

The Climate Crisis and Our Health: Roles and Opportunities in Primary Care

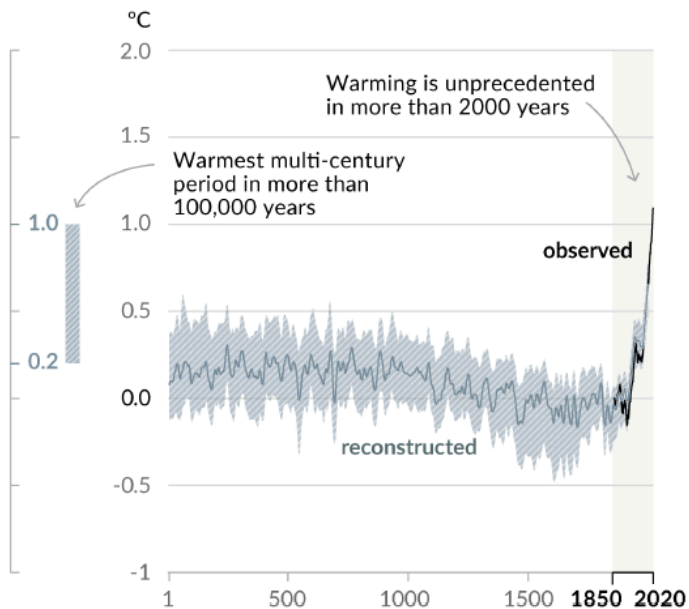
Annual Conference of the
Association of Departments of Family Medicine
June 9, 2022, Denver

Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

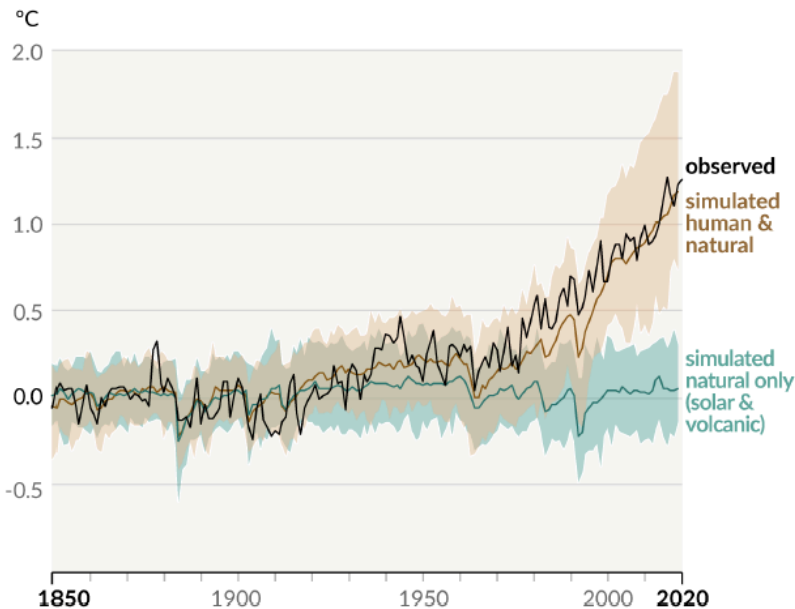
Figure SPM.1

Changes in global surface temperature relative to 1850-1900

a) Change in global surface temperature (decadal average) as **reconstructed** (1-2000) and **observed** (1850-2020)



b) Change in global surface temperature (annual average) as **observed** and simulated using **human & natural** and **only natural** factors (both 1850-2020)





[Credit: NASA]

“Recent changes in the climate are widespread, rapid, and intensifying, and unprecedented in thousands of years.

SIXTH ASSESSMENT REPORT

Working Group I – The Physical Science Basis

ipcc
INTERGOVERNMENTAL PANEL ON climate change





[Credit: Yoda Adaman | Unsplash]

“It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.



[Credit: Peter John Maridable | Unsplash]

“ Unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions, limiting warming to 1.5°C will be beyond reach.

The science is unequivocal: the heating of the planet is caused by human activities.

Climate impacts are here and happening now.

Extreme events are increasingly happening at the same time (=compound extreme events)

A doubling of global mean surface temperatures will likely lead to further warming

climate adaptation IPCC Sixth Assessment Report 2021

The thirteen chapters of the Working Group I contribution to the Sixth Assessment Report provide an assessment of the current state of knowledge on the physical science of climate change, including the evidence on the physical processes, the observed changes, and the projected future changes.

biological processes.

ipcc

INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2021

The Physical Science

“CODE RED FOR HUMANITY”
UN Secretary General

WGI

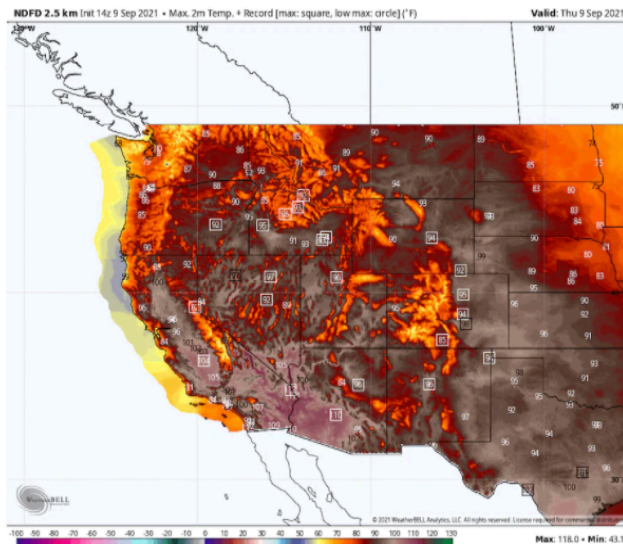
Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change



Capital Weather Gang

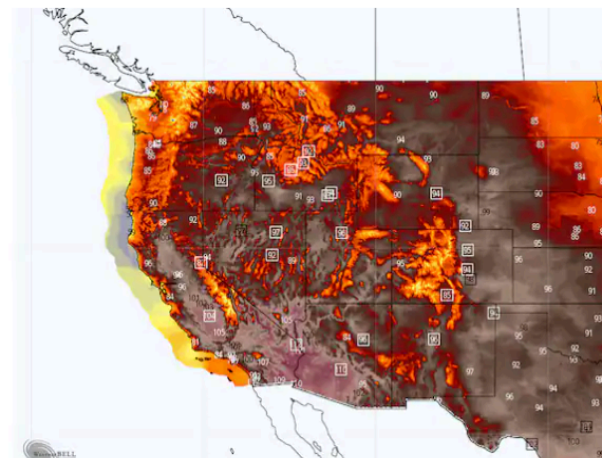
Record heat, fire danger plague West after hottest summer on record for U.S.

A siege of dry lightning could ignite new blazes in Northern California and Oregon into Friday



Forecast highs in the West on Thursday from the National Weather Service. Boxed values indicate record highs predicted. (WeatherBell)

MOST READ WEATHER



- 1 Record heat, fire danger plague West after hottest summer on record for U.S.
- 2 D.C.-area forecast: Breezy today but rain-free and sunny for days to come



By Jason Samenow and Diana Leonard

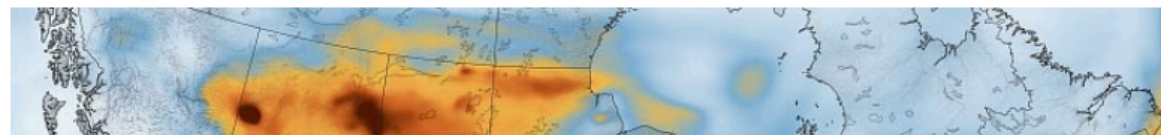
Yesterday at 5:34 p.m. EDT

📺 ⬆️ 💬 344

NASA Satellites Show Smoke Across North America

TOPICS: Earth Observatory NASA Wildfires

By ADAM VOILAND, NASA EARTH OBSERVATORY JULY 26, 2021



PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

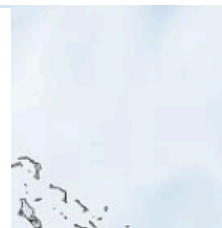
Article

Fine Particles in Wildfire Smoke and Pediatric Respiratory Health in California

Rosana Aguilera, Thomas Corringham, Alexander Gershunov, Sydney Leibel and Tarik Benmarhnia

Pediatrics April 2021, 147 (4) e2020027128; DOI: <https://doi.org/10.1542/peds.2020-027128>

CONCLUSIONS: Wildfire-specific PM_{2.5} was found to be ~10 times more harmful on children's respiratory health than PM_{2.5} from other sources, particularly for children aged 0 to 5 years. Even relatively modest wildfires and associated PM_{2.5} resolved on our record produced major



18 States With the Worst Drought Right Now

24/7 Wall St. · May 14



These are the impacts of California's worst drought on record

NPR · 10 hours ago

California is rationing water amid its worst drought in 1,200 years

CBS News · 5 days ago



The Southwest's Drought and Fires Are a Window to Our Climate Change Future

ProPublica · May 11



The Western U.S. Is Experiencing the Worst Drought in More Than 1200 Years

Smithsonian Magazine · Feb 17



Full study

- **Download the full study:** Rapid attribution analysis of the extraordinary heatwave on the Pacific Coast of the US and Canada June 2021, pdf (37 pages, 8.6 MB)

ada

Health effects of climate change

CLIMATE
CHANGE

Temperature Rise

Sea level Rise

Hydrologic Extremes

Droughts

Floods

Fires

Urban Heat Island Effect

Air Pollution &
Aeroallergens

Vector-borne Diseases

Water-borne Diseases

Water resources &
Food supply

Mental Health &
Environmental Refugees

Heat Stress
Heart attacks

Respiratory
diseases: COPD &
Asthma

Malaria
Dengue
Hantavirus
Zika

Cholera
Cryptosporidiosis
Campylobacter
Leptospirosis

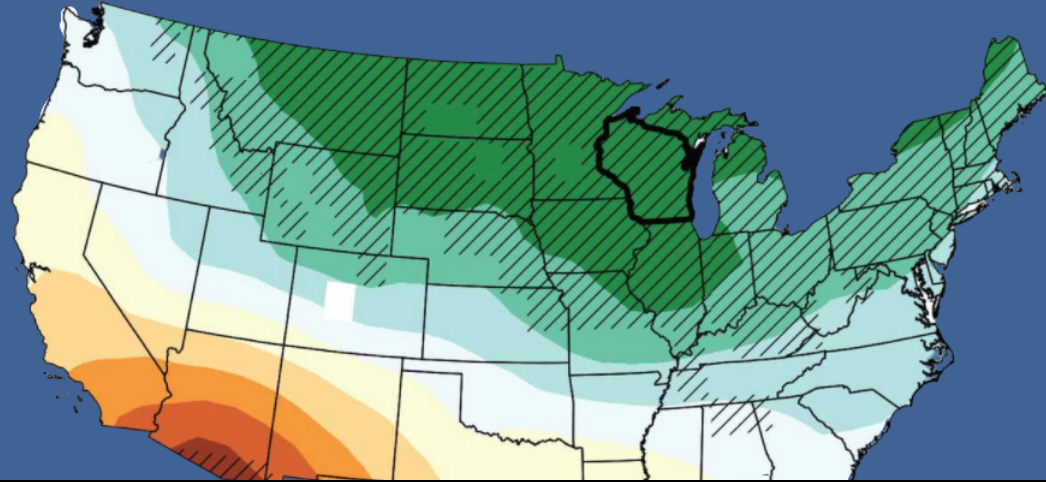
Malnutrition
Diarrhea
Toxic Red Tides

Forced Migration
Overcrowding
Human Conflicts
Patz, 1998



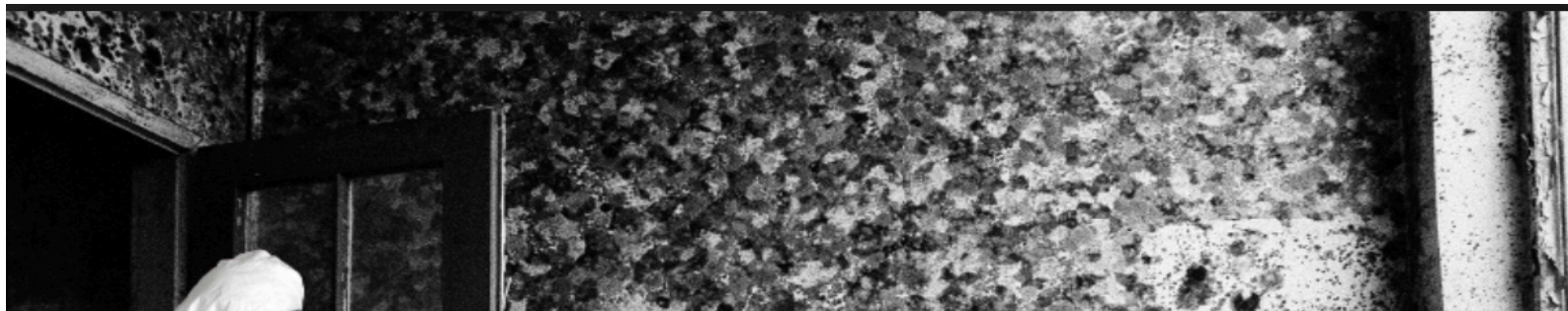
FLOODING

- In southern and western Wisconsin, annual precipitation is **now 7 inches more than the 1950 – 2006 average.**
- **Health Impacts Include:**
 - Water-borne illness
 - Drowning
 - Electrocution
 - Tetanus and wound infections
 - Physical barrier to receiving care
 - Respiratory health risks
 - Vector-borne disease
 - Harmful algal blooms



By 2050, Chicago could see a doubling in “Combined Sewage Overflow” (CSO) events (Patz et al. 2008)

Floods pose risks to water contamination... but after floods, asthmatics end up in emergency rooms

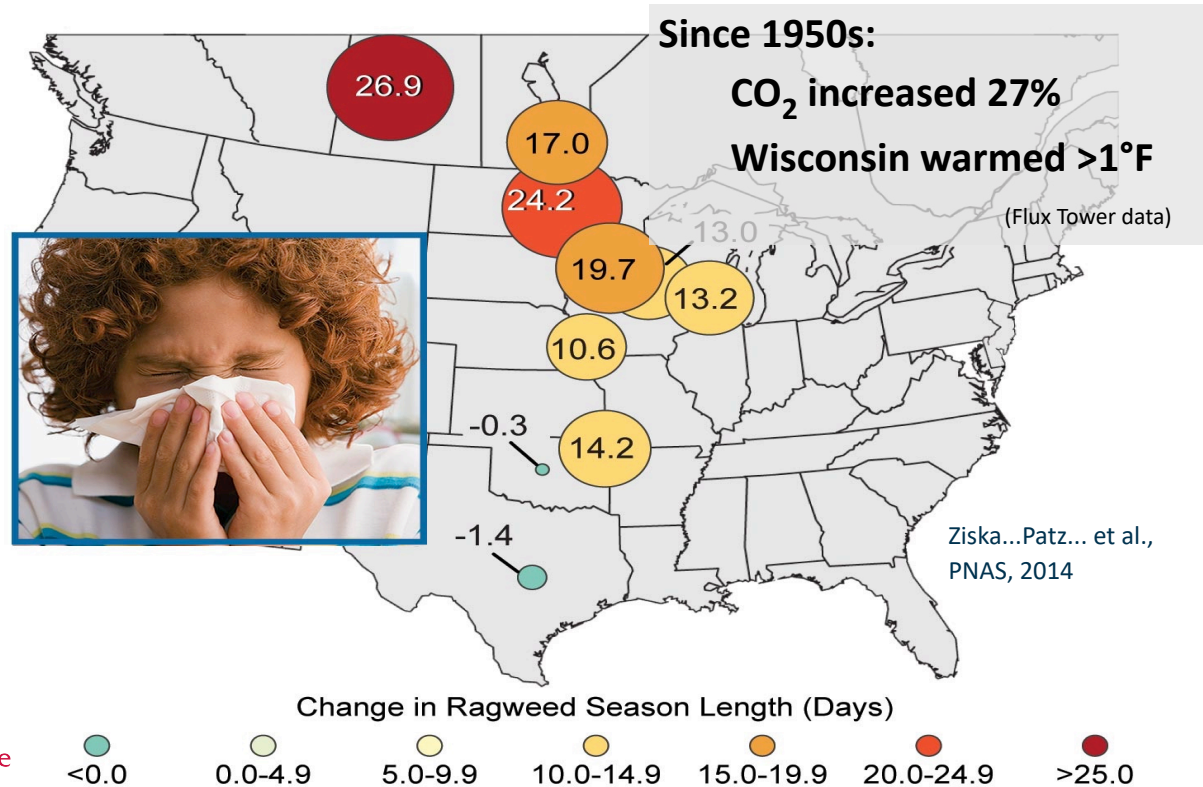


A Racist Past, a Flooded Future: Formerly Redlined Areas Have \$107 Billion Worth of Homes Facing High Flood Risk—25% More Than Non-Redlined Areas

Published on March 14, 2021 by [Lily Katz](#)

Updated on March 17th, 2021

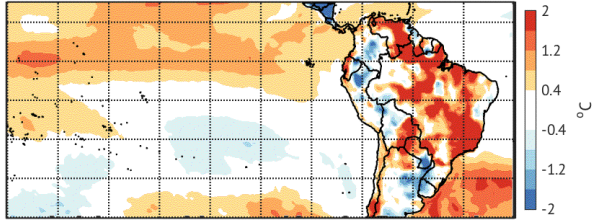
Warming, CO₂ and longer ragweed season



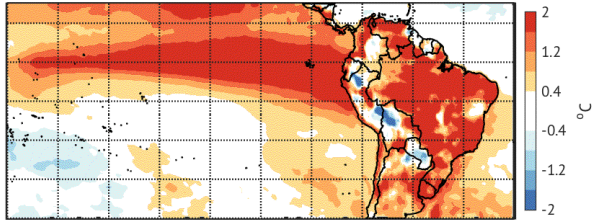
Insect-borne diseases are especially sensitive to weather conditions



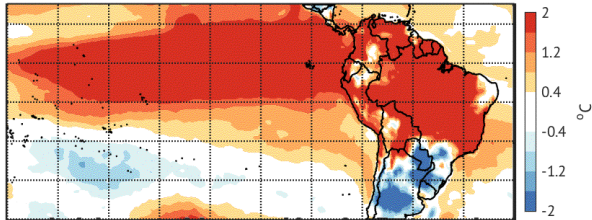
Surface Temp (2m TMAX): OCT 2014 - MAR 2015



Surface Temp (2m TMAX): APR 2015 - SEP 2015



Surface Temp (2m TMAX): OCT 2015 - FEB 2016



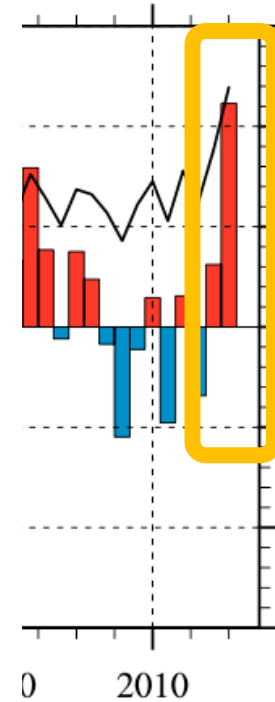
El Niño of 2015
one of the strongest in the recent historical
record, surpassing the 1997-98 event



Vectorial capacity for Zika/Dengue Transmission, South America

In the laboratory, “Zika virus transmission was optimized at 29°C... the predicted thermal minimum for Zika transmission is **5°C warmer** than that of dengue.”

Tesla et al. 2018

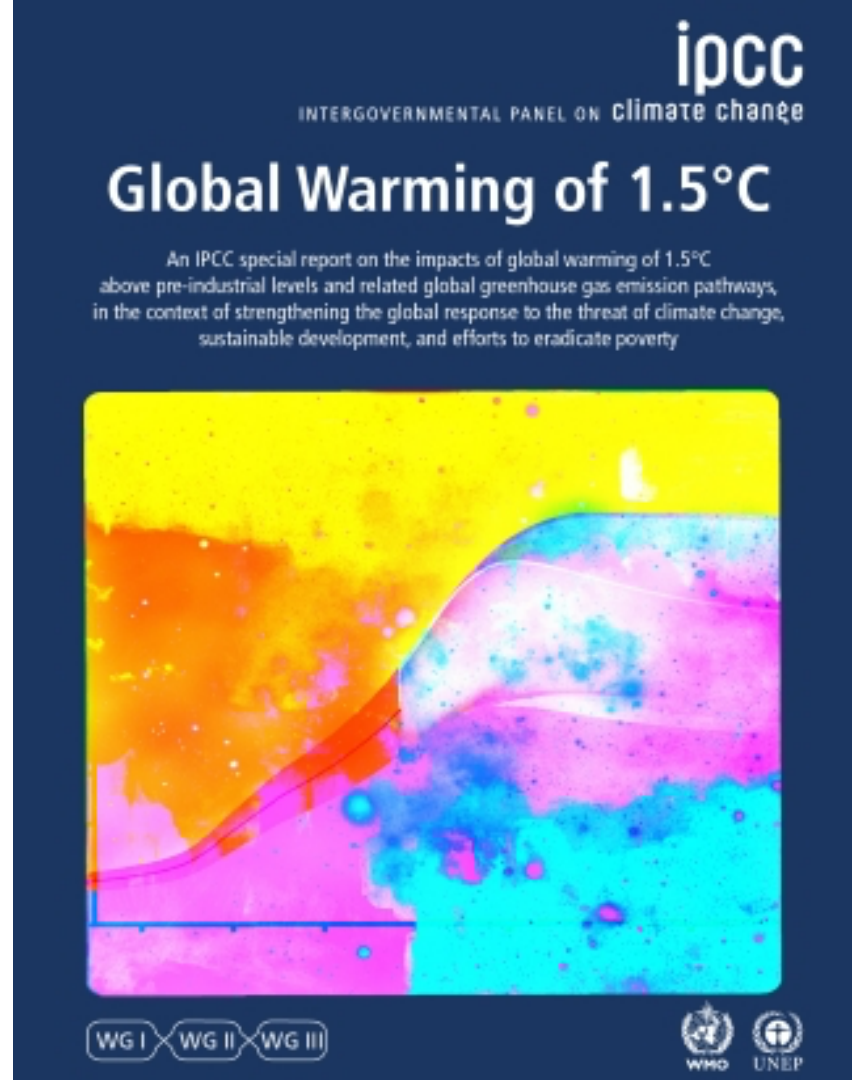


The United Nations Intergovernmental Panel on Climate Change (IPCC) released this new report Oct. 8, 2018

To stabilize at 1.5°C warming, we'll
need to:

Cut emissions from burning fossil fuels
(& cutting rainforests) **by 45% by the
year 2030**, and be net carbon-zero by
2050.

That's SOON !!!



Greta skips school to sit
outside Swedish Parliament
8-28-2018

SKOLSTREJK
FÖR



Greta Thunberg to US Congress on climate change: 'Wake up'

The Swedish teen activist tells US politicians to 'listen to scientists' and enact strong measures on climate change.

18 Sept 2019



But could combating Climate Change be cost-free?

Special Communication , *JAMA*, 2014

Climate Change

Challenges and Opportunities for Global Health


Jonathan A. Patz,
Daniel J. Vimont, **Solving the global climate crisis: the greatest health opportunity of our times?**

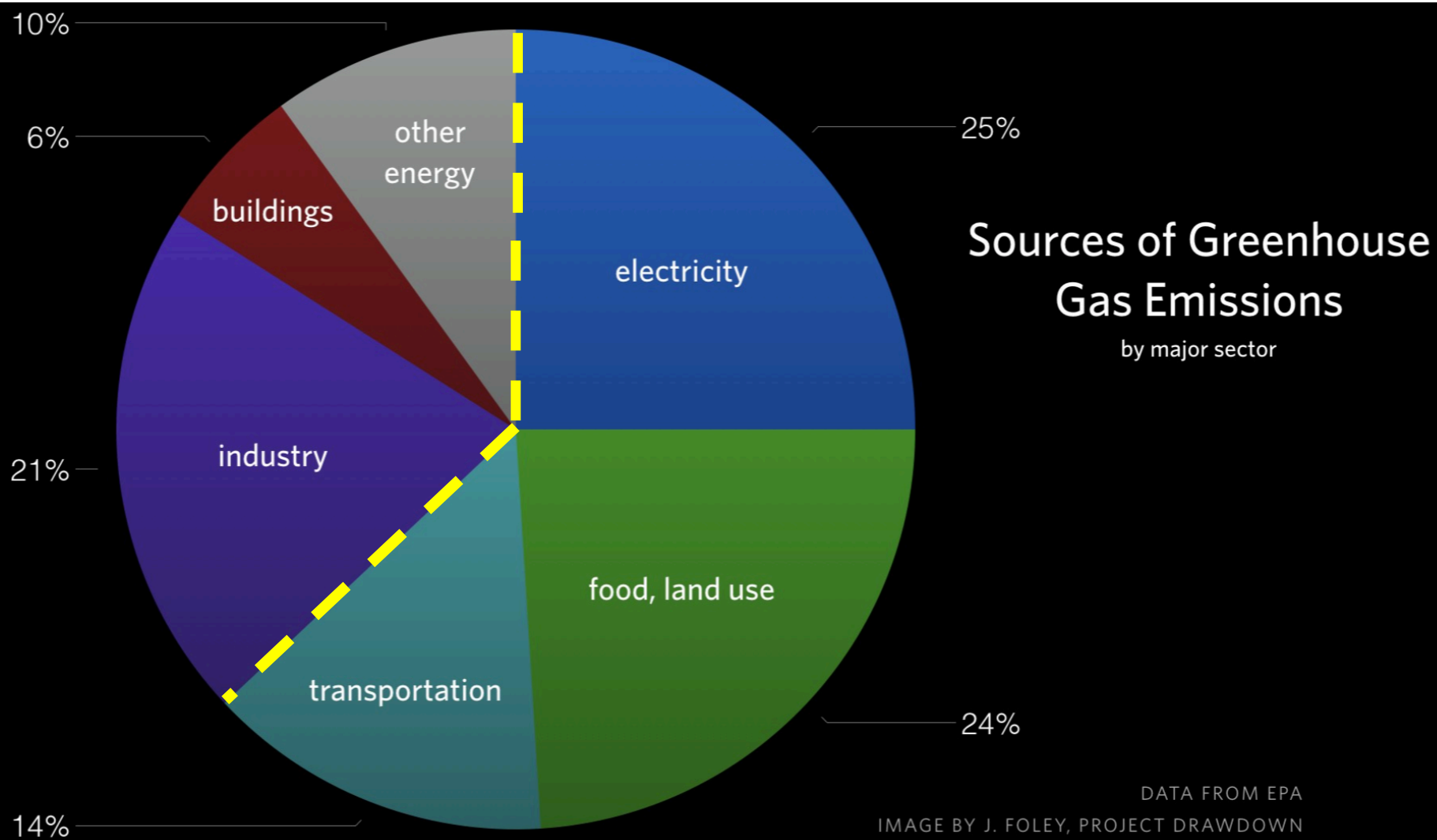
February 28, 2020 , *JAMA*

Jonathan A. Patz,
Public Health **A Low-Carbon Future Could Improve Global Health and Achieve Economic Benefits**

Jonathan A. Patz, MD, MPH^{1,2}; Valerie J. Stull, PhD, MPH¹; Vijay S. Limaye, PhD³

Climate Solutions Double as Health Interventions

Nicholas A. Mailloux¹ , Colleen P. Henegan¹, Dorothy Lsoto¹, Kristen P. Patterson², Paul C. West
Jonathan A. Foley² and Jonathan A. Patz^{1,4,5,*}



Action on climate change: Opportunities for Health

Energy Sector

Air pollution (from burning fossil fuels):

7 million premature deaths/year (WHO and GBD)



Food Sector

Energy intensive diets (e.g. red meat)

“Universal Healthy Reference Diet” could avert:

11 million premature deaths/year
(EAT-Lancet Commission, 2019)



Transportation Sector

Physical inactivity from sedentary lifestyles:

3.9 million premature deaths/year

(Strain et al. 2020)



Regional and global contributions of air pollution to risk of death from COVID-19

Andrea Pozzer ^{1,2}, Francesca Dominici³, Andy Haines⁴, Christian Witt ⁵, Thomas Münzel ^{6,7*}, and Jos Lelieveld ^{2,8*}

COVID-19 mortality attributable to air pollution

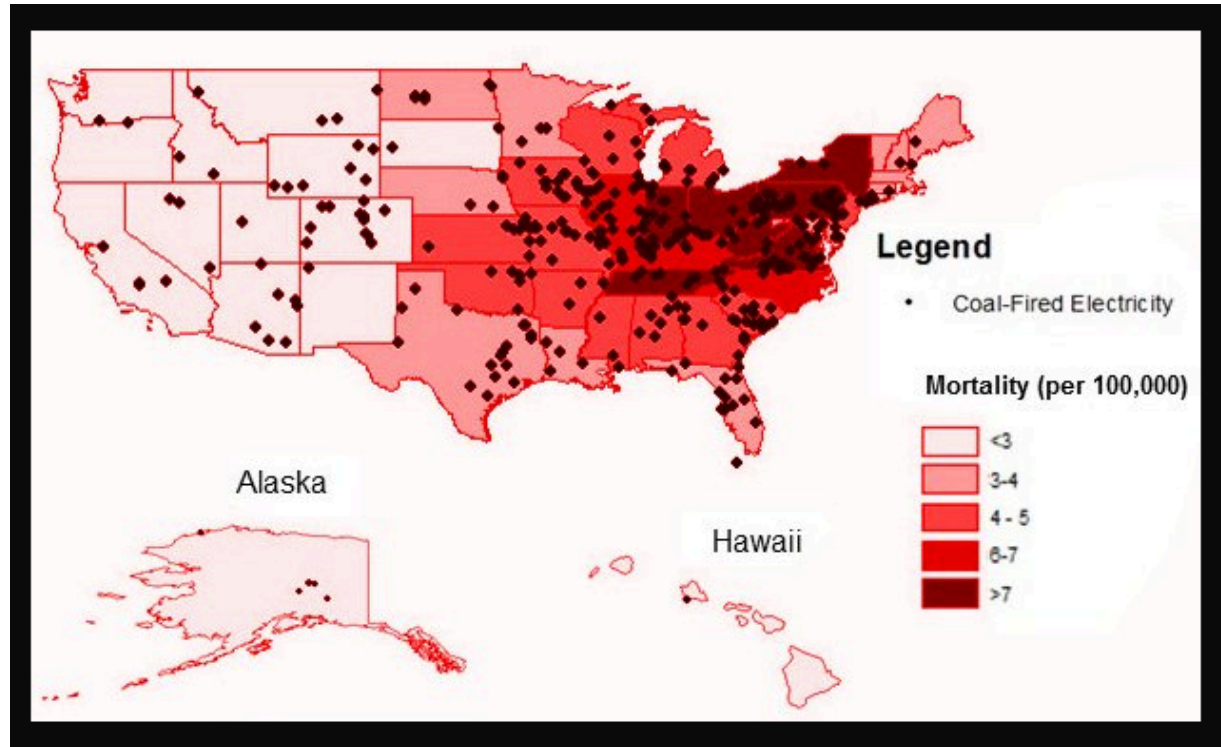
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Table 1 Regional percentages of COVID-19 mortality attributed to fossil fuel-related and all anthropogenic sources of air pollution

Region	Population (million)	COVID-19 mortality fraction attributed to air pollution (%)	
		Fossil fuel-related emissions	All anthropogenic emissions
Europe	628	13 (6–33)	19 (8–41)
Africa	1345	2 (1–19)	7 (3–25)
West Asia	627	6 (3–25)	8 (4–27)
South Asia	2565	7 (3–22)	15 (8–31)
East Asia	1685	15 (8–32)	27 (13–46)
North America	525	14 (6–36)	17 (6–39)
South America	547	3 (1–23)	9 (4–30)
Oceania	28	1 (0–20)	3 (1–23)
World	7950	8 (4–25)	15 (7–33)

The 95% confidence levels are given in parentheses.

Map showing estimated mortality rates and PM_{2.5} pollution from coal-fired power plants in the U.S.



**>140,000
premature
deaths/yr from
air pollution
in the U.S.**

Prehoda & Pearce, 2017.

Cost of cleaner energy:
< \$30/ tCO₂ ??

Benefits of cleaner energy:
\$200*/ tCO₂

WHICH NUMBER IS BIGGER???

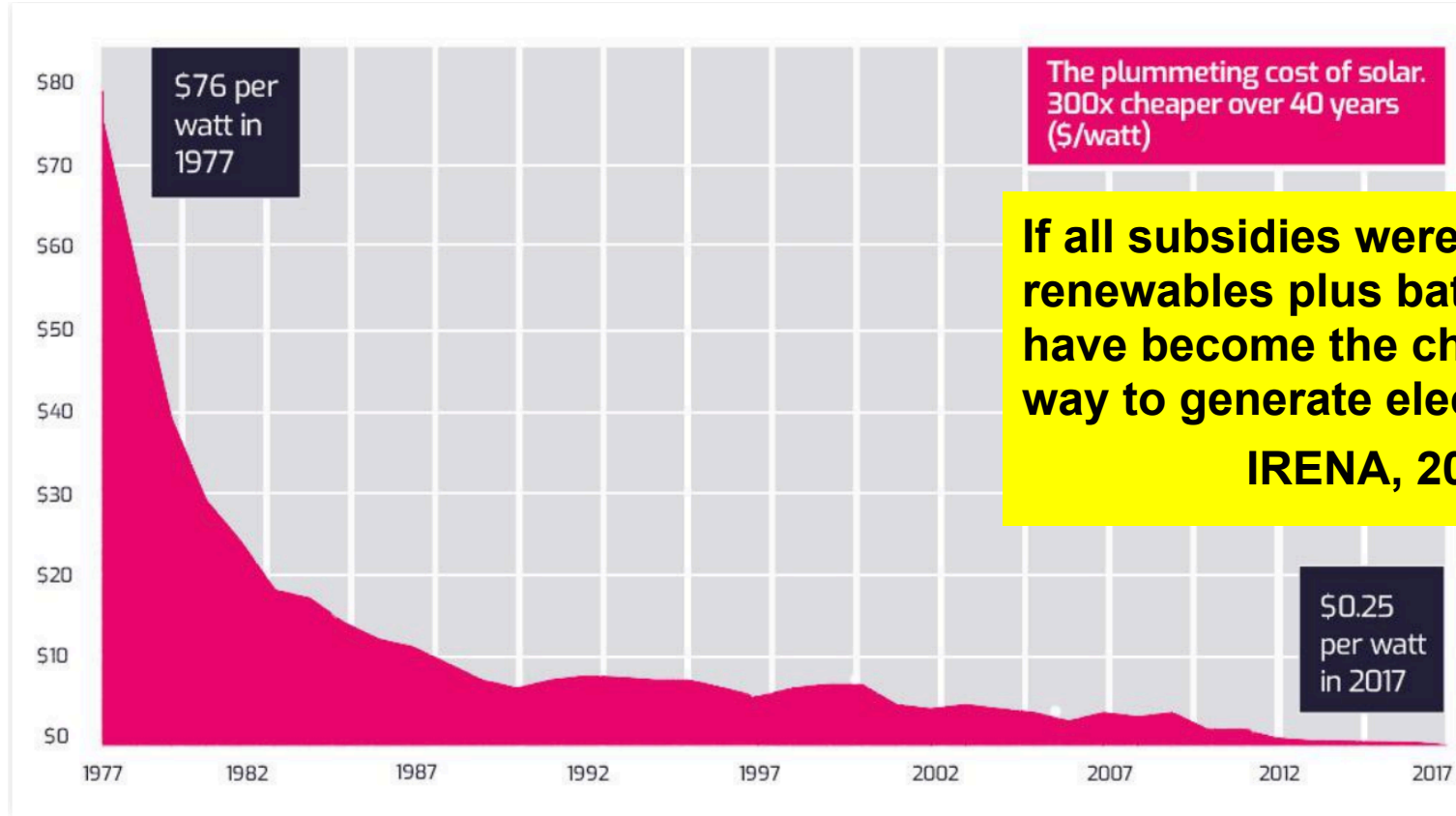


(* Range: \$50 to \$380)

West et al. 2013

For E. Asia, co-benefits are **10 to 70 times** greater

Plummeting cost of solar (300x cheaper over 40 yrs.)



CLIMATE SOLUTIONS

Cutting air pollution from fossil fuels would save 50,000 lives a year, study says

Researchers also determined the cuts would provide more than \$600 billion a year in health benefits in the United States



By Steven Mufson

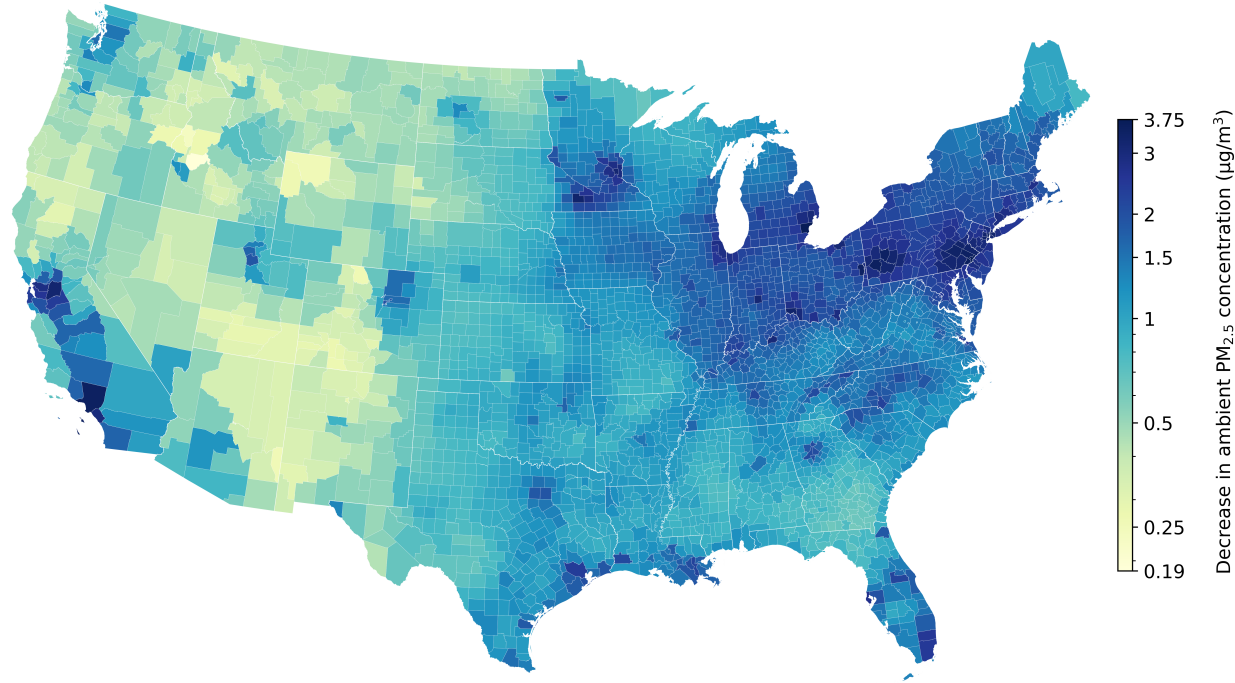
May 16, 2022 at 9:00 a.m. EDT

Nationwide and Regional PM_{2.5}-Related Air Quality Health Benefits From the Removal of Energy-Related Emissions in the United States

Nicholas A. Mailloux✉, David W. Abel, Tracey Holloway, Jonathan A. Patz

First published: 16 May 2022 | <https://doi.org/10.1029/2022GH000603>

County-level decrease in ambient PM_{2.5} concentrations from the simultaneous removal of PM_{2.5}, SO₂, and NO_x emissions in six energy-related sectors.



Mailloux et al. 2022

County-level decrease in ambient $\text{PM}_{2.5}$ concentrations from the removal of $\text{PM}_{2.5}$, SO_2 , and NO_x emissions in each of the six energy-related sectors.

Mailloux et al. 2022





Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems

Walter Willett, Johan Rockström, Brent Loken, Marco Springmann, Tim Lang, Sonja Vermeulen, Tara Garnett, David Tilman, Fabrice DeClerck, Amanda Wood, Malin Jonell, Michael Clark, Line J Gordon, Jessica Fanzo, Corinna Hawkes, Rami Zurayk, Juan A Rivera, Wim De Vries, Lindiwe Majele Sibanda, Ashkan Afshin, Abhishek Chaudhary, Mario Herrero, Rina Agustina, Francesco Branca, Anna Lartey, Shenggen Fan, Beatrice Crona, Elizabeth Fox, Victoria Bignet, Max Troell, Therese Lindahl, Sudhvir Singh, Sarah E Cornell, K Srinath Reddy, Sunita Narain, Sania Nishtar, Christopher J L Murray

Global diet exceeds a “universal healthy reference diet”

“**More** vegetables, fruits, whole grains, legumes, nuts, and unsaturated oils, a low to moderate amount of seafood and poultry...”

No or a low quantity of red meat, processed meat, added sugar, refined grains, and starchy vegetables.”

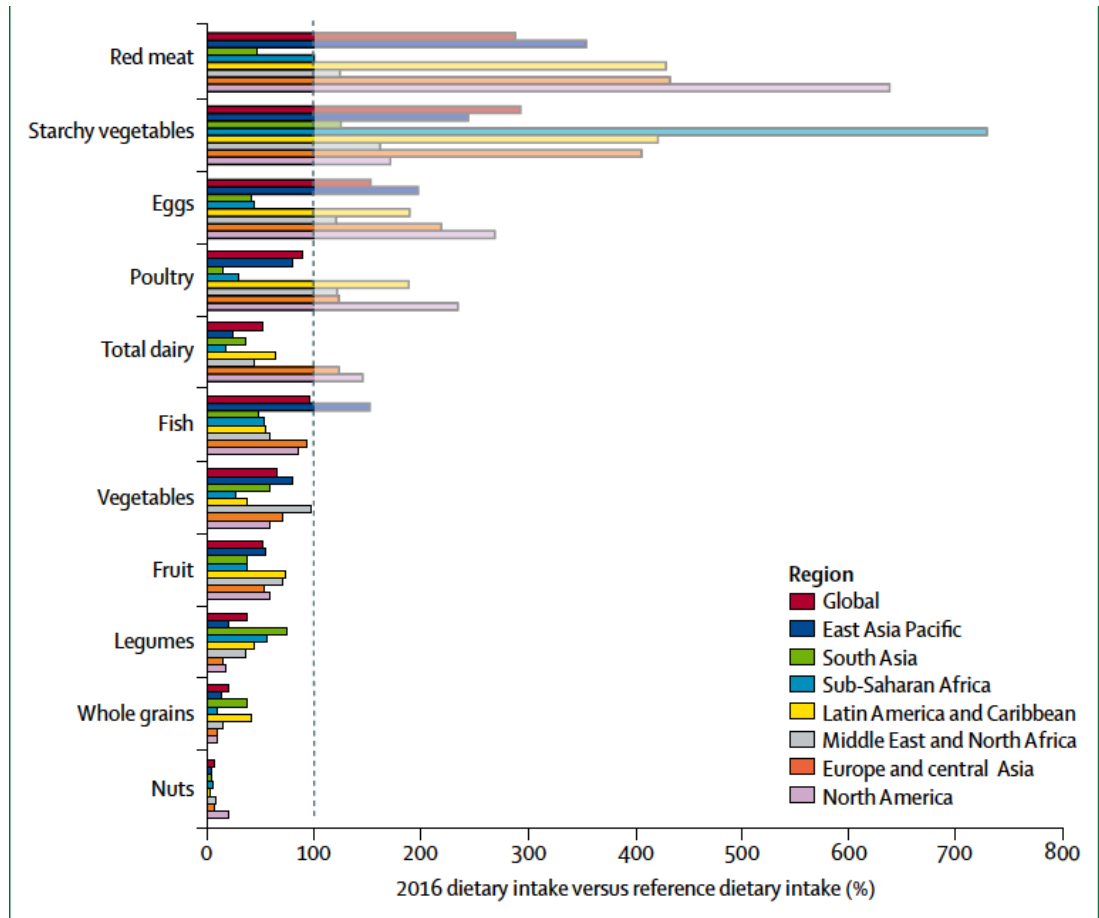


Figure 1: Diet gap between dietary patterns in 2016 and reference diet intakes of food

	Percentage	Number	Comments
Comparative Risk Model*	19%	11 100 000 (using Global Burden of Disease number of total deaths; 158 regions)	Changes in fruits, vegetables, nuts, and legumes were main contributors
Global Burden of Disease Model†	22.4%	10 886 000 (195 countries)	Changes in sodium, fruits, vegetables, whole grains, and nuts were main contributors
Empirical Disease Risk‡	23.6%	11 600 000 (190 countries)	Estimates based on a 10-variable index of diet quality

*Dietary factors included high consumption of red meat (including beef, lamb, and pork), low consumption of fruits,

Widespread adoption could
prevent 10.9 million to 11.6 million deaths annually,
 while substantially
reducing environmental effects of food production.

Transportation Sector

U.S. cities with highest rates of walking & cycling to work...

...have **obesity rates 20 percent lower**, and **diabetes rates 23 percent lower** — compared with U.S. cities with the lowest rates of walking and cycling.

(Pucher et al. 2010)

Exercise also reduces the risk of:

- Heart disease
- Cancer
- Dementia
- Depression



The Potential Health and Environmental Benefits of Cycling in the U.S.

The Initiative for Health-Oriented Transportation
University of Wisconsin-Madison
Global Health Institute
April 21, 2021

Samuel G. Younkin, Ph.D., Assistant Research Scientist, Global Health Institute, Initiative for Health-Oriented Transportation, University of Wisconsin-Madison

Henry Fremont, Research Assistant, Global Health Institute, Initiative for Health-Oriented Transportation, University of Wisconsin-Madison

Logan Moore, Research Intern, Global Health Institute, Initiative for Health-Oriented Transportation, University of Wisconsin-Madison

Nicholas Mailoux, Ph.D. Candidate, Nelson Institute for Environmental Studies, University of Wisconsin-Madison

Daritzza De Los Santos, M.S., Ph.D. Candidate, Nelson Institute for Environmental Studies, University of Wisconsin-Madison

Jonathan Patz, M.D., MPH, Professor and John P. Holton Chair in Environment, Director, Global Health Institute, University of Wisconsin-Madison

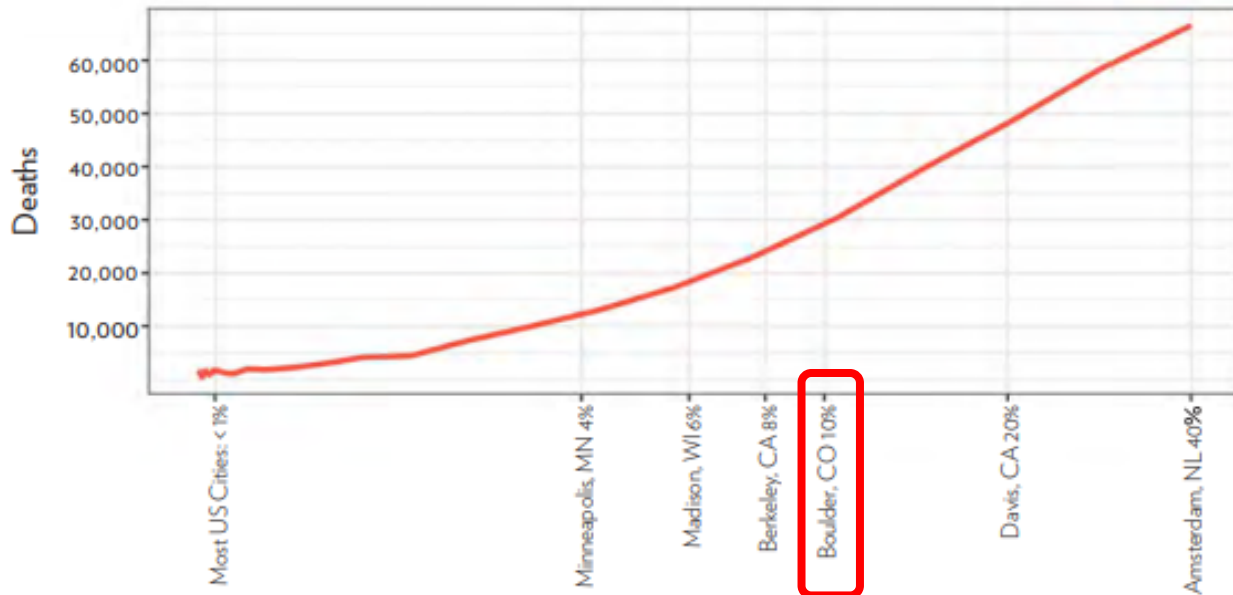


Figure 1: Annual deaths averted versus cycling mode share



Mitigation & Adaptation via Urban Green Space

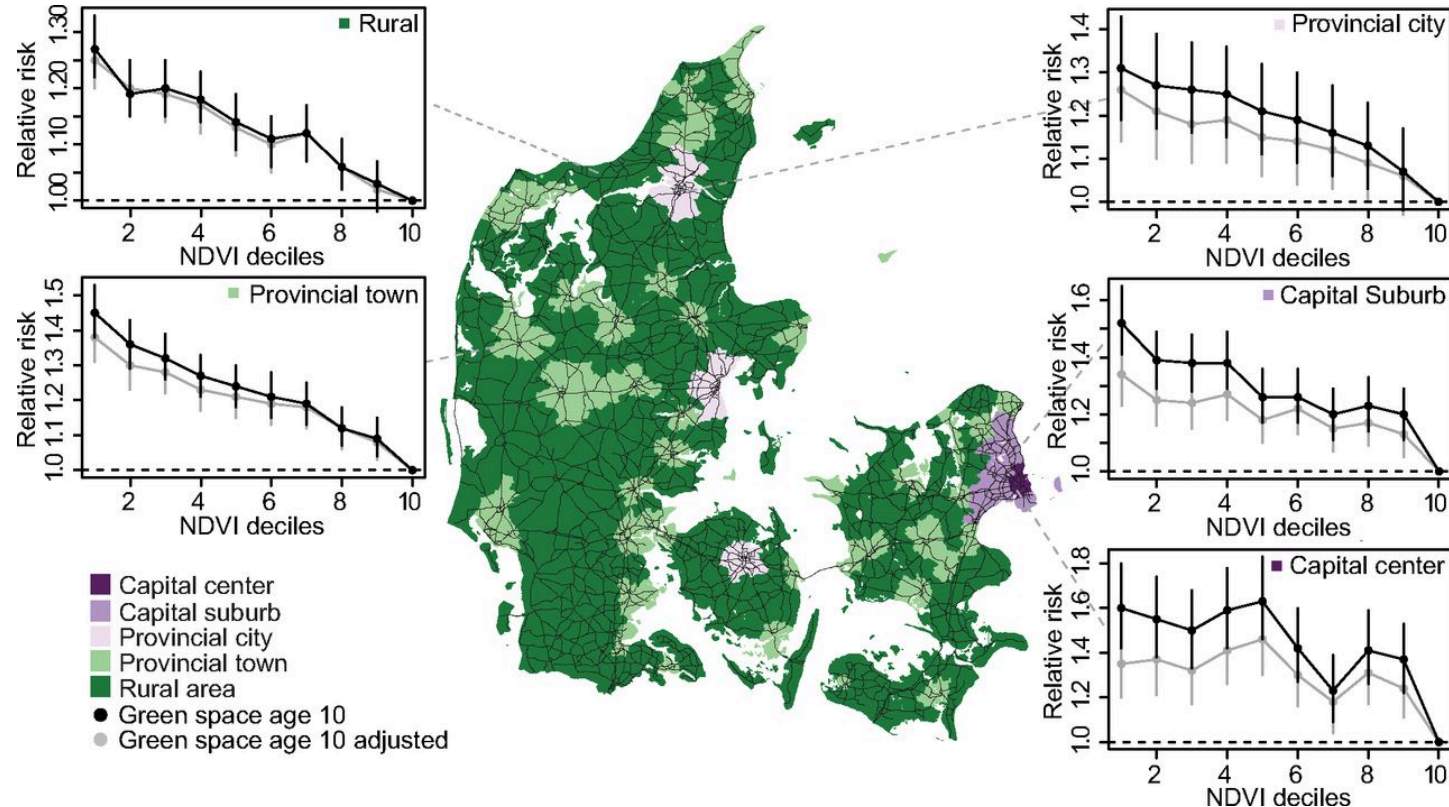
Depression, stress & anxiety
reduction

Beyer et al. 2014

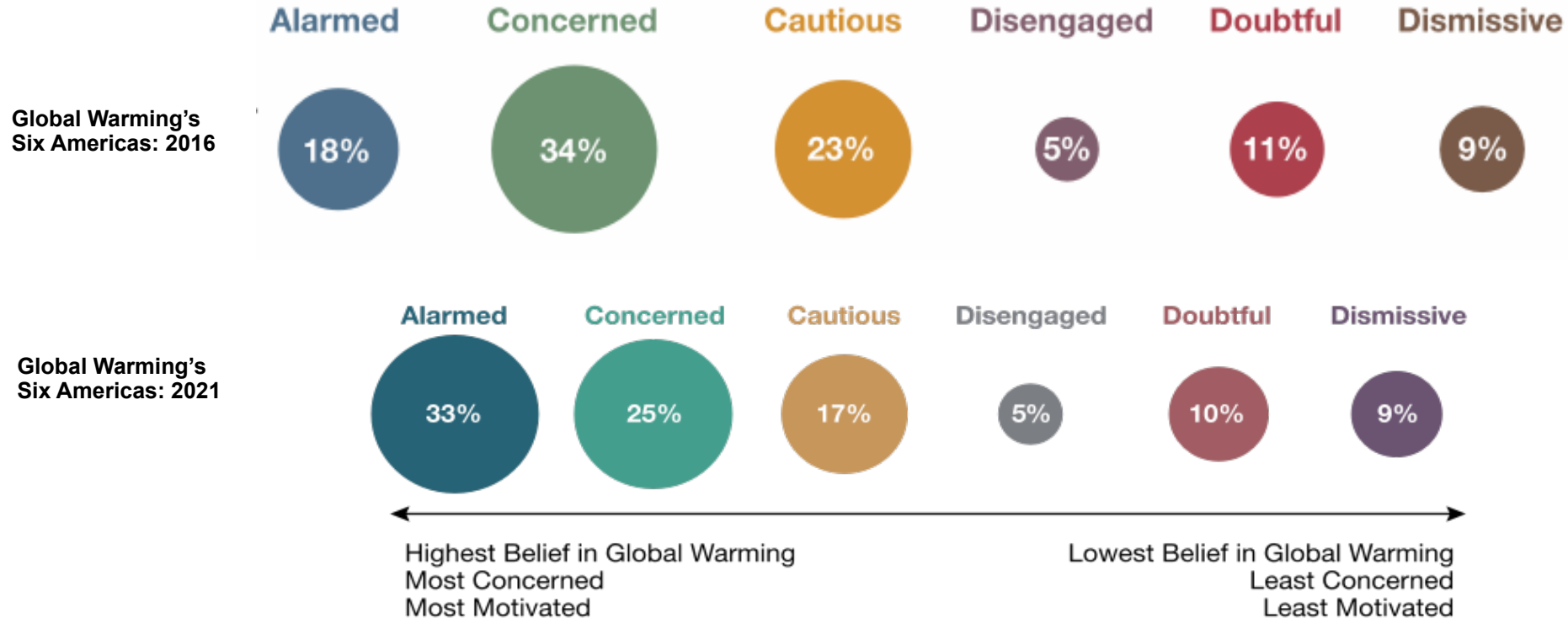
Neighborhood social cohesion and
reductions in crime and violence



Association between risk of developing any psychiatric disorder and childhood green space across urbanization levels.



Americans are rapidly waking up to the realities of climate change



Courtesy: Ed Maibach

September 2021
(n=1,006)

Five key truths about global warming (in 10 words)

IT'S REAL	Global warming is happening.
IT'S US	Human activity is the main cause.
EXPERTS AGREE	More than 99% of the world's climate experts are convinced, based on evidence, that human activity is warming the planet.
IT'S BAD	The impacts are serious and affect people—especially children, older adults, people with chronic illnesses, and member of low-income & communities of color
THERE'S HOPE	There are so many actions we can take that will address climate change AND improve our health—in equitable ways.

Courtesy: Ed Maibach

Health Organizations

Medical Society Consortium
on Climate and Health

Global Climate and Health Alliance

Health Care Without Harm / Global
Green & Healthy Hospitals

Medical Students for a Sustainable
Future (MS4SF)

A CALL TO ACTION ON CLIMATE AND HEALTH

2018

Climate change is a global health emergency. It is impacting the health of our communities today. A growing number of health organizations around the world are taking climate action—from working on the front lines to take care of communities impacted by climate-related threats, to responding to health emergencies, to taking ambitious steps towards reducing the carbon footprint of our health systems. We must do more.

As the world faces unprecedented heat, droughts, fires, and storms, this is a crucial moment for global leaders to ratchet-up their commitments to climate action. To achieve the ambition of both the Sustainable Development Goals and the Paris Agreement, the global community must accelerate action to protect our health and that of future generations. We call on our health sector colleagues, and on leaders in all sectors and at all levels of government, to act now to support healthy people, in healthy places, on a healthy planet.

Climate Change threatens to undo decades of health and development gains and is the “greatest public health challenge of the 21st century.”^{1,2} Extreme heat and weather events caused thousands of deaths and displaced over 200 million people between 2008 and 2015; air pollution, whose primary driver—fossil fuel combustion—is also the primary driver of climate change, caused over 7 million deaths in 2016; vector-borne diseases are spreading to new communities; the agricultural, food, and water systems we depend on for our survival are under threat; and the frequency and severity of droughts, floods, and fires are increasing.^{3,4,5,6}

Without transformational action, climate change will be increasingly severe—leading to more illness, injury, and death; mass migration; and worsening health inequities. Nations and communities with the fewest resources, weakest health systems, and often the least responsibility for climate pollution are the most affected, and face potentially unmanageable pressures as the impacts of climate change mount. Without a serious reduction in carbon emissions and short-lived climate pollutants, we face an increasing risk of rapid environmental changes that might overwhelm human adaptive capacity.⁷ Or as UN Secretary General António Guterres has said, climate change poses “an existential threat to humanity.”⁸

Action to reduce climate change can dramatically improve health. Many policies that move us towards our climate goals have demonstrable and significant health benefits. Climate action in the energy, transportation, land use, agricultural, and other sectors has the potential to avoid millions of preventable deaths each year.⁹ Shifting to renewable energy, sustainable food production and diets, active transportation, and green cities will lower climate pollution while simultaneously reducing the

A CALL TO ACTION ON CLIMATE AND HEALTH · PAGE 1 · <https://www.globalclimateandhealthforum.org/call-to-action>

- 5 million health professionals
- 17,000 hospitals & health centers

#HealthyClimate Prescription

**An urgent call for climate action from the health community
ahead of COP26**

#ClimatePrescription

The 2021 United Nations climate negotiations in November (COP26) are a critical moment and opportunity to put the world on a path that protects people from catastrophic climate change. The health community around the world is coming together to send a message to national leaders and country delegations, calling for real action to address the climate crisis.

Over 450 organisations representing over 45 million health workers, together with over 3,400 individuals from 102 different countries, have written an open letter to Heads of State around the world as well as every nation's lead climate negotiator, calling for urgent climate action to protect people's health.

**Now endorsed by
over 600 health
organizations
representing over
46 million health
professionals**

Delivering a 'Net Zero' National Health Service

"...the NHS just became the world's first health system to commit to delivering a net zero health service.

- 2040 target for net zero direct emissions (and an ambition to reduce emissions by 80% by 2028)***
- A new Net Zero Hospital Standard for the construction of all new hospitals***
- A commitment to deliver the world's first zero-emission ambulance***
- Within the decade, only purchase from net zero suppliers***

NHS takes the initiative in tackling the climate health crisis with net zero carbon plan

Ed Brown

GM, 02 October 2020

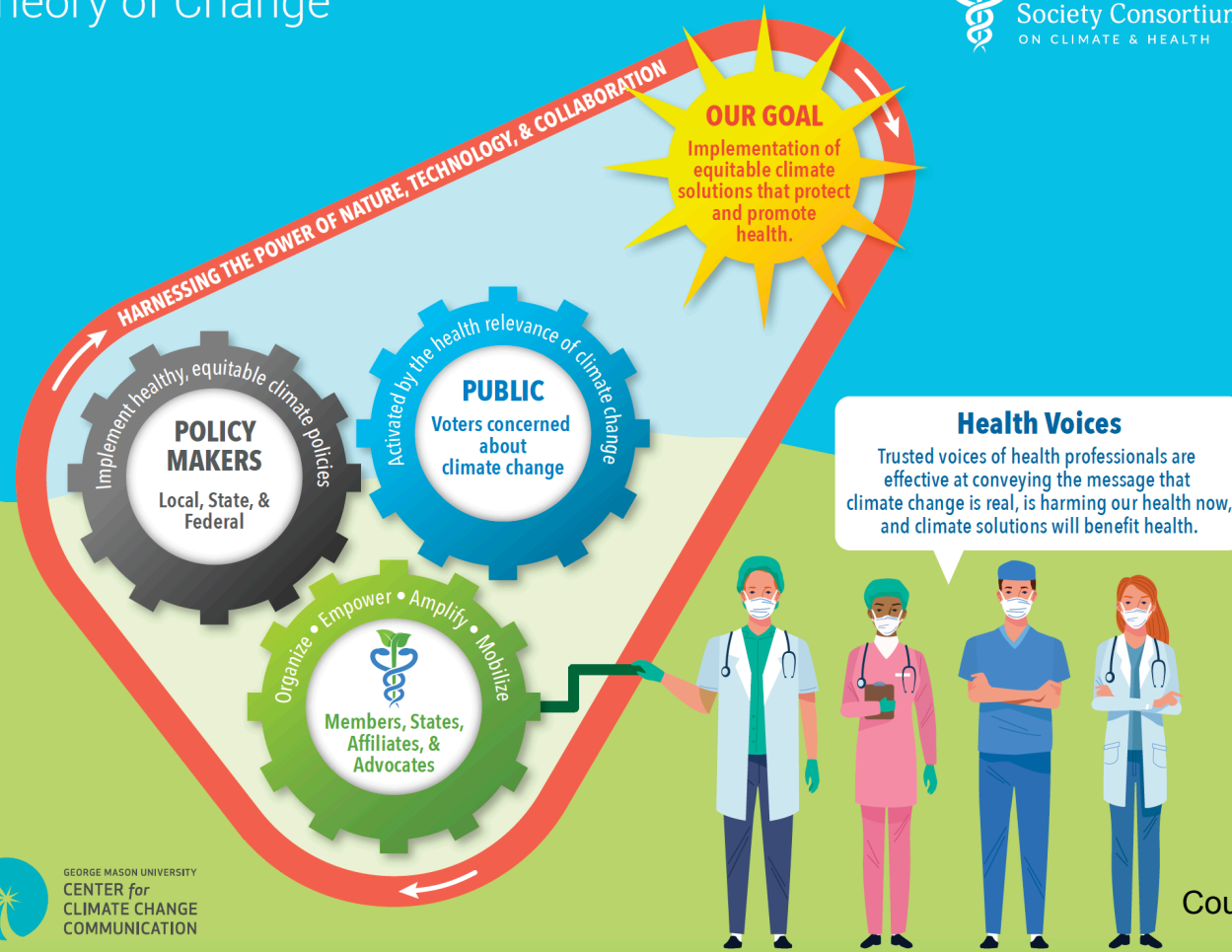


A major report setting out the steps necessary to decarbonise the NHS has been recently published – detailed in the plan are a developed gradual approach to target net carbon zero by 2040.

Commitments made in *Delivering an 'Net Zero' National Health Service* are: for medicine supply chains to reach net zero by the end of this decade, the road testing of the world's first zero-emission ambulance by 2022 with a further 2032 target for the complete fleet, the construction of 40 new 'net zero hospitals', a shift to digitalisation of care, the transformation of medical devices (such as inhalers) towards greener alternatives, and by promoting better staff practices.

Because nurses and doctors are the top most trusted professionals

Theory of Change



Global Consortium on Climate and Health Education, Columbia University

CLIMATE RESOURCES FOR HEALTH EDUCATION

An expert-reviewed repository of learning objectives, slides, and cases for climate change and health curricula.



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Sign up to write content for slides and cases or as an expert reviewer



WRITE

Develop slides and cases with a team of your choosing



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Share our climate-health education resources with students and educators around the world

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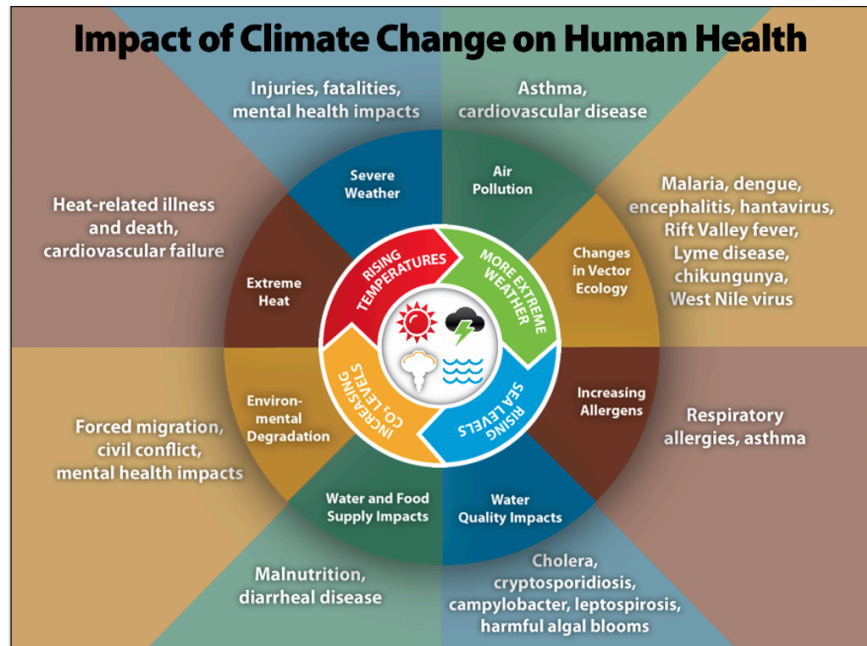


Climate Change and Departments of Family Medicine: An Example and Resource Guide

The impacts of climate change on departments of family medicine and how we can be part of the solution

Created as a supplement to the 2022 ADFM Annual Conference session on climate change and family medicine featuring Jonathan Patz, MD, MPH

Why we care: Climate Change has massive impacts on human & planetary health



Conclusion

Family Medicine Departments are ideally positioned to lead the discourse and train the next generation of trusted messengers and change-makers to help solve the climate crisis ...and our health will enormously benefit in the process of reaching a clean energy economy.

THANK YOU

patz@wisc.edu

@jonathanpatz (Twitter)



Photo from: **The World We Want:**
Shaping the Post-2015 Development
Framework

At your table, select one (or two) of the 5 pillars of actionable change to focus on:

1. Advocacy
 2. Clinical Care
 3. Education
 4. Business Operations
 5. Research
-

The Climate Crisis & Our Health

DISCUSSION QUESTIONS

(5 pillars: advocacy, clinical care, education, business operations, research)

1. Within this pillar, share or expound on any “promising practices” to mitigate climate change.
1. Which resources or case studies could you use or adapt from our collective Climate Change Resource Document?
(Scan the QR code for quick access)
 - a. Can you identify something that is missing? (Please add!)
1. How might you implement these ideas and resources in your department? What could this look like for you?

ACTION: Write down 3 to 5 action steps or ideas to try in your own department to address climate change (in at least one of the 5 pillars)

