



Caring for Patients in the 21st Century: How the Climate Crisis Changes (almost) Everything

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Disclosures:

K Gundling, MD, is a stockholder of Exact Sciences

Suzanne Wilson, PhD, course organizer, has nothing to disclose

*Happy 50th
Anniversary*

VAPD



50 years ago in Medicine

Measles vaccine

First commercial CT scanner

Transdermal patches

Immunosuppressive effects of ciclosporin

Presence of hepatitis C virus

Warnings about dietary sucrose

A Few Advances in Medicine

Robotic surgery

Insulin pumps

Polymerase chain reaction technology

Human genome mapping and related technologies such as CRISPR

Cancer diagnosis and treatment

HIV/AIDS

Quality of care and fewer medical errors

Collaborative responses to public health threats

Global decline in poverty



War



Civil Rights
Social Justice

Rachel
Carson



Earthrise
1968

Santa Barbara
Oil Spill
1969





Earth Day
April 25th, 1970

Clean Air Act (1970)
Environmental Protection
Agency (1970)
Clean Water Act (1972)
Endangered Species Act
(1973)

?

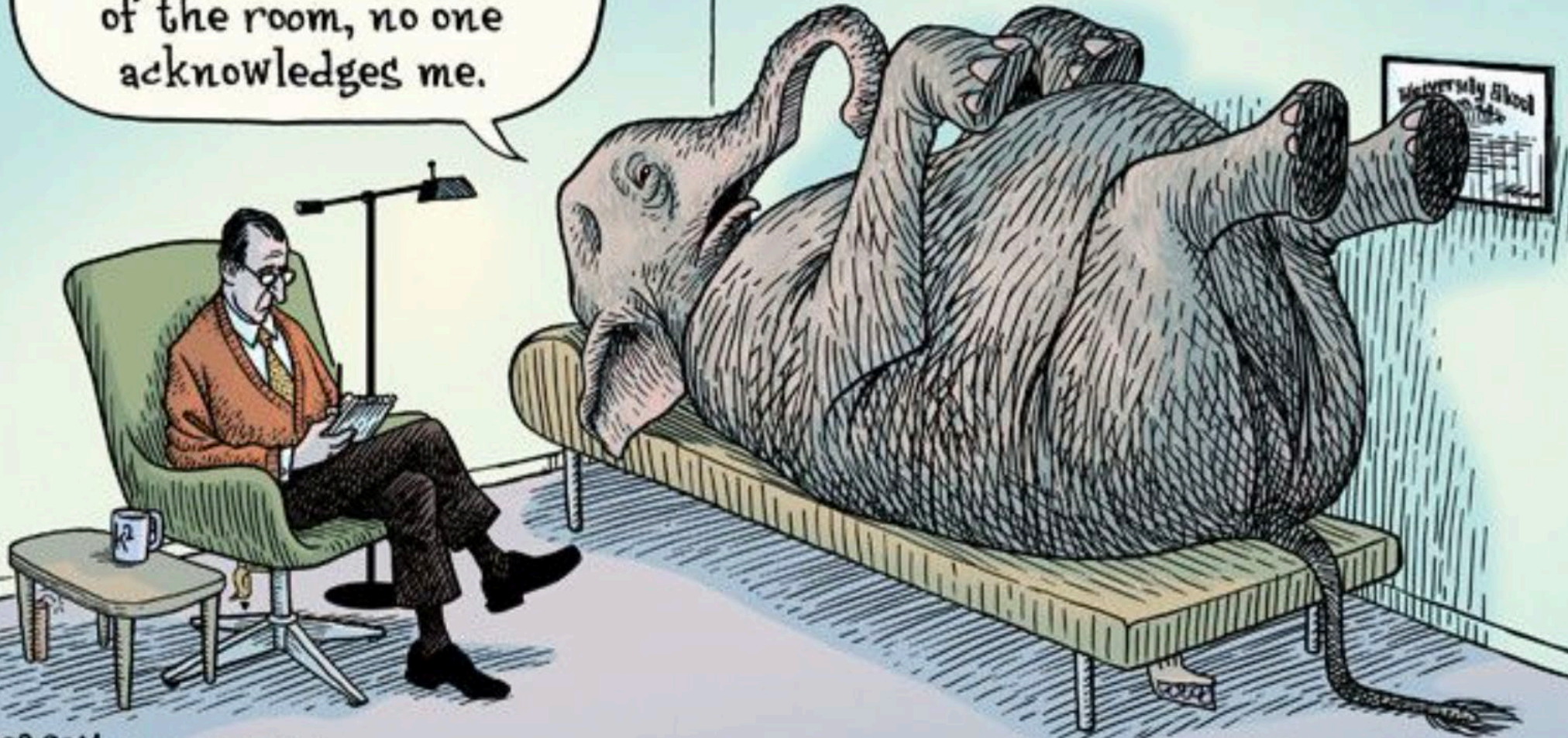
1972-2022



Tubbs Fire 2017

Wikipedia CC BY-4.0 Melia Robinson

Sometimes, even if I stand in the middle of the room, no one acknowledges me.



EDITORIAL

Call for Emergency Action to Limit Global Temperature Increases, Restore Biodiversity, and Protect Health

Lukoye Atwoli, Abdullah H. Baqui, Thomas Benfield, Raffaella Bosurgi, Fiona Godlee, Stephen Hancocks, Richard Horton, Laurie Laybourn-Langton, Carlos Augusto Monteiro, Ian Norman, Kirsten Patrick, Nigel Praities, [et al.](#)

September 16, 2021

N Engl J Med 2021; 385:1134-1137

DOI: 10.1056/NEJMe2113200

NEJM



Lancet

Finally!

220 academic medical journals acknowledge the **health emergency** of climate change and threat of environmental damage to human health

COMMENT | [VOLUME 398, ISSUE 10304, P939-941, SEPTEMBER 11, 2021](#)



PDF [96 KB]

Call for emergency action to limit global temperature increases, restore biodiversity, and protect health

[Lukoye Atwoli](#) • [Abdullah H Baqui](#) • [Thomas Benfield](#) • [Raffaella Bosurgi](#) • [Fiona Godlee](#) • [Stephen Hancocks](#) • et al.

[Show all authors](#)

Published: September 04, 2021 • DOI: [https://doi.org/10.1016/S0140-6736\(21\)01915-2](https://doi.org/10.1016/S0140-6736(21)01915-2)



Learning Objectives

- Contemplate the evolving challenges to planetary health between 1972 and 2022
- Define the mechanism by which the planet is warming
- Describe at least 3 ways that changing climate patterns harm your patients
- Develop a plan of action that both protects patients and complements your interests and practice

My current knowledge about the impact of climate change on human health is:

- A) As expert as anyone in this new field – I am fully involved
- B) Good awareness of the topic – concerned about implications
- C) Vague awareness, but I'm too busy to pay attention or take concrete steps
- D) No knowledge or not interested

1) What changes to the Planet are problematic for public health?

2) How do these changes impact our patients?
Personal Health and Public Health challenges

3) What can health professionals do?
A Framework of Opportunities, and
Examples of specific actions and resources



The Greenhouse Effect



Some sunlight that hits Earth is reflected back into space, while the rest becomes heat

Greenhouse gases prevent heat from escaping into space, warming the planet

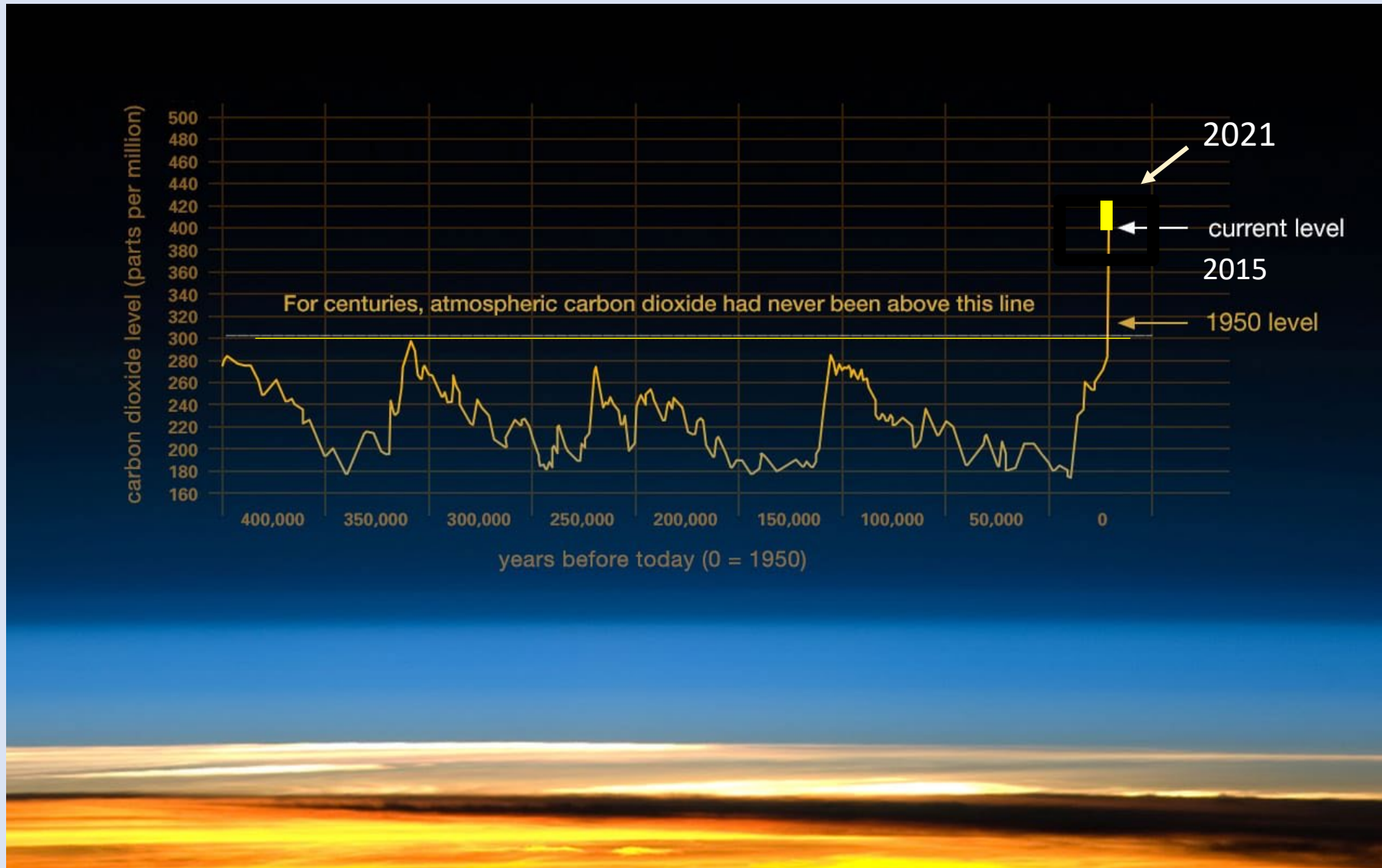


...like sitting in a hot car on a summer day, with the windows closed.

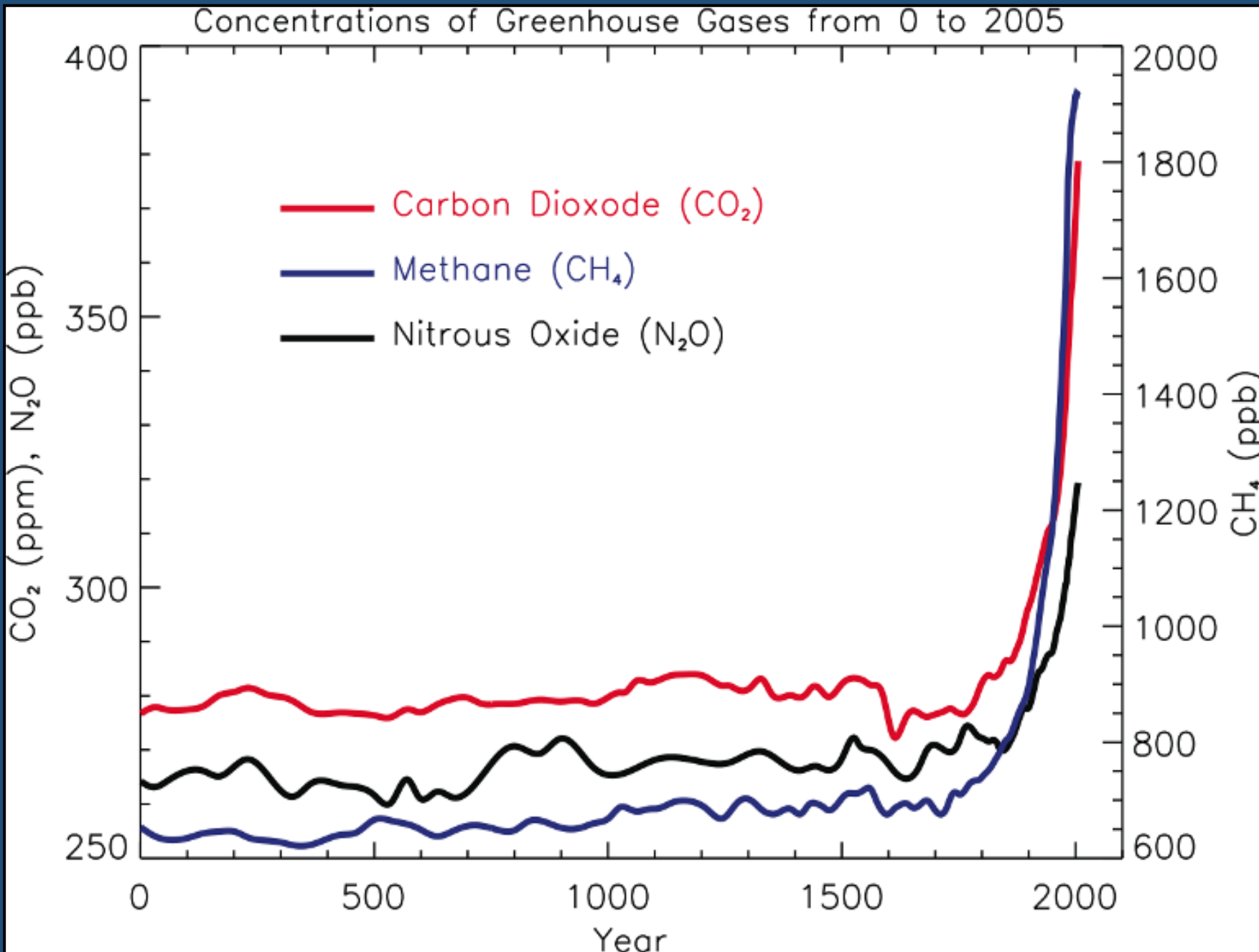
Efbrazil, CC BY-SA 4.0
<<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons
Last Accessed 05/16/21



NOAA



Atmospheric CO₂ concentration from ice-core data before 1958, and from direct measurements at Mauna Loa Observatory after 1958. Source NASA



Global Warming Potential:

$\text{CO}_2 = 1$

$\text{CH}_4 = 28-36$

$\text{N}_2\text{O} = 265-298$

epa.gov

IPCC AR4

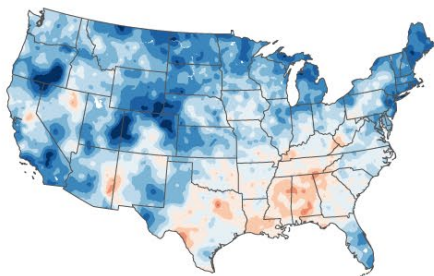
The increase in atmospheric GHG levels is due substantially to the burning of fossil fuels, but also due to improper land and water management, the way we raise and consume animals, our methods of waste and trash disposal, poor forest management, and a host of other factors.



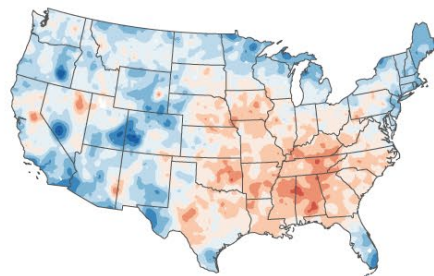
US National Park Service

U.S. ANNUAL TEMPERATURE COMPARED TO 20th-CENTURY AVERAGE

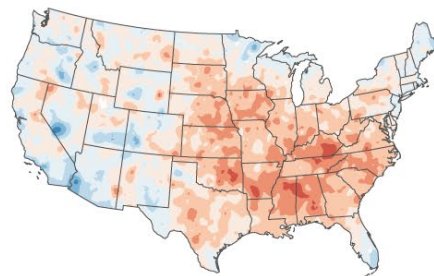
1901-1930



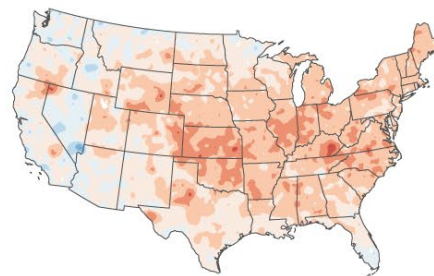
1911-1940



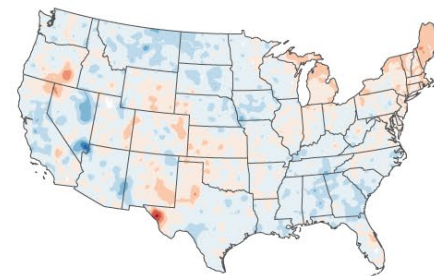
1921-1950



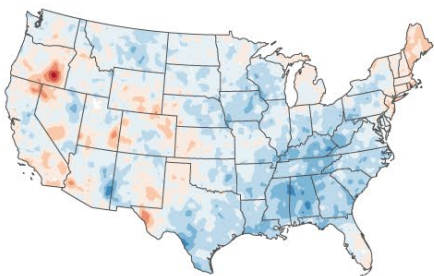
1931-1960



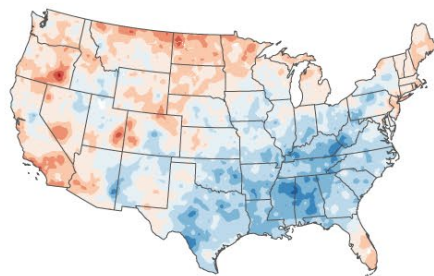
1941-1970



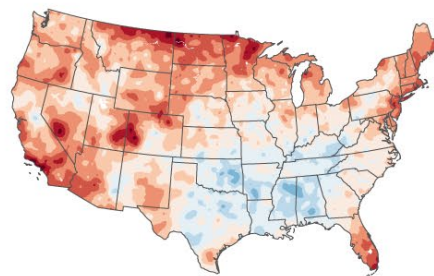
1951-1980



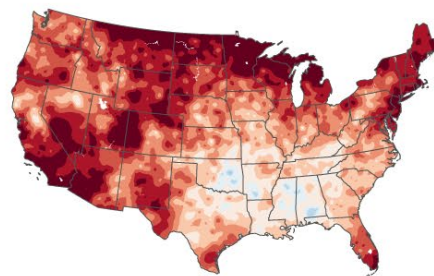
1961-1990



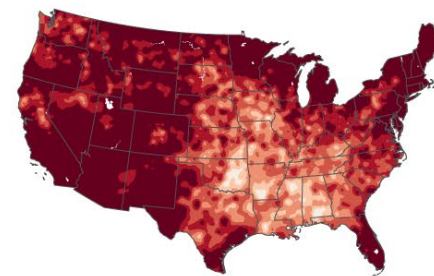
1971-2000



1981-2010



1991-2020



30-year Normal
compared to 1901-2000



NOAA Climate.gov
Data: NCEI

Long term, profound changes to ecosystems and livable land

Examples:

- *Rising sea levels, decreased ice pack
- *Acidification of the oceans
- *Decreased fresh water supplies
- *Decreased protein content of grains
- *Changes in quantity and quality of arable land



CC B137, Miami, 2016 King Tide
Wikipedia

Acute weather events

Examples:

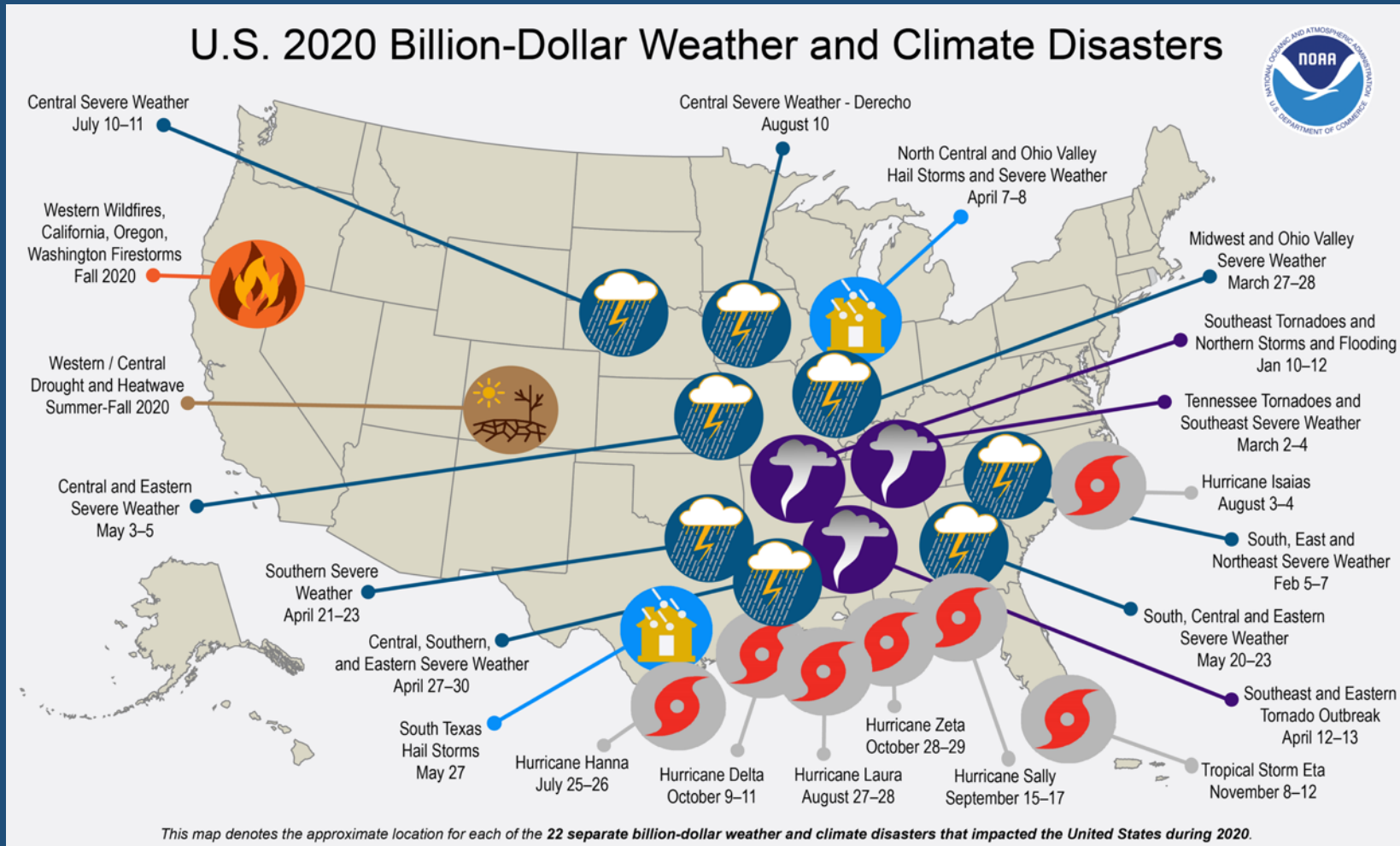
- *Hurricanes
- *Tornados
- *Wildfires
- *Flooding
- *Derechos



Leading edge shelf cloud over Minnesota Derecho

NOAA

“In 2020, the United States experienced record-smashing 22 weather or climate disasters that each resulted in at least \$1 billion in damages, including a record 7 linked to landfalling hurricanes or tropical storms.”



22 events
Estimated \$95 billion damages

Summary

*We are
causing:*

Profound, chronic
changes to earth's
ecosystems

Consequent acute
weather events that
are more frequent and
more severe

1) What changes to the Planet are problematic for public health?

2) How do these changes impact our patients?

Personal Health and Public Health challenges

3) What can health professionals do?

A Framework of Opportunities, and

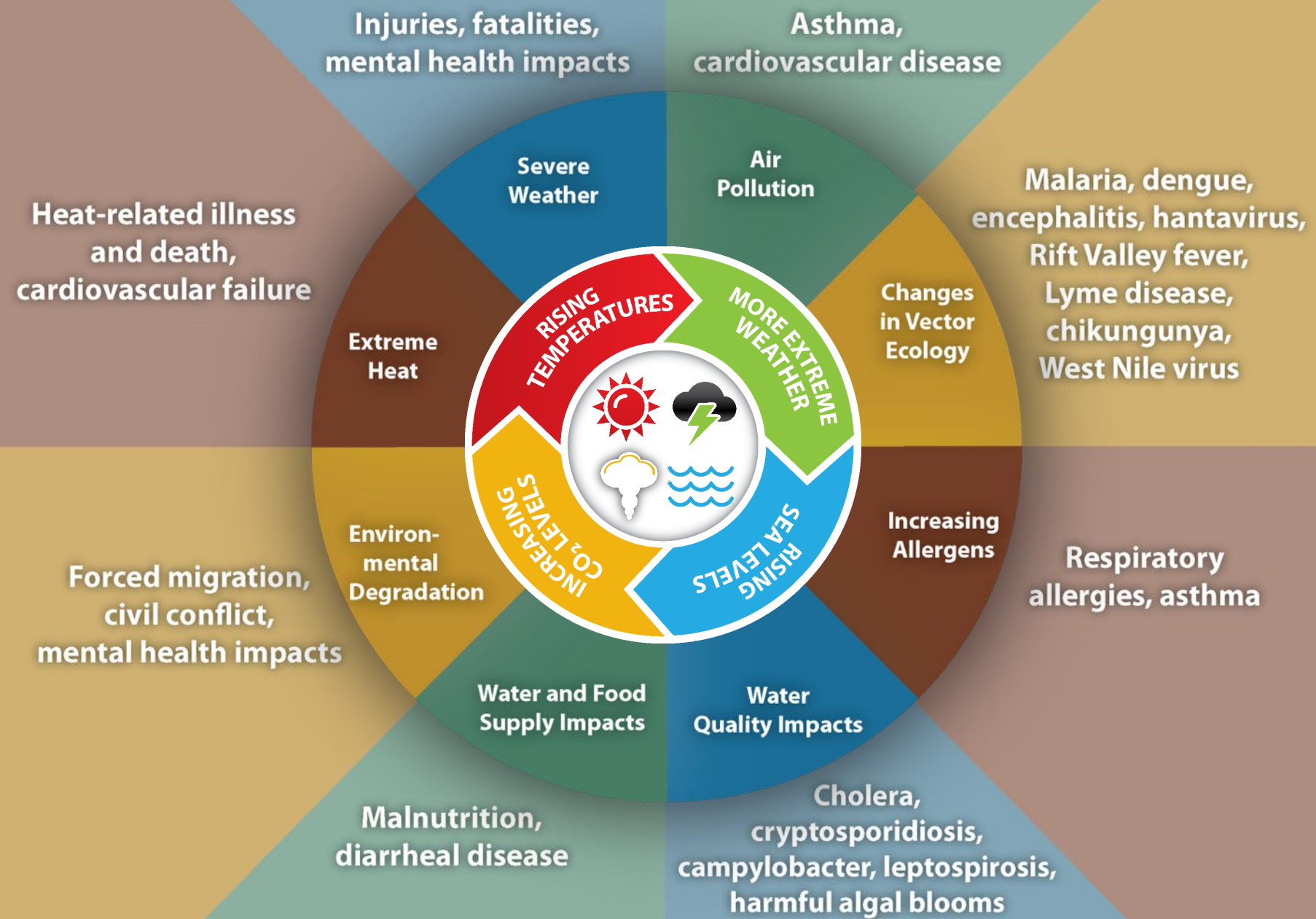
Examples of Specific Actions and Resources



Do you have questions about vulnerability/effects of climate change built into your encounters with patients?

- A) Yes, it is a standard component of our intake process
- B) Climate health is not a standard component of intake, but I frequently raise the topic and assess patient vulnerability
- C) The topic arises primarily when patients have an obviously related problem (smoke exposure and asthma exacerbation)
- D) What the heck are you talking about?

Impact of Climate Change on Human Health



Impact of Climate Change on Human Health

Environmental change

Severe air pollution

Vector ecology

Increasing allergens

Water quality

Food security

Environmental degradation

Extreme heat

Severe weather

Public Health Consequence

Excessive deaths; multiple organ damage

Shifting vulnerability of populations

Increased community respiratory disease

Water borne infections; algal blooms

Starvation, migration

Mass migration, civil conflict

Excessive deaths

Loss of habitat, livelihood; severe injuries

Major U.S. Climate Trends

“MacroRegions”

Rising Temperatures

U.S. average temperature has increased by 1.3°F to 1.9°F since record keeping began in 1895. Warming has been the greatest in North and West while some parts of the Southeast have experienced little change.



Wildfires

Wildfires in the West start earlier in the spring, last later into the fall, and burn more acreage.



Extreme Precipitation

Heavy downpours are increasing nationally, especially over the last three to five decades. The largest increases are in the Midwest and Northeast.



Floods

Floods have been increasing in parts of the Midwest and Northeast.



Heat Waves

Heat waves have become more frequent and intense, especially in the West.



Drought

Drought has increased in the West. Over the last decade, the Southwest has experienced the most persistent droughts on record.



Cold Waves and Winter Storms

Cold waves have become less frequent and intense across the Nation. Winter storms have increased in frequency and intensity since the 1950s and their tracks have shifted northward.



Sea Level

Sea levels along the Mid-Atlantic and parts of the Gulf Coast have risen by about 8 inches over the last half century.



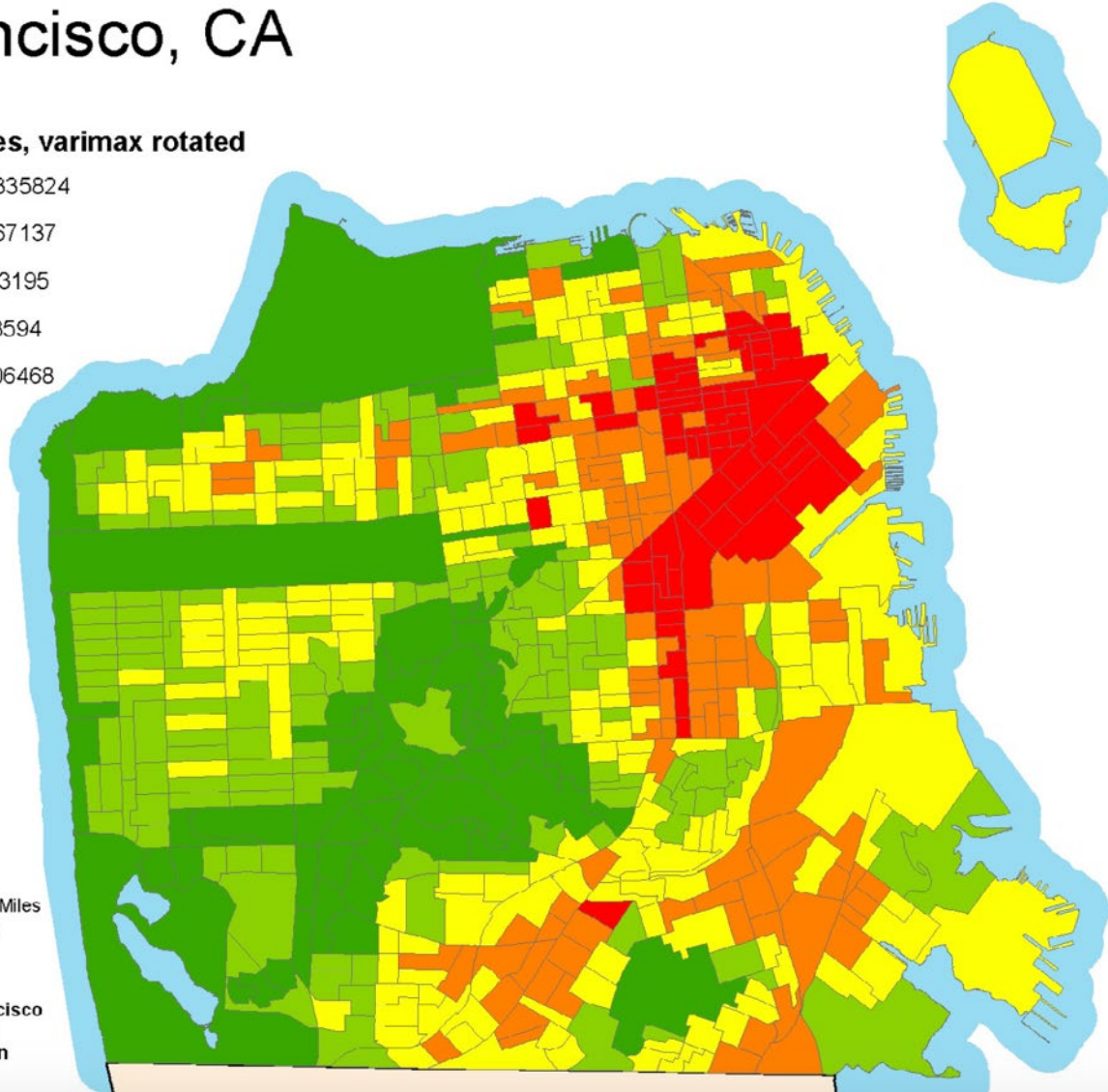
Hurricanes

The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest (category 4 and 5) hurricanes, have all increased since the early 1980s.

Credit: US EPA
Allison Crimmins

Heat Vulnerability Index by Census Block Group San Francisco, CA

Sum of factor scores, varimax rotated



City and County of San Francisco
Department of Public Health
Environmental Health Section

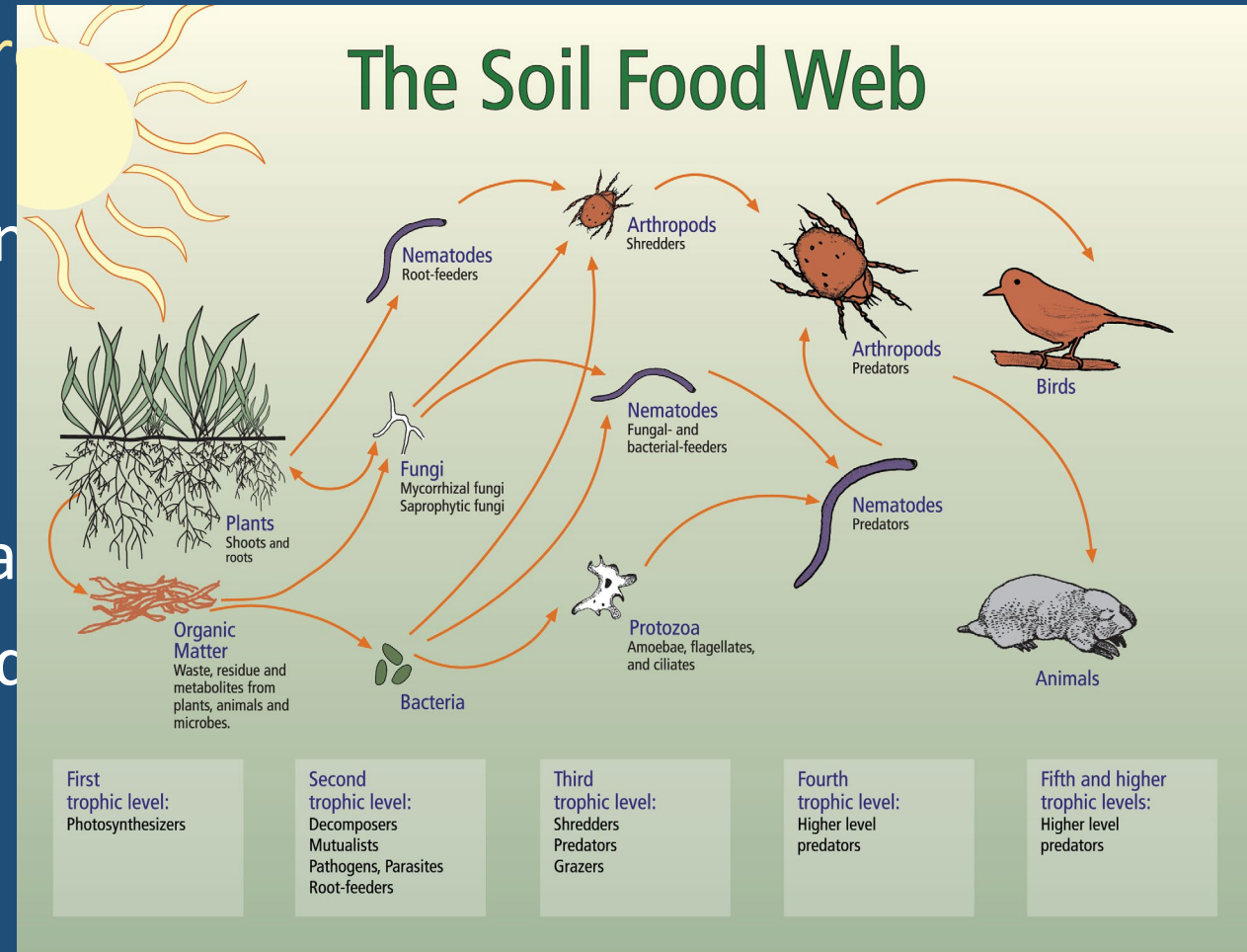
“MicroRegions”

We experience
vulnerability
to heat unequally

Health Inequities are the Hallmark of Planetary Degradation

The earliest and greatest impacts are responsible:

- Communities of color near ports are
- Populations on low lying islands
- Poor people everywhere
- Communities that lack access to ba
- People who live in food deserts and



Impact of Climate Change on Human Health

Examples of Patient Presentations

Air pollution – asthma/COPD exacerbation, stroke

Vector borne disease – can you recognize Dengue fever?

Increased allergens – asthma, COPD, atopic dermatitis

Water quality – diarrhea, dehydration, fever

Food security – weight loss, signs of vitamin deficiencies

Extreme heat – heat stroke, renal failure, cardiac disease

Severe weather – acute injuries, mold exposure, loss of medications

Air pollution:

7 **10.2** million excess deaths annually

Mortality associated with PM_{2.5} fossil fuel combustion

Unequivocal links to:

heart disease, stroke, COPD, lung cancer, premature birth, dementia,
brain development, childhood lower respiratory infections

Vohra, et al
Env Research 2021
195, 110754

The Lancet 2019
394, Issue 10192

Mental Illness:

Anxiety and depression due to losses

Economic stresses

PTSD

Heat induced suicide and domestic violence

Childhood anxiety and depression

Health of first responders

Solastalgia

Climate Psychiatry Alliance
Climatepsychiatry.org

Dentists do not escape unscathed!

- **Vector-borne diseases:** oral lesions with Zika virus
- **Poor air quality and increased heat:** more asthma, allergic rhinitis; increasing risk of dental caries, gingival inflammation and alterations in salivary pH
- **Air pollution:** COPD exacerbations and periodontal disease
- **Increased exposure to UV radiation** = increased lip and skin cancers
- **Clean water scarcity:** deprioritization of oral hygiene, and poor sanitation leads to GI disease, malnutrition
- **Extreme weather events:** disruption of care and supply chains
- **Medications:** Heat associated challenges for patients on diuretics and SSRIs; albuterol and epinephrine are less efficacious in warmer temps

Summary

Climate change is a health emergency that is causing *accelerating* damage to our patients and communities

Fixing the
Climate Crisis



Pivotal
Opportunity to
Rectify Health
Inequities

1) What changes to the Planet are problematic for public health?

2) How do these changes impact our patients?
Personal Health and Public Health challenges

3) What can health professionals do?

*A Framework of Opportunities, and
Examples of Specific Actions and Resources*





*There are many ways
to take action*

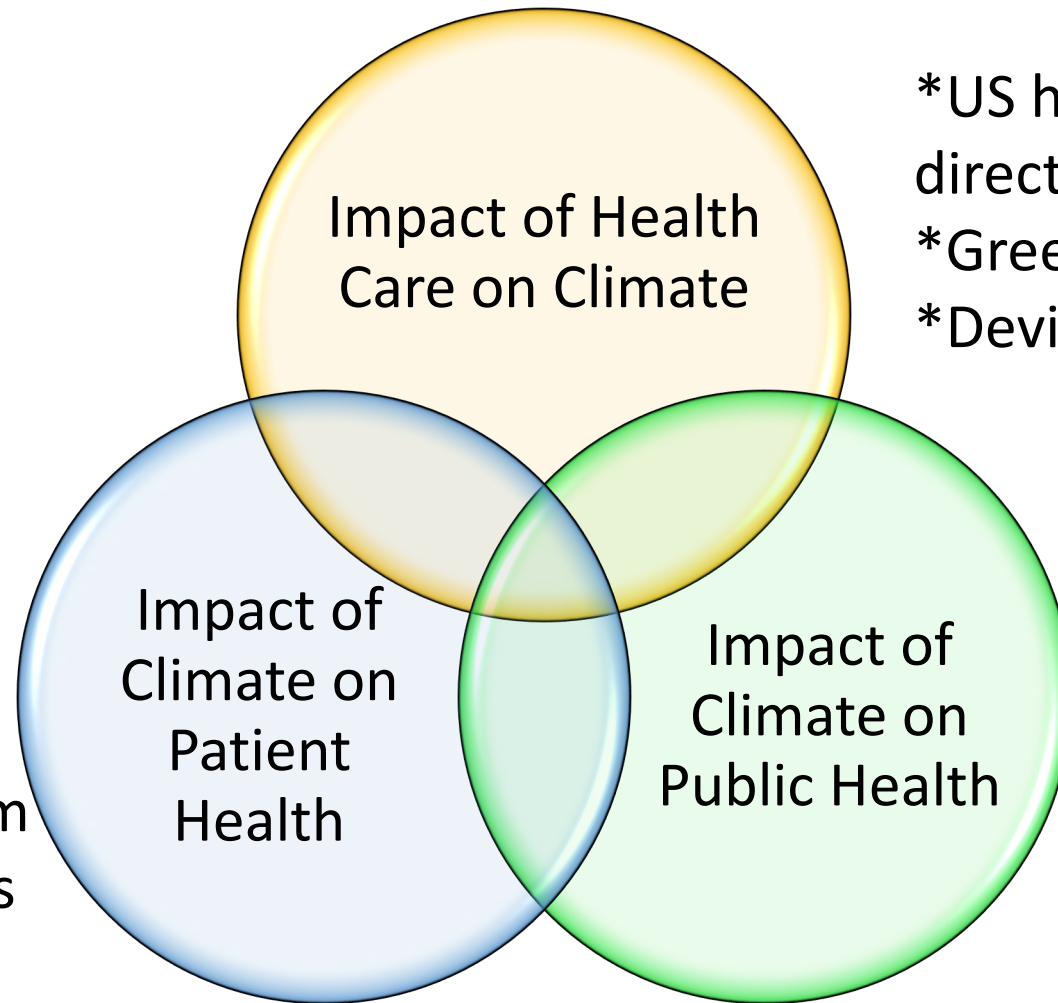
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<<https://creativecommons.org/licenses/by/2.0>>, via Wikimedia
Commons

Steps to Climate Health Action

Step 1

- Identify where your work, personal life, and interests best fit into an opportunity framework

Opportunity Framework for Action in Climate and Human Health



“Sustainability”

- *US health care contributes directly to human illness.
- *Greenhouse gases and waste
- *Devices and supplies

- *Mental illness
- *Heart and lung disease from air pollution and wildfire smoke
- *Vector-borne diseases
- *Respiratory disease from prolonged pollen seasons

- *Population displacement
- *Food scarcity
- *Fresh water shortages
- *Rising sea levels
- *Exacerbation of Health inequities

Steps to Climate Health Action

Step 1

- Identify where your work, personal life, and interests best fit into an opportunity framework

Step 2

- **Consider how to apply your existing skills, and learn relevant new skills**

Examples

Application of Skill Sets (Examples)

Direct Patient care

*Institute standardized questions to screen for vulnerability.

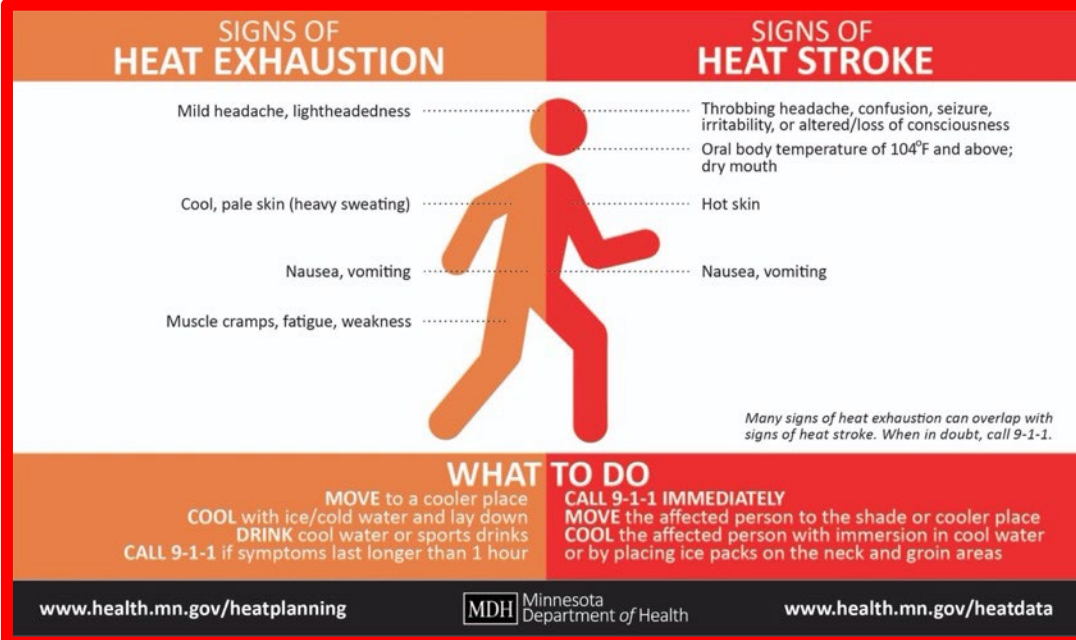
“How do you stay cool on hot days?”

“What protections do you have against wildfire smoke?”

*Design best methods of communicating with patients before acute weather events

*Develop patient education materials

*Become expert in recognizing and treating specific climate health conditions



The image is a patient education sheet titled "Sample Patient Education Sheet for Heat Events". It is divided into two main columns: "SIGNS OF HEAT EXHAUSTION" (orange background) and "SIGNS OF HEAT STROKE" (red background). A central illustration of a person is used to point to symptoms on both sides. Below the columns is a "WHAT TO DO" section with instructions for both conditions. At the bottom, there are website URLs and the Minnesota Department of Health logo.

SIGNS OF HEAT EXHAUSTION	SIGNS OF HEAT STROKE
Mild headache, lightheadedness	Throbbing headache, confusion, seizure, irritability, or altered/loss of consciousness
Cool, pale skin (heavy sweating)	Oral body temperature of 104°F and above; dry mouth
Nausea, vomiting	Hot skin
Muscle cramps, fatigue, weakness	Nausea, vomiting

WHAT TO DO

HEAT EXHAUSTION: MOVE to a cooler place; COOL with ice/cold water and lay down; DRINK cool water or sports drinks; CALL 9-1-1 if symptoms last longer than 1 hour.

HEAT STROKE: CALL 9-1-1 IMMEDIATELY; MOVE the affected person to the shade or cooler place; COOL the affected person with immersion in cool water or by placing ice packs on the neck and groin areas.

Many signs of heat exhaustion can overlap with signs of heat stroke. When in doubt, call 9-1-1.

www.health.mn.gov/heatplanning | MDH Minnesota Department of Health | www.health.mn.gov/heatdata

Sample Patient Education Sheet
for Heat Events

Application of Skill Sets (Examples)

Education

Design/adapt teaching modules specific to your colleagues, trainees; engage with public health foundations and community service orgs

Research

Collaborate with researchers to gather and disseminate important data

Advocacy

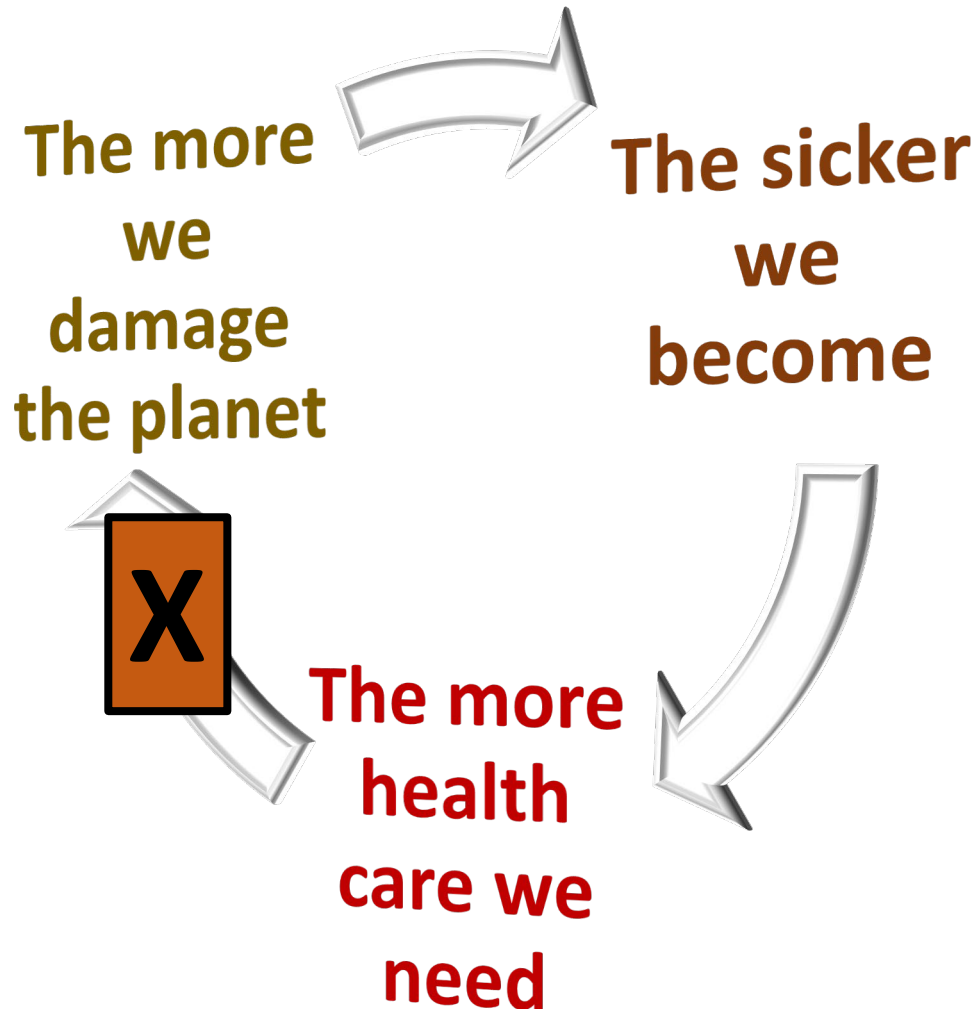
Advocate for your patients, for the most vulnerable, for public health systems; join new physician advocacy collaborations, such as *Climate Health Now*

<https://www.climatehealthnow.org>

Medical Society Consortium on Climate and Health
<https://medsocietiesforclimatehealth.org>



The Irony of Becoming Sick on a Warming Planet:



How to break this cycle:

Application of Skills and Knowledge Within “Sustainability”

Save money while “Greening” your office

<https://mygreendoctor.org>

Minimize waste and single use items

Update old freezers

Eliminate plastic utensils

Transition to Meatless Mondays

Steps to Climate Health Action

Step 1

- Identify where your work, personal life, and interests best fit into an opportunity framework

Step 2

- Consider how to apply your existing skills, and learn relevant new skills

Step 3

- **Gather information and build your network**

Gather information and build your network

- Key examples throughout the presentation
- Planetary Health Alliance

<https://www.planetaryhealthalliance.org/planetary-health>

- Physicians for Social Responsibility

<https://SFBayPSR.org>

- Health Care Without Harm <https://noharm.org>

- Look for an Office of Sustainability where you work or at your local university <https://sustainability.ucsf.edu>

- UCSF Center for Climate, Health and Equity <https://climatehealth.ucsf.edu>

- Contact Dr. Gundling for a copy of the “Climate and Health: Resource Guide”

katherine.gundling@ucsf.edu

Steps to Climate Health Action

Step 1

- Identify where your work, personal life, and interests best fit into an opportunity framework

Step 2

- Consider how to apply your existing skills, and learn relevant new skills

Step 3

- Gather information and build your network

Step 4

- **Have fun!**



*Align yourself
with young
people*

The Climate Crisis has Changed (**almost**) Everything

What hasn't changed?

The primacy of the patient-physician/dentist relationship

The importance of taking a good history

The organs are still there!

The value of continuous education

What's "normal" will continue to shift all around us



The Blue Marble - Apollo 17, 1972