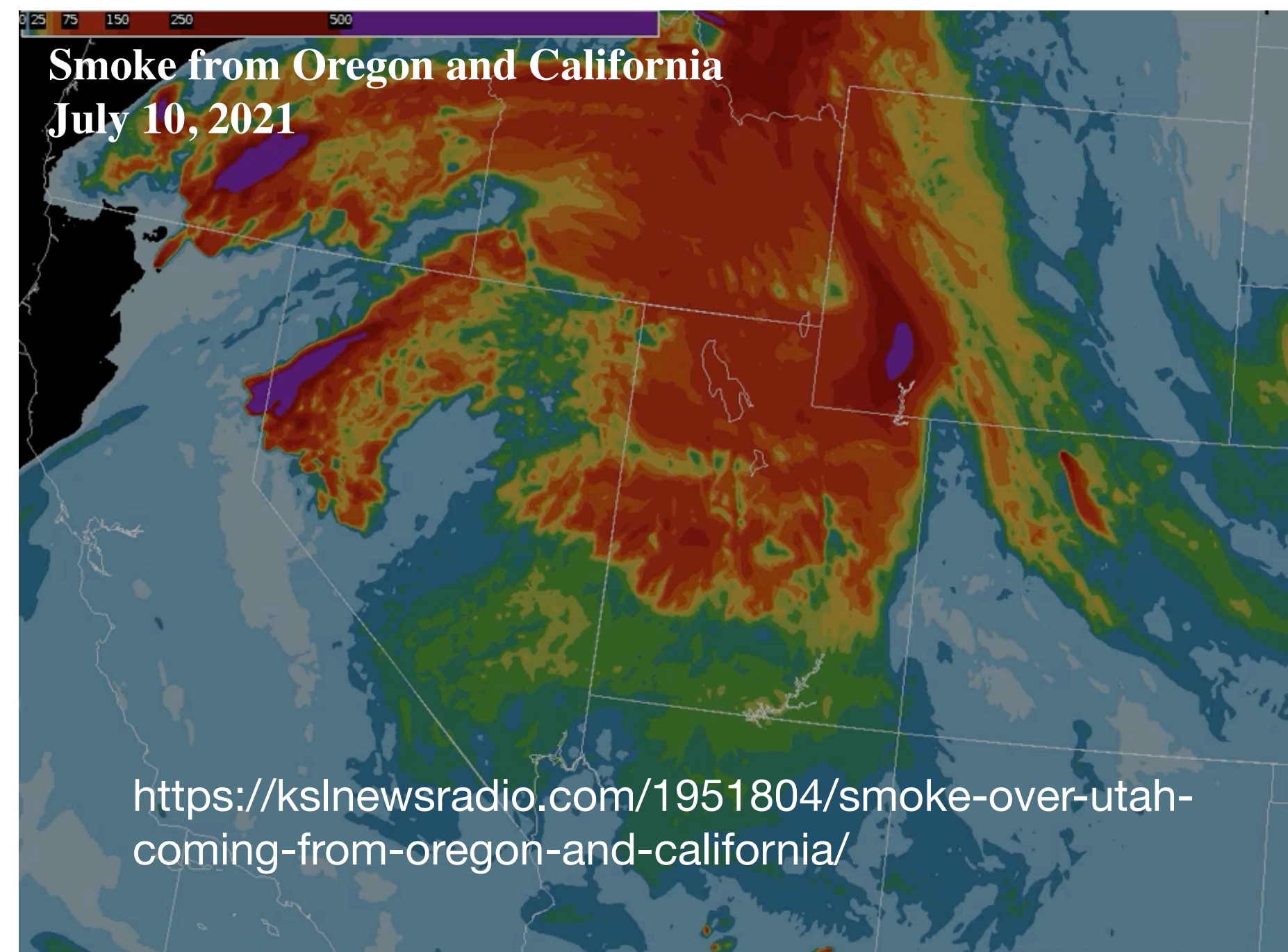
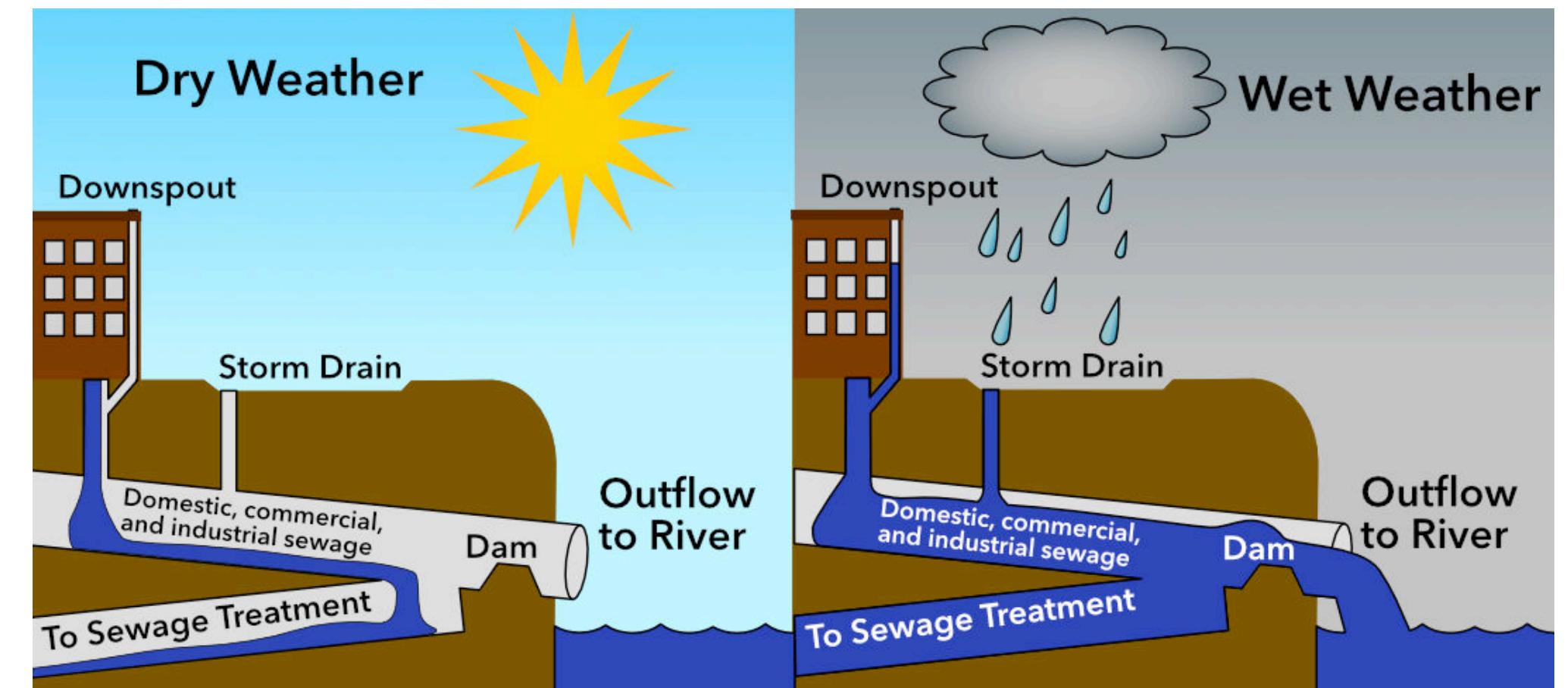


Figure courtesy of Harvard. Data from [Recent warming by latitude associated with increased length of ragweed pollen season in central North America](#) External link, Ziska et. al., PNAS March 8, 2011 108 (10) 4248-4251.

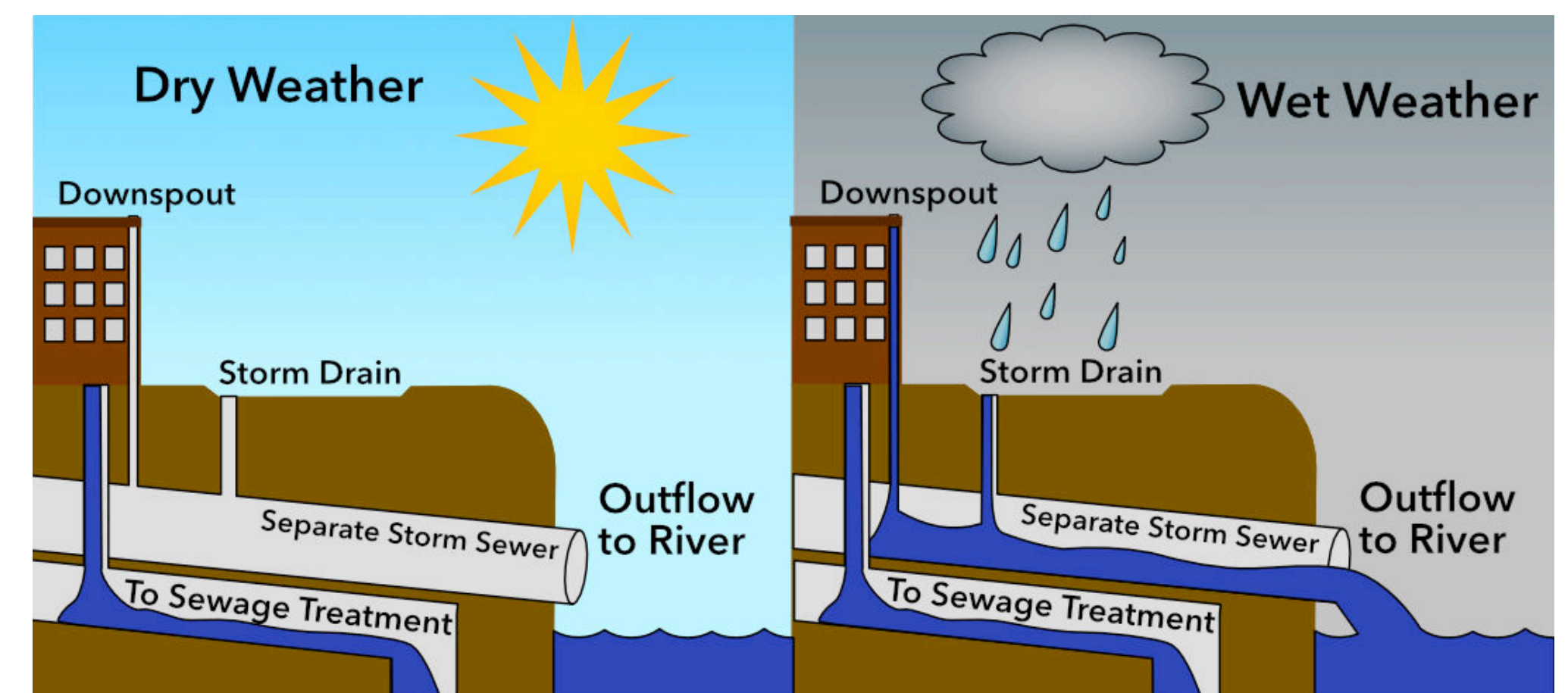
Water

- Combined sewers: after extreme rainfall, more E Coli contaminated water and ER visits
 - Reduce with more vegetation and fewer paved surfaces
- Algal blooms
- Water scarcity affects 2/3 globally
- Groundwater salinization: more salt in drinking water, bad for irrigation

Combined Sewer Overflow System



Separated (Sanitary) Sewer Overflow System



Water

- Groundwater salinization: Sea levels rise and groundwater depletion leads to more salt in drinking water, bad for irrigation

How sea water rise salinizes ground water

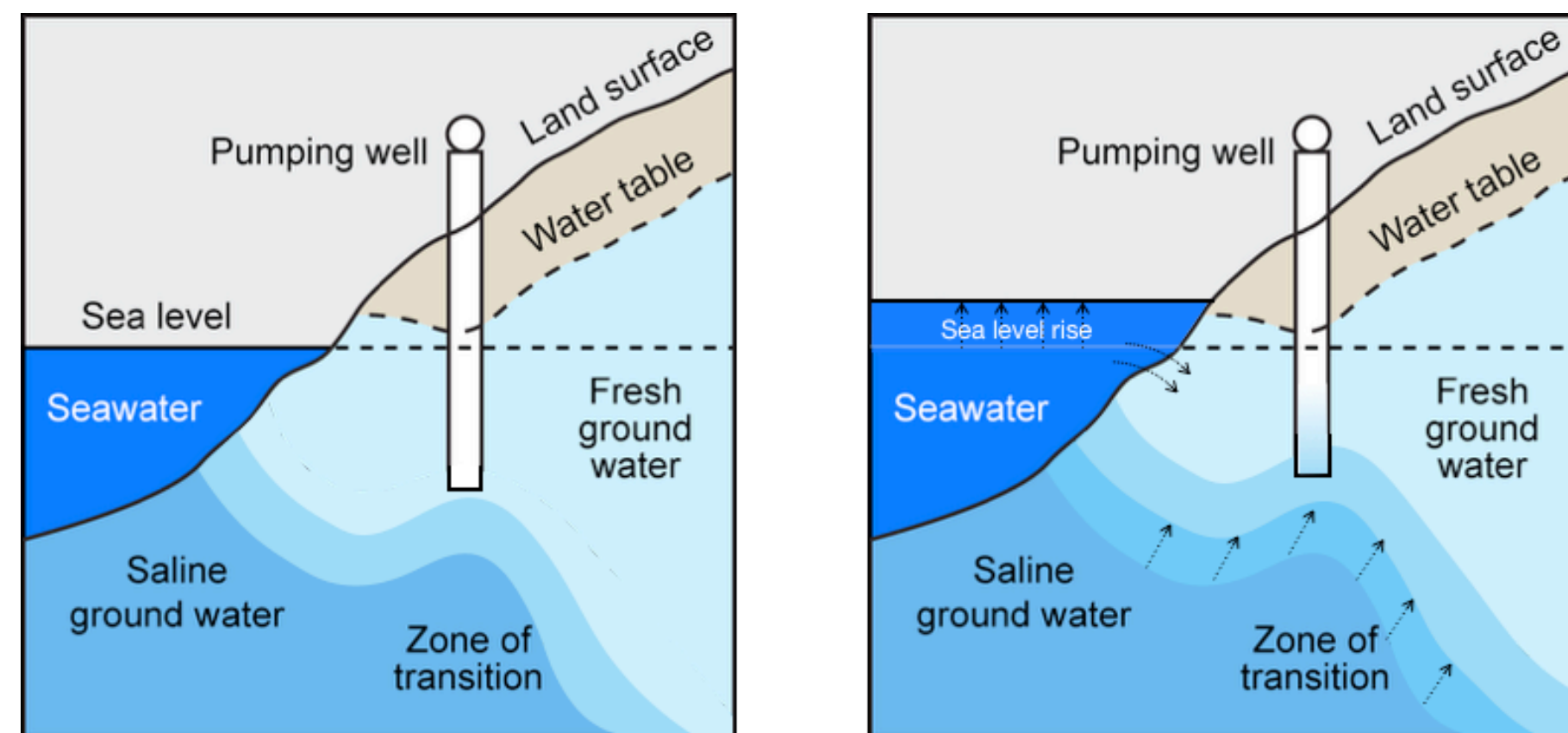
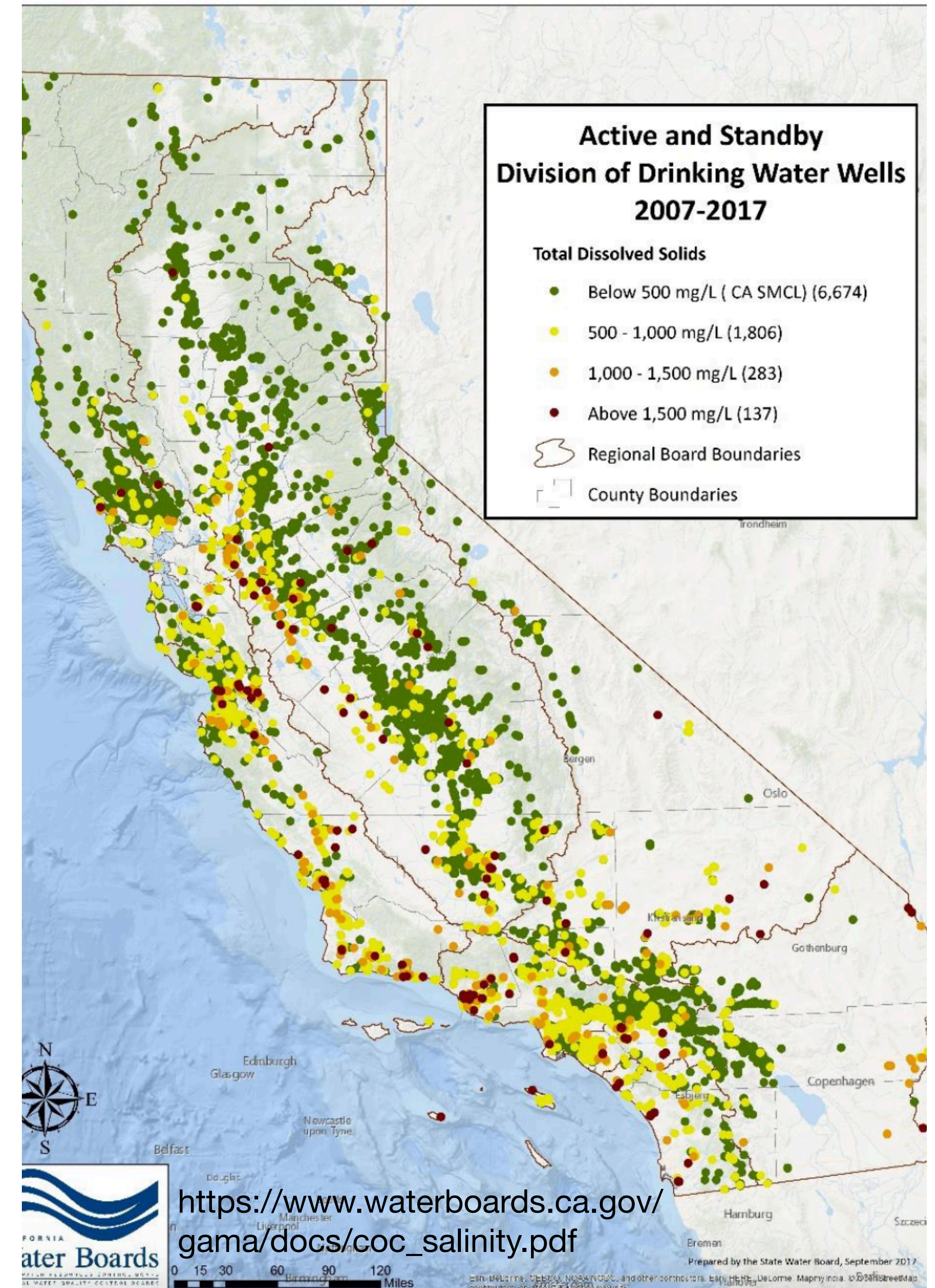


Figure adapted from [Climate Adaptation and Saltwater Intrusion External link](#) at EPA.gov.

Image from My Job Depends on Ag Magazine, Jan 2, 2020, Victor Martino



https://www.waterboards.ca.gov/gama/docs/coc_salinity.pdf

Mental Health

- Trauma of extreme climate events
- Climate refugees
- Climate anxiety
- Children’s mental health and well-being

A family in Barataria, Louisiana, returns to their home after it flooded during Hurricane Ida in August 2021. Photographer: Brandon Bell/Getty Images Bloomberg News March 7, 2023

Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey

Caroline Hickman*, Elizabeth Marks*, Panu Pihkala, Susan Clayton, R Eric Lewandowski, Elouise E Mayall, Britt Wray, Catriona Mellor, Lise van Susteren

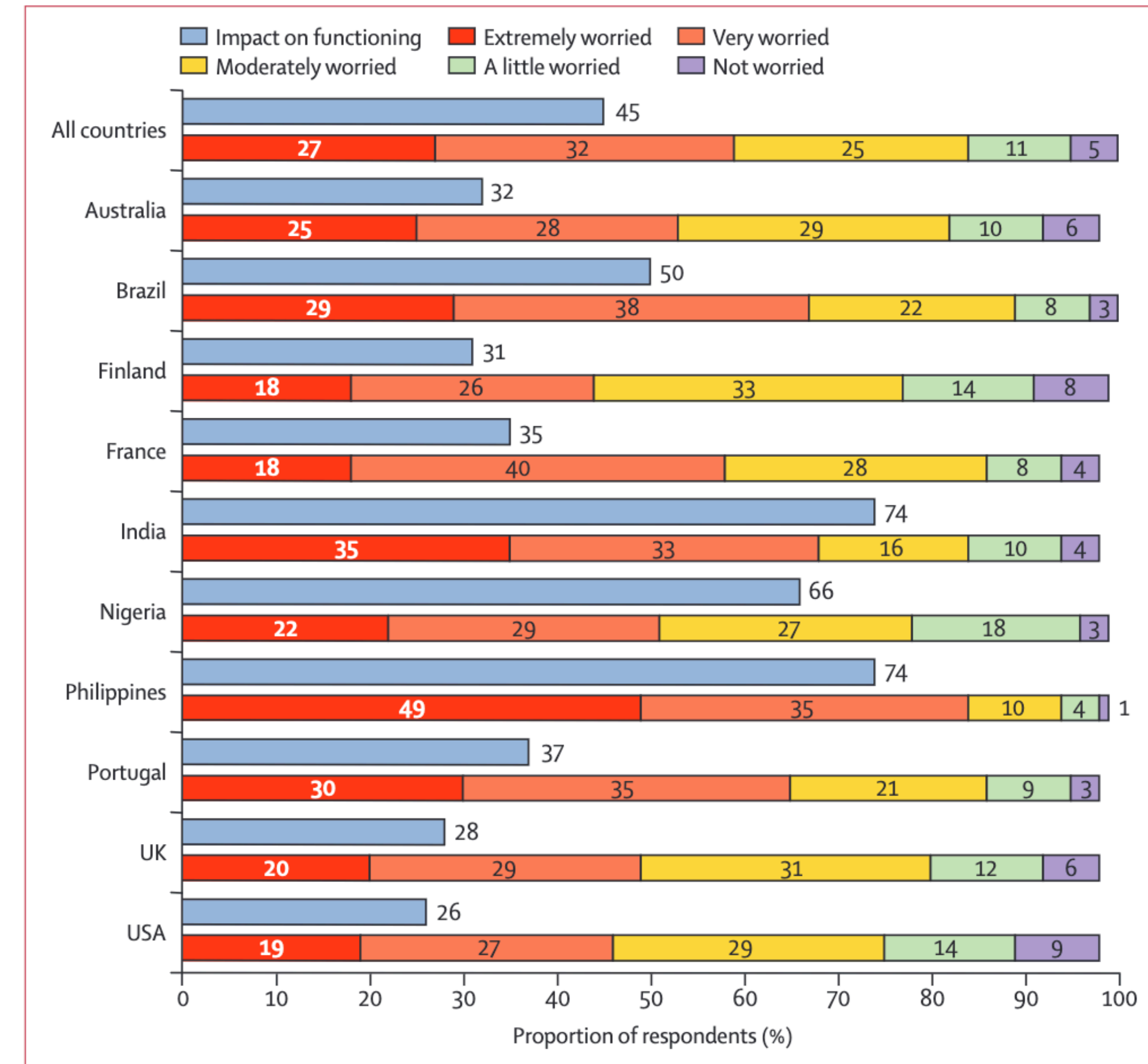


Figure 1: Worry about climate change and impact on functioning

Hitting the Poorest the Hardest

The Climate Gap

Number of months/year when water consumption exceeds availability

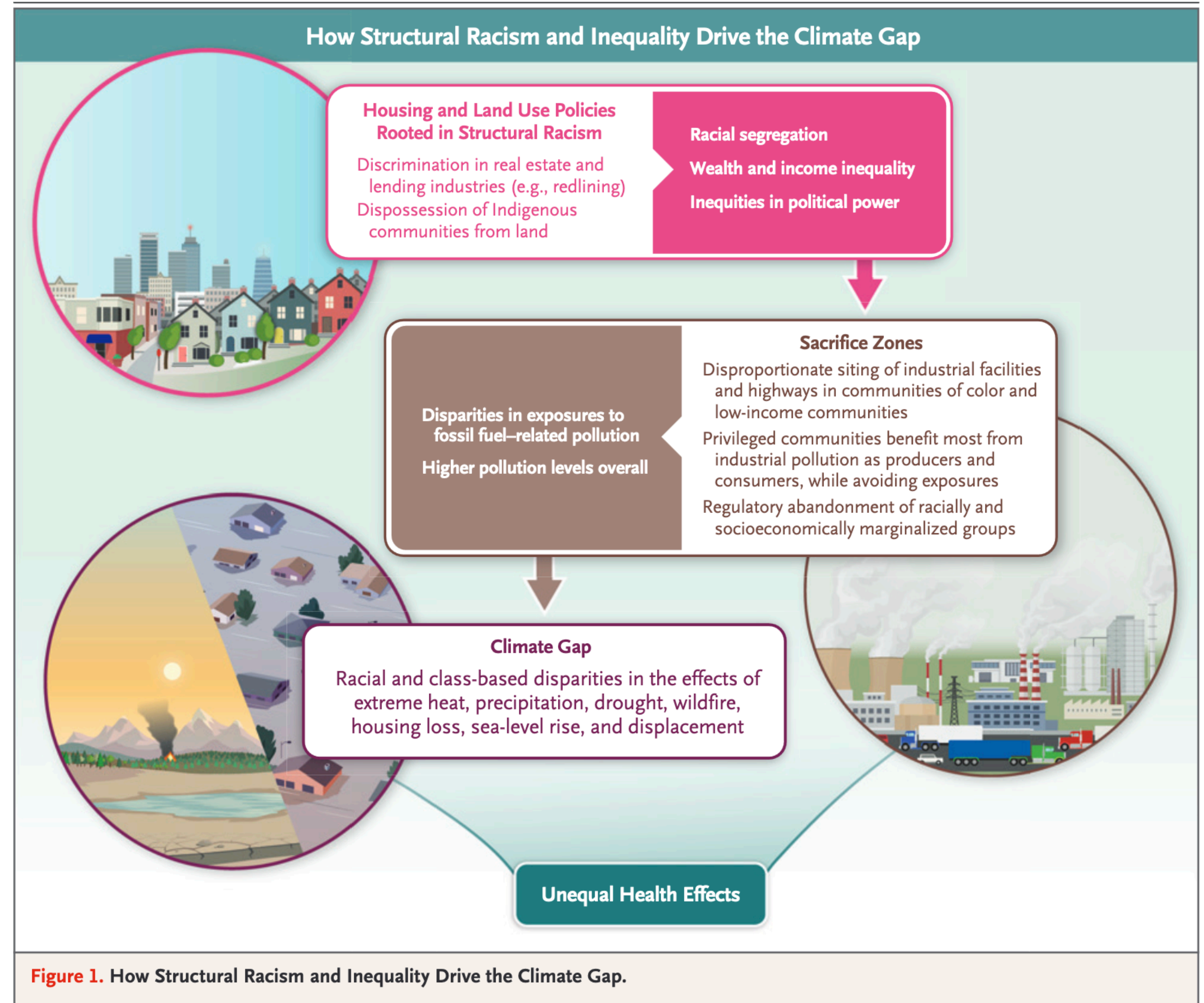
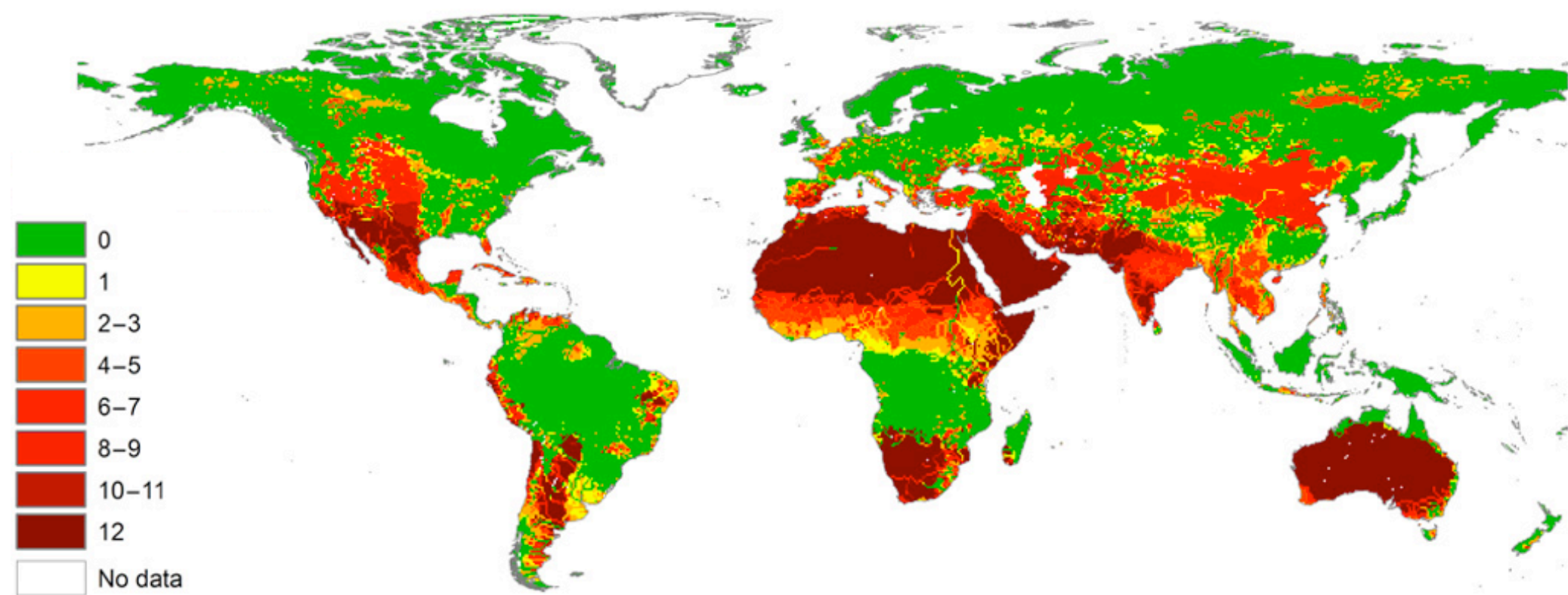


Figure 1. How Structural Racism and Inequality Drive the Climate Gap.

Figure from [Four billion people facing severe water scarcity External link](#), Mesfin M. Mekonnen and Arjen Y. Hoekstra, Science Advances 12 Feb 2016: Vol. 2, no. 2, e1500323 [https://doi.org/10.1126/sciadv.1500323 External link](https://doi.org/10.1126/sciadv.1500323)

Two-front Battle: Adaptation & Mitigation

- You've got to adapt (bail)
 - Prepare for climate events
 - Ensure secure energy sources, transportation, supply chain, financial resources
 - Build resilience
- You've got to mitigate (plug holes)
 - Reduce greenhouse gas emissions by switching to clean technologies to power vehicles and produce electricity
 - Reduce waste



Figure from LinkedIn Steward Bond. Data Quality: Plug the Holes before bailing the Boat 2014 <https://www.linkedin.com/pulse/20140826143308-16074186-data-quality-plug-the-holes-before-bailing-the-boat>

US Health Care



- Top in the world, accounting for **27%** of the global health care footprint
- Responsible for 8.5% of US greenhouse gas emissions
- Emissions rose 6% from 2012-2018
- Resulted in the loss of 388,000 disability-adjusted life-years in 2018



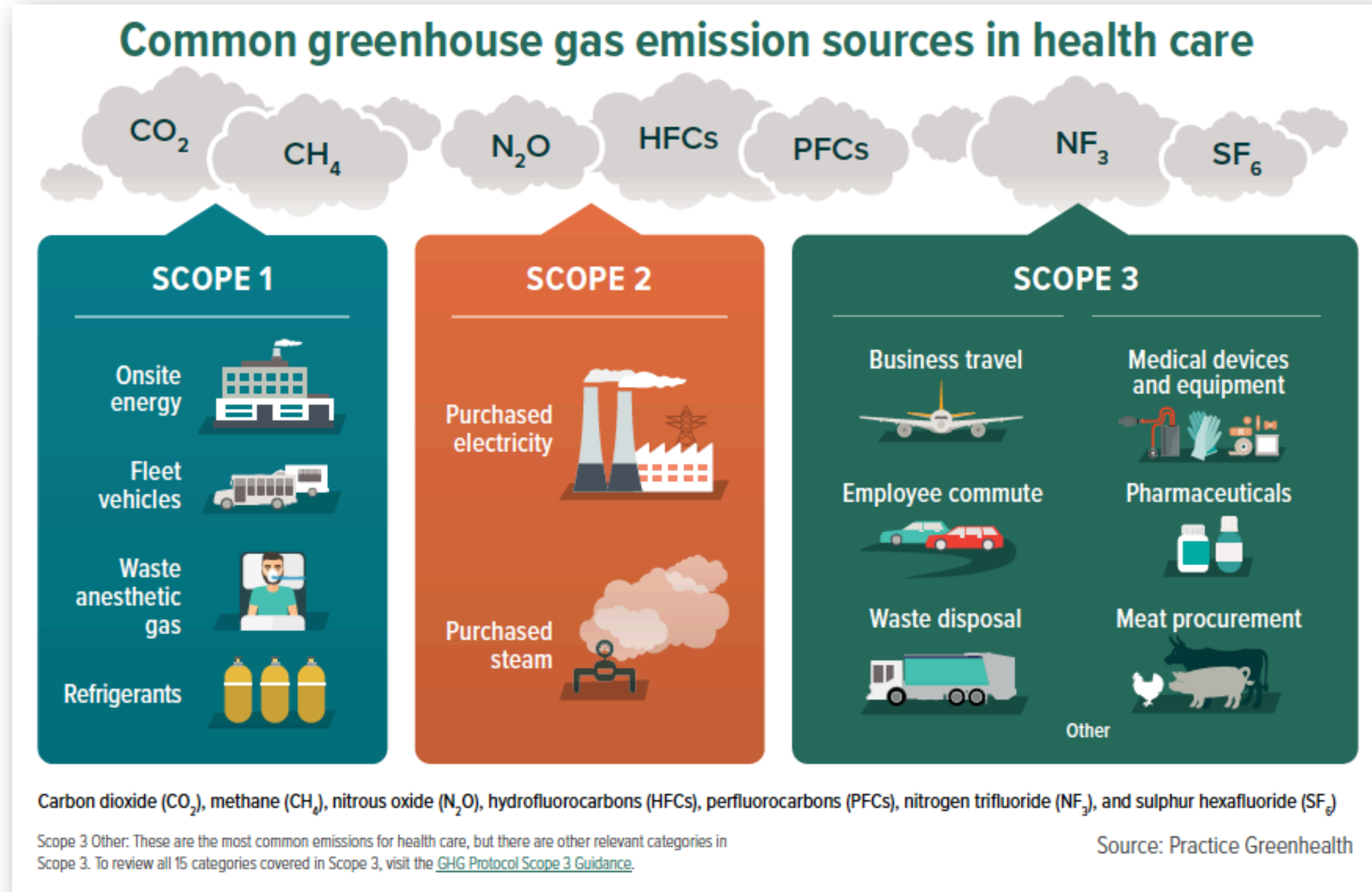
Eckelman MJ, Huang K, Lagasse R, Senay E, Dubrow R, Sherman JD. Health care pollution and public health damage in the United States: an update. *Health Aff (Millwood)*. 2020;39(12):2071-2079

Slide courtesy of Emily Mediate, Health Care Without Harm
<https://noharm-uscanada.org/ClimateFootprintReport>



What is producing all those emissions?

- 7% is direct emissions (fossil fuels, anesthetic gases)
- 11% is from purchased energy
- 82% comes from choices: pharmaceuticals, medical devices & supplies, food, transportation, other purchased services, investments



Some Recommendations

National → **Hospital** → **Informatics**

AHRQ Primer

1. Set net zero goals
2. Establish structural enablers
 - Executive leadership team
 - Data collection & management
 - Educate, Empower the workforce
 - Procurement policies
3. Understand emissions (DATA)
 - Inventory facility/energy emissions
 - Inventory supply chain, travel
 - Use benchmarks
4. Prepare & execute your plan
 - Reduce energy (LEED), EV, anesthetics
 - Influence suppliers, reduce waste
 - **High VALUE** care

Reducing Healthcare Carbon Emissions

A Primer on Measures and Actions for Healthcare Organizations to Mitigate Climate Change

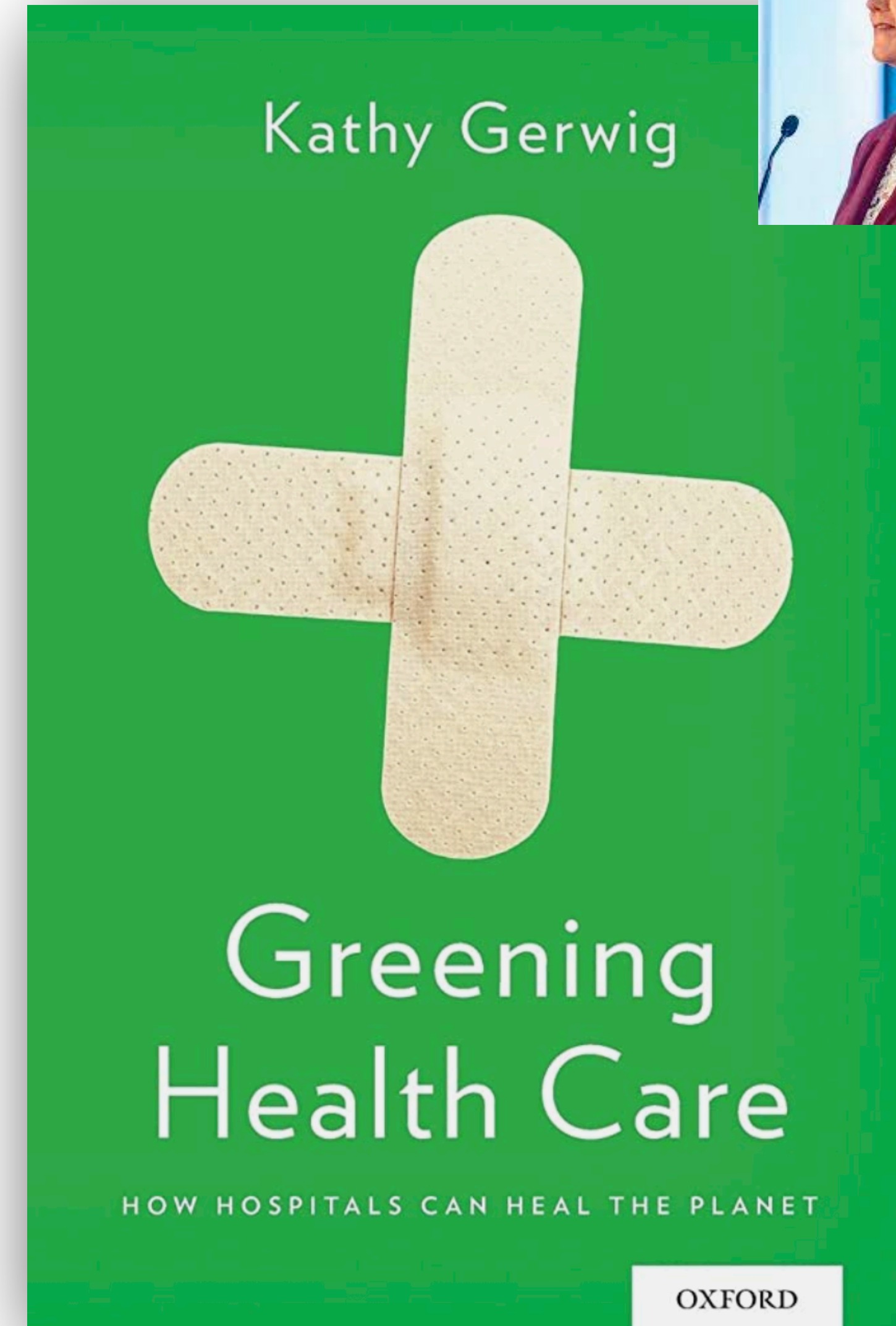


AHRQ Publication No. 22-M011
September 2022
www.ahrq.gov

A Health System's Response

CASE STUDY: Kaiser Permanente

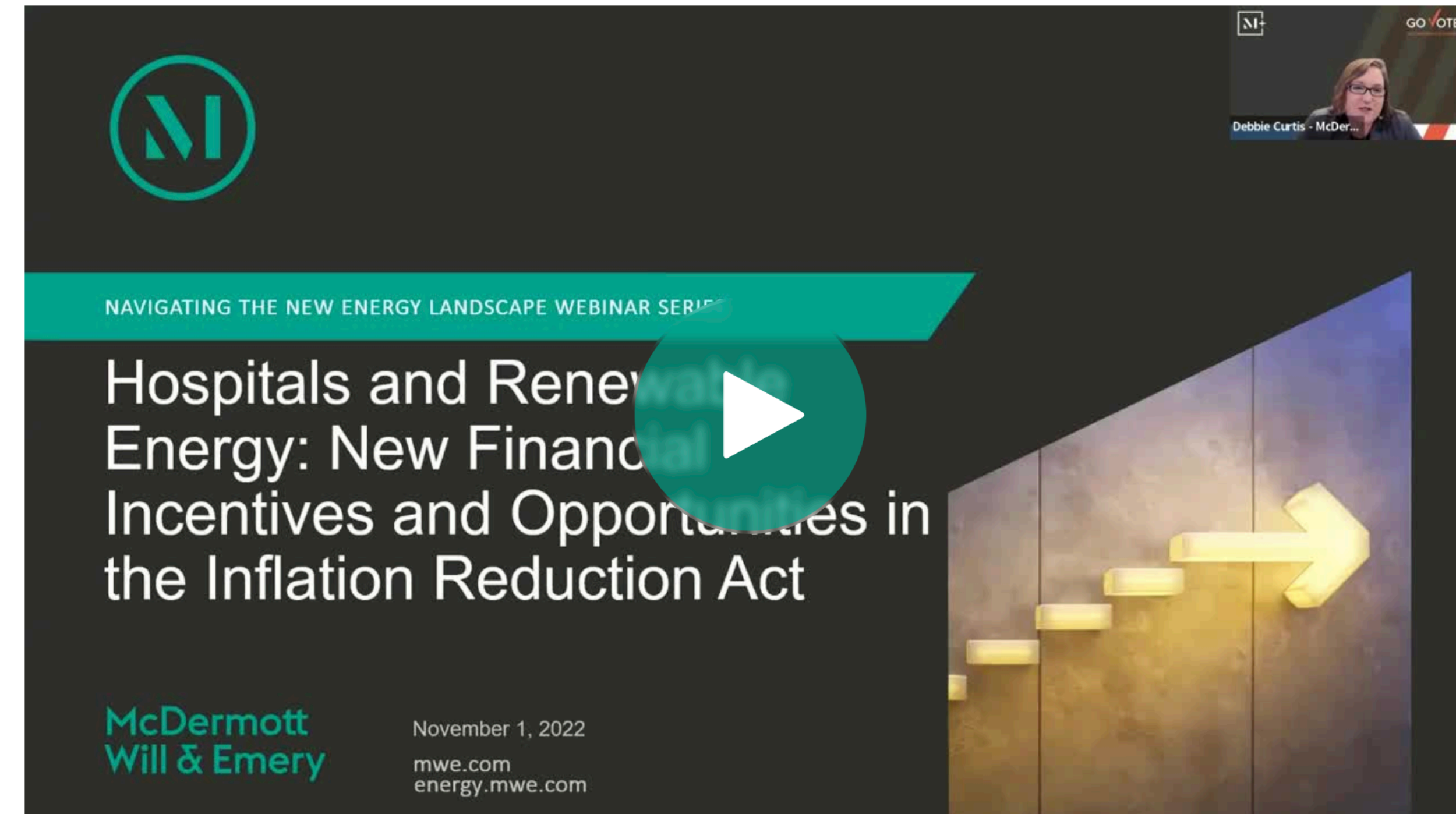
- Achieved carbon neutral in 2020
 - Partially through purchased offsets
- Installed solar power 100 sites
- Solar power purchasing, plus battery storage, new renewable microgrid
- EV charging, fleet electrification
- Telemedicine
- Data services: EPEAT-registered computers, servers, phones, TVs
- Reprocessed surgical devices, reduce single use devices
- Reduce food waste



2022 Inflation Reduction Act

Unlocks key opportunities

- New financial incentives for energy efficiency
 - Investment tax credits = direct cash payments cover at least 30% and as much as 50-60% of costs
 - Upgrades/retrofits are highly incentivized
- New access to tax equity market via transferability to monetize any solar projects we develop
- Benefit from broader solar development incentives (that will reduce costs)
- By offsetting capital costs, hospitals and benefit from LOWER costs of solar, wind energy and Strengthen Resilience



<https://www.mwe.com/events/hospitals-renewable-energy-new-financial-incentives-opportunities-in-the-inflation-reduction-act/>



Bloomberg News June 30, 2022

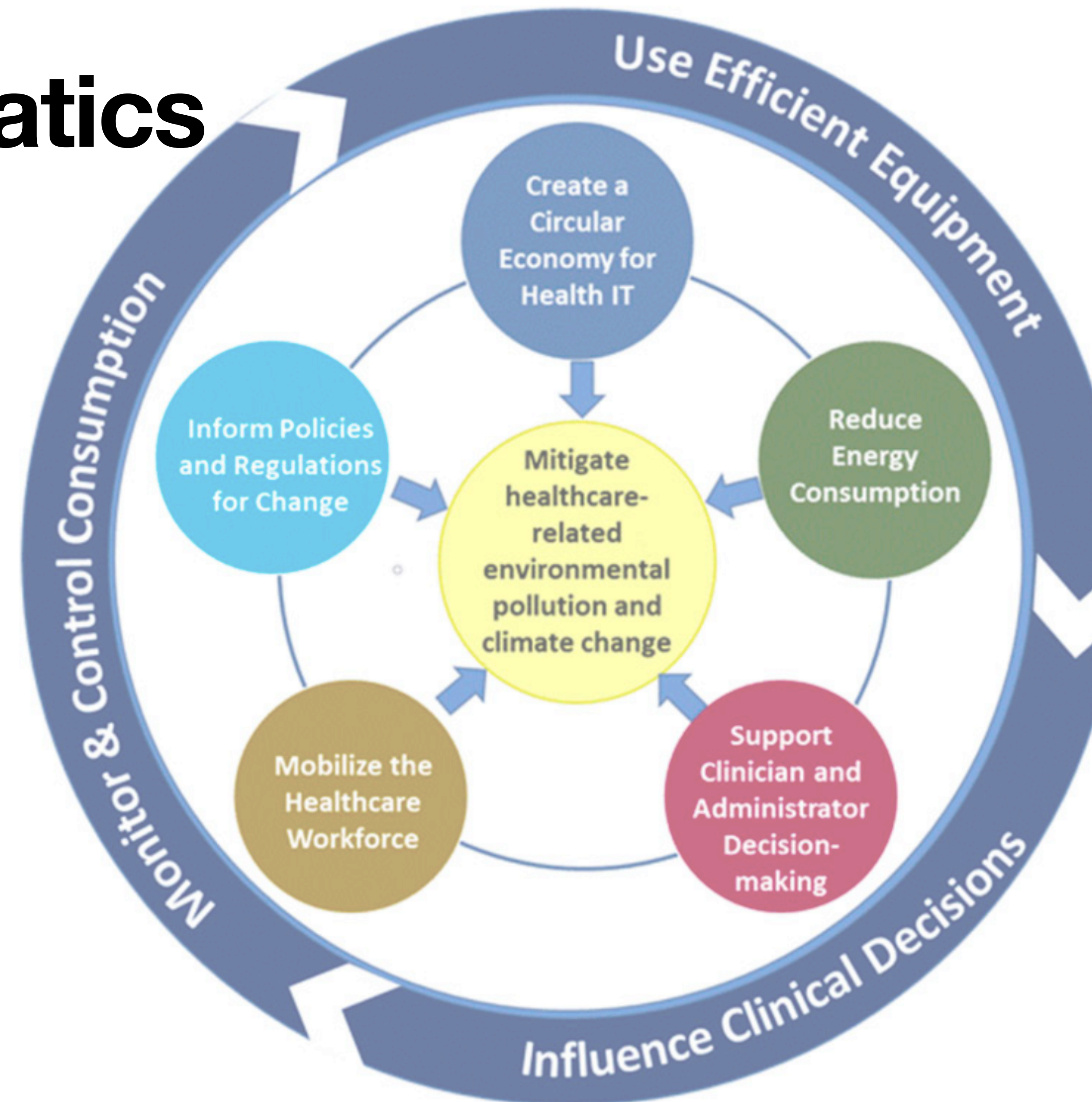
Some Recommendations

National → Hospital → **Informatics**

Clinical Climate Informatics

i-CLIMATE Framework

- Computers, data centers, ME
 - Replacing computers every 2-4 yrs?
 - 50% of all office computers on 24/7
- Measure, display, monitor perf
 - Anesthetic gases: monitoring flow
 - Medical equipment use
 - Supply chain management
 - Reduce waste in care delivery
- Mobilize workforce, Inform patients



Sitting DF, Sherman JD, Eckelman MJ, Draper A, Singh H, I-CLIMATE: a “clinical climate informatics” action framework to reduce environmental pollution from healthcare. JAMIA 2022 Nov 14;29(12):2153-2160

One Path Forward

Reforming Health Care

Tackling Climate Change



Adaptation

- More prevention & primary care
- Reducing unnecessary care and procedures
- Reducing waste, including tech waste
- Lower energy bills (renewables)
- Effective back-up energy (microgrids)
- Telehealth
- Digital health & home-based care with remote patient monitoring
- Palliative care
- Stronger, more resilient communities with robust social infrastructure and support

Mitigation

Resources

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5. US Health and Human Services. Federal Resources to Support Emissions Reduction and Climate Resilience for Healthcare Stakeholders. <https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/actions/health-care-sector-pledge/federal-resources/index.html> (last accessed October 10, 2022)
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7. Sitting DF, Sherman JD, Eckelman MJ, Draper A, Singh H, I-CLIMATE: a “clinical climate informatics” action framework to reduce environmental pollution from healthcare. JAMIA 2022 Nov 14;29(12):2153-2160
8. edX: HarvardX PH278.Ax The Health Effects of Climate Change