

The Role of Medicine in Planetary Health

Family Medicine Grand Rounds & Laura Mann Integrative Health Lecture Series
UVM, Burlington, VT January 6, 2025

Jonathan Patz, MD, MPH

Vilas Distinguished Professor & John P Holton Chair of Health and the Environment
University of Wisconsin-Madison





CLIMATE
STABILITY



LIVING IN
HARMONY
WITH NATURE



TOWARDS A
POLLUTION
FREE PLANET

TACKLING THE TRIPLE PLANETARY CRISIS: A NEW FUNDING PARADIGM

"The truth is, we have been poor custodians of our fragile home. Today, the Earth is facing a triple planetary crisis. Climate disruption. Nature and biodiversity loss. Pollution and waste. This triple crisis is threatening the well-being and survival of millions of people around the world.

Antonio Guterres,
Secretary-General of the United Nations

The building blocks of happy, healthy lives — clean water, fresh air, a stable and predictable climate — are in disarray, putting the Sustainable Development Goals in jeopardy.

But there is still hope."



UN “Triple Planetary Crisis”

1. Climate Change
2. Biodiversity Loss
3. Pollution

Climate Change is a top priority for the National Academy of Medicine



NATIONAL ACADEMY OF MEDICINE

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**GRAND CHALLENGE ON
CLIMATE CHANGE,
HUMAN HEALTH & EQUITY**

RESEARCH ARTICLE

Epidemiology

Heat stress and adverse pregnancy outcome: Prospective cohort study

Shanmugam Rekha¹  | Sirala Jagadeesh Nalini²  |
Sellappa Kanmani⁴  | Jane Elizabeth Hirst^{5,6}  | Vid

“Results: Of the 800 participants
...**Heat-exposed women had a
doubled risk of miscarriage.**
High occupational heat exposure
was associated with an
**increased risk of any adverse
pregnancy and adverse
outcome at birth in India.”**



Article

Fine Particles

Rosana Aguilera, Thon
Pediatrics April 2021, 147

CONCLUSIONS: W
respiratory health
Even relatively mo
health impacts, pa

► [Environ Int.](#) 2023 Apr;174:107879. doi: 10.1016/j.envint.2023.107879. Epub 2023 Mar 17.

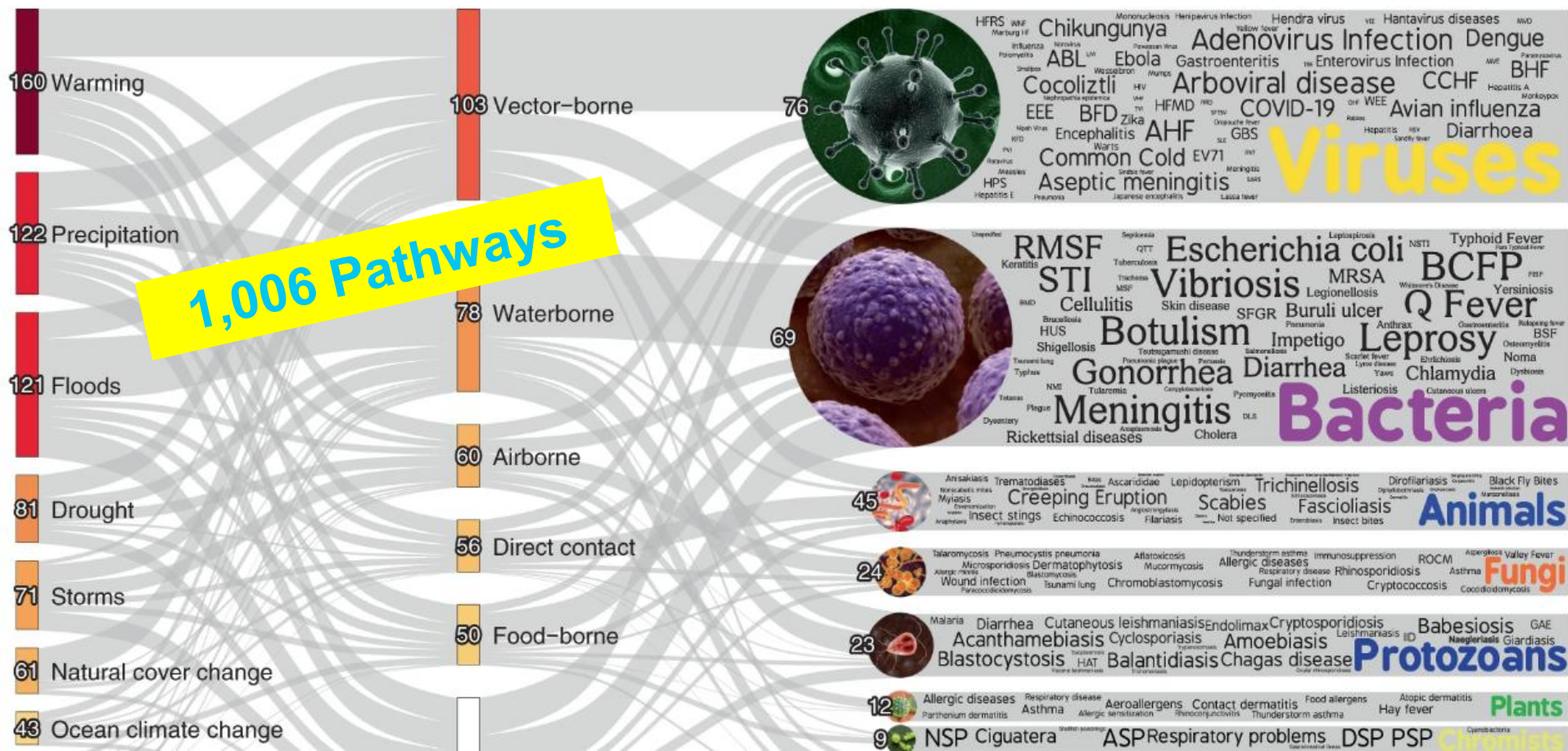
Preterm birth and term low birth weight associated with wildfire-specific PM_{2.5}: A cohort study in New South Wales, Australia during 2016–2019

Yiwen Zhang¹, Tingting Ye¹, Pei Yu¹, Rongbin Xu¹, Gongbo Chen¹, Wenhua Yu¹,
Jiangning Song², Yuming Guo¹, Shanshan Li³

Fig. 3: Pathogenic diseases aggravated by climatic hazards.

From: [Over half of known human pathogenic diseases can be aggravated by climate change](#)

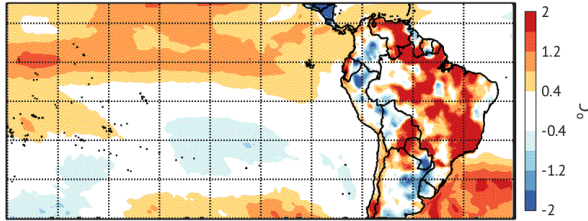
Mora...Patz, et al. 2022



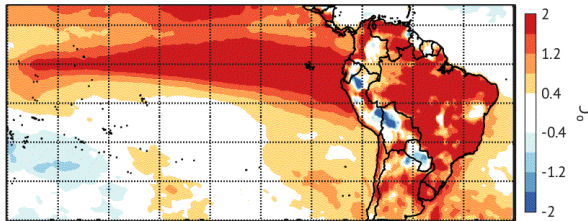
Insect-borne diseases are especially sensitive to weather conditions



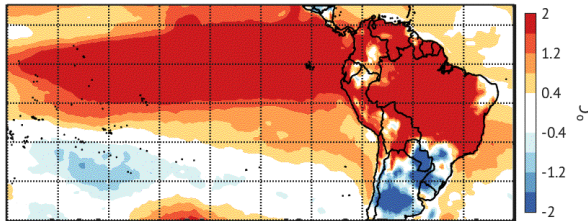
Surface Temp (2m TMAX): OCT 2014 - MAR 2015



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



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



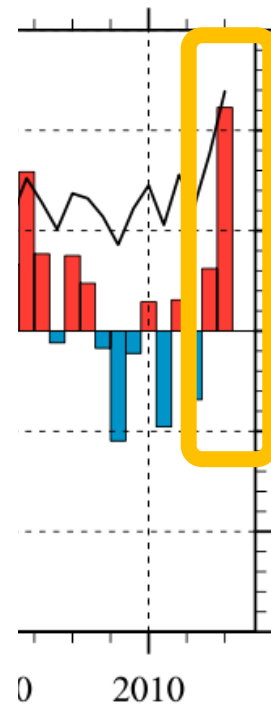
El Niño of 2015
one of the strongest in
the recent hisorical
record, surpassing the
1997-98 event



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



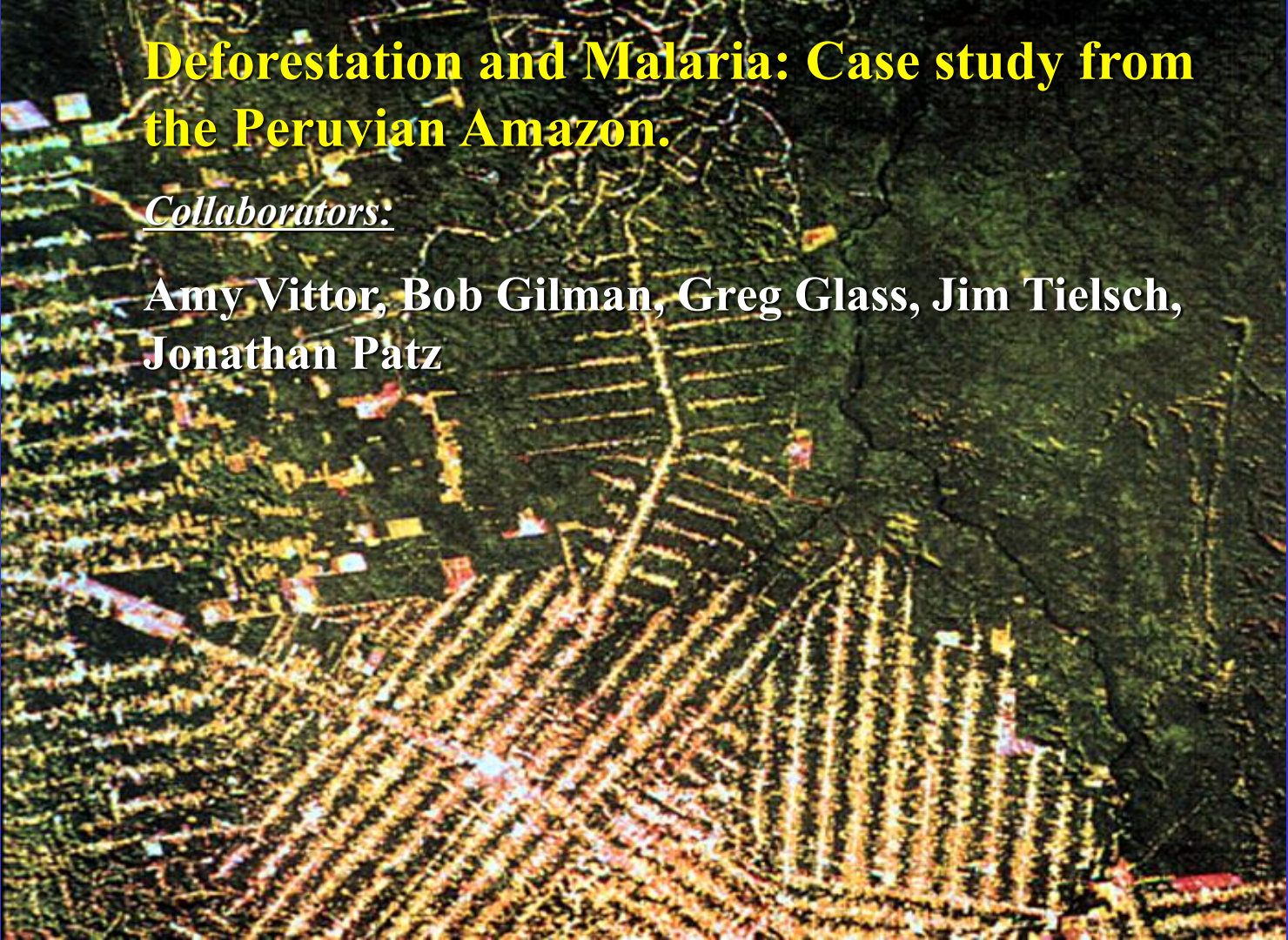
Land use change and Infectious Diseases



Deforestation and Malaria: Case study from the Peruvian Amazon.

Collaborators:

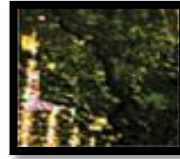
Amy Vittor, Bob Gilman, Greg Glass, Jim Tielsch,
Jonathan Patz



Malaria Risk and Deforestation in the Amazon Forest



Deforestation



Mosquito* Biting Rate

Vittor et al...Patz (2006)



Mosquito* Larvae

Vittor. et al...Patz

(2009)

* *Anopheles darlingi* sp.

For every 1% of deforestation, the incidence rate (new cases) of malaria increased by 11%

Olson...Patz, 2010

Bat-borne virus case study: Hendra virus and deforestation



Deforestation Brings Bat-Borne Virus Home to Roost

Habitat loss and food shortages have pushed bats into closer proximity to horses and humans, fueling Hendra virus spillover, a new study suggests.



A new study that uses 25 years of data from Australia suggests that environmental changes have been driving viral spillovers by radically altering the ecology of black flying foxes. Shutterstock

By [Emily Anthes](#)

Nov. 16, 2022

In September 1994, [a mysterious interspecies outbreak](#) erupted in Hendra, a suburb of Brisbane, Australia. First, a pregnant mare fell ill and died. Soon, more horses were sick, spiking fevers and

nature

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Article | [Published: 16 November 2022](#)

Pathogen spillover driven by rapid changes in bat ecology

[Peggy Eby](#), [Alison J. Peel](#), [Andrew Hoegh](#), [Wyatt Madden](#), [John R. Giles](#), [Peter J. Hudson](#) & [Raina K. Plowright](#)

[Nature](#) (2022) | [Cite this article](#)

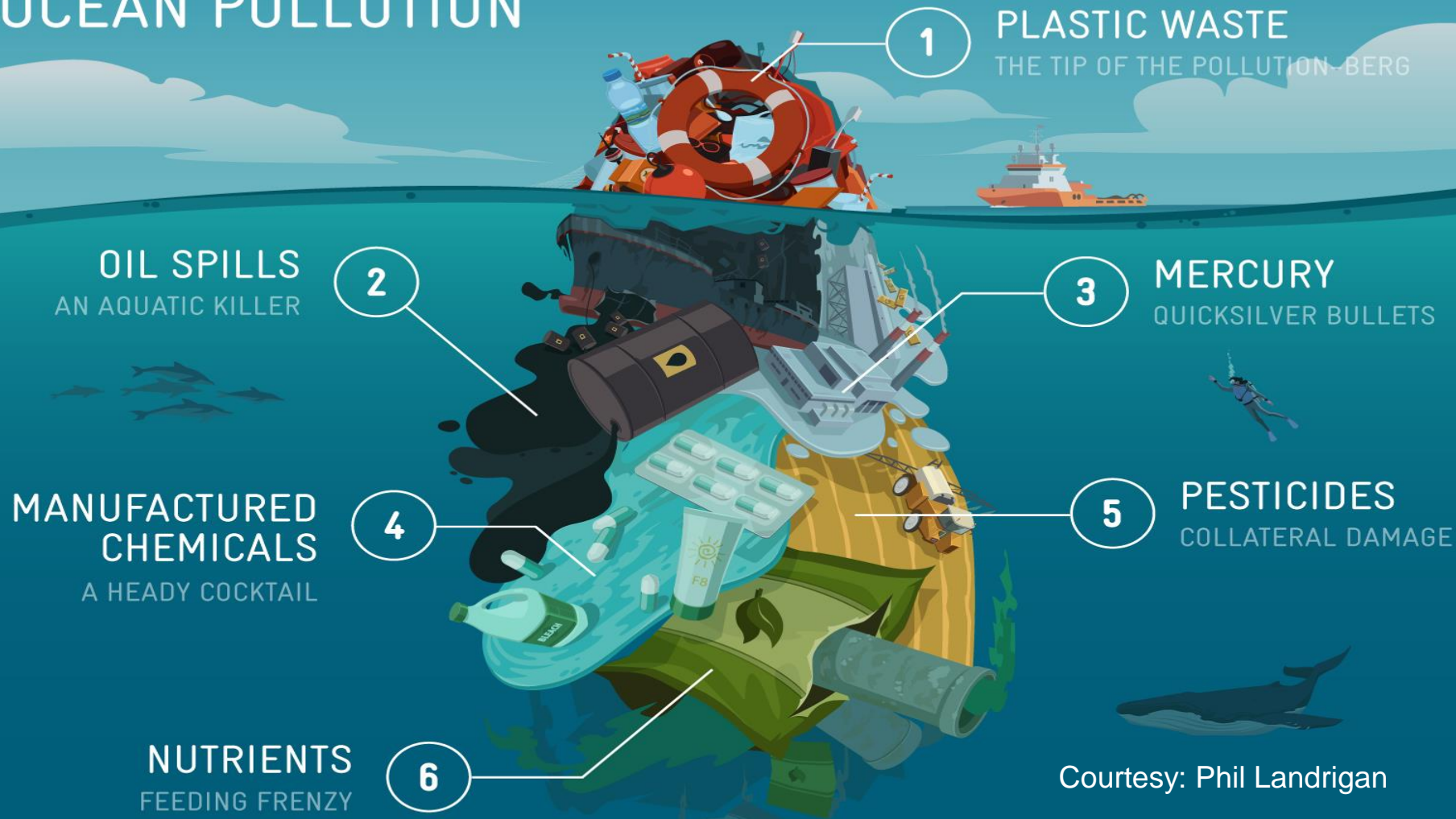
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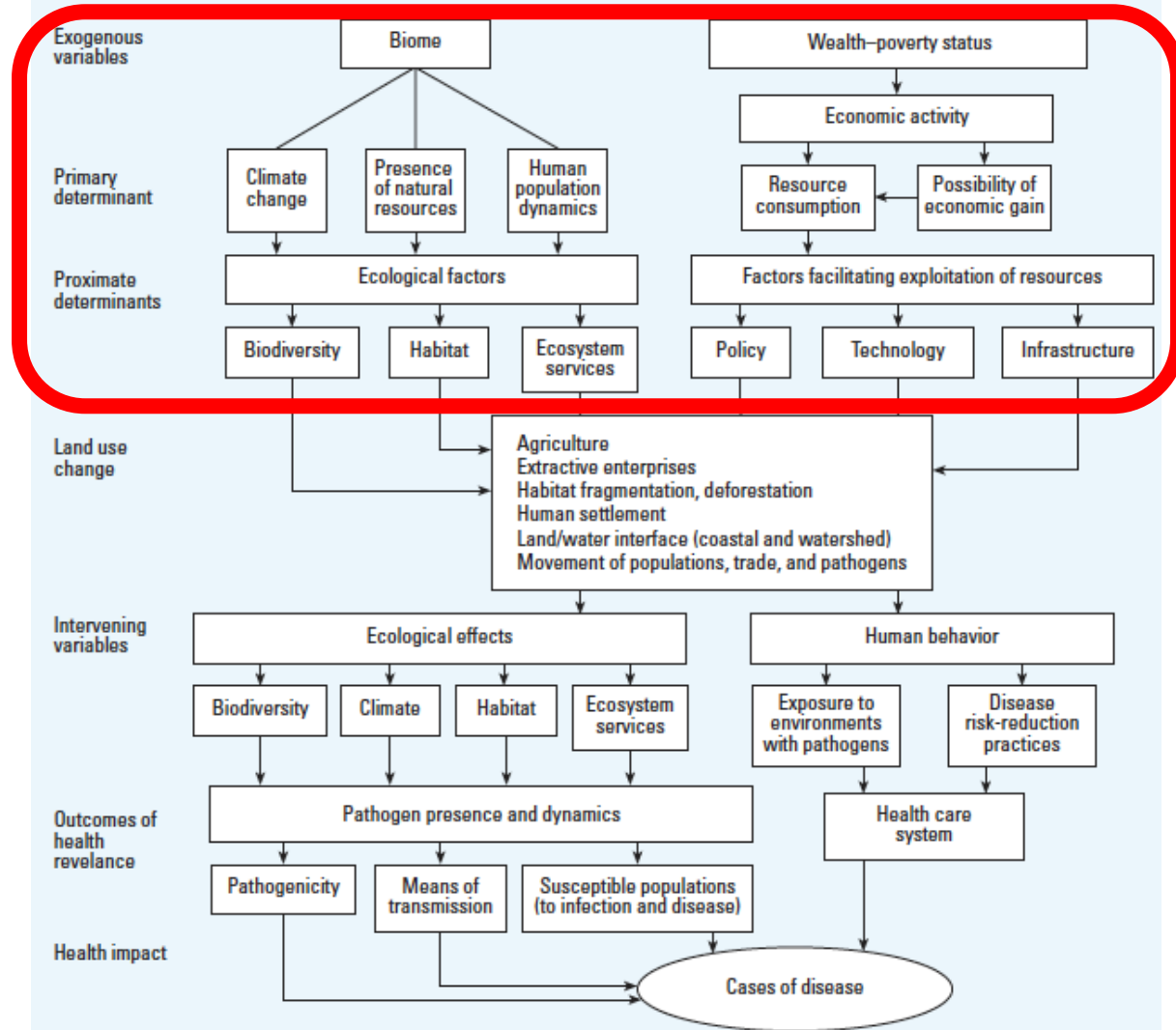
We are providing an unedited version of this manuscript to give early access to its findings.

Before final publication, the manuscript will undergo further editing. Please note there may be errors present which affect the content, and all legal disclaimers apply.

OCEAN POLLUTION



Courtesy: Phil Landrigan



In summary

In your spare time ... revisit this chart.

But for now ask yourselves, **“Do we focus enough on the early ecological determinants of disease emergence for effective prevention?”**

Patz, et al. 2004

“Unhealthy Landscapes”



The
ROCKEFELLER
FOUNDATION

THE LANCET



The Rockefeller Foundation–Lancet Commission on
planetary health

Safeguarding human health in the Anthropocene epoch:
report of The Rockefeller Foundation–Lancet Commission on
planetary health

“Planetary health is rooted in understanding the interdependencies of human and natural systems.” – Rockefeller Foundation



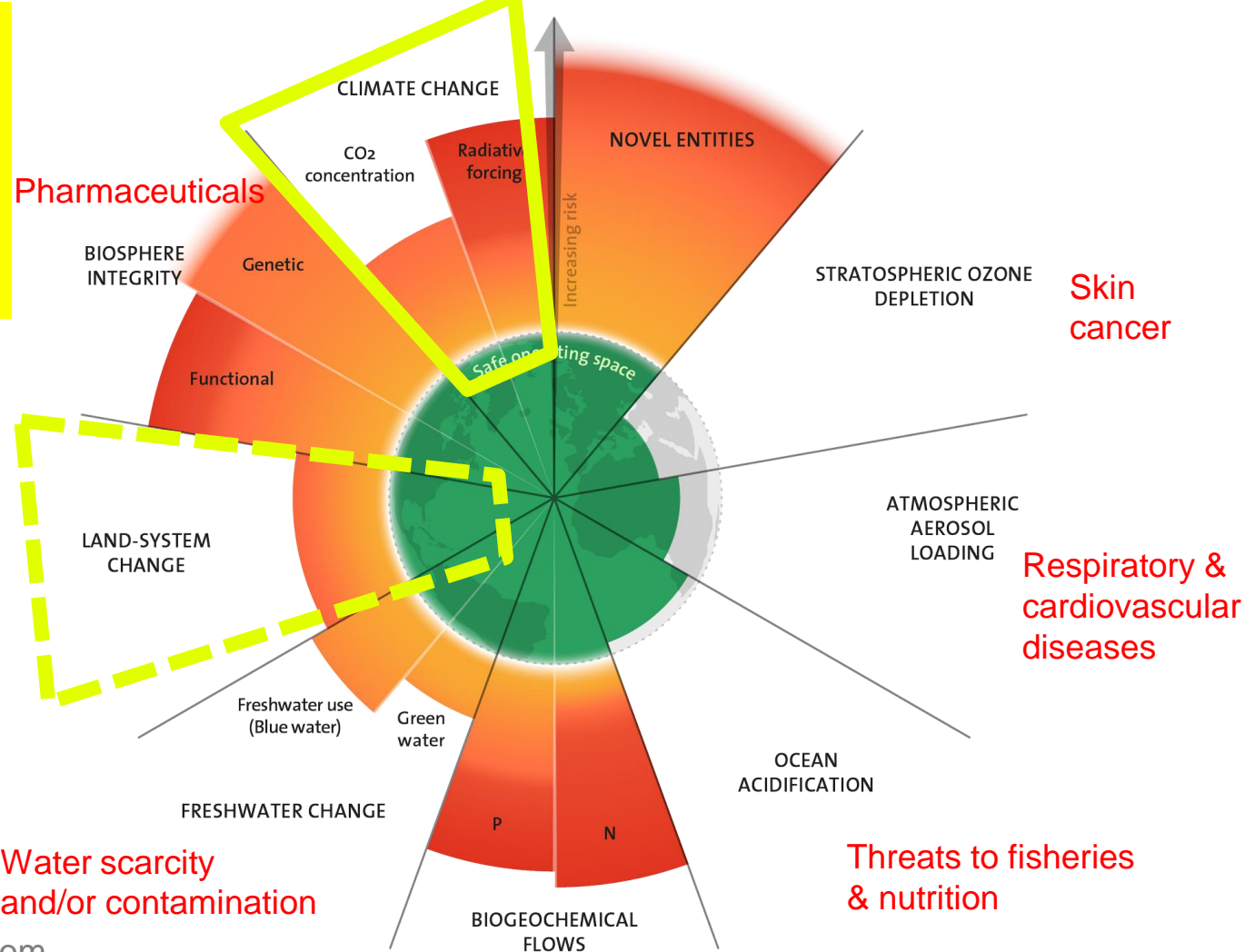
Planetary Boundaries

9 boundaries within which humanity can continue to develop & thrive for generations to come

In other words...
vital signs
for the planet



Planetary Boundaries

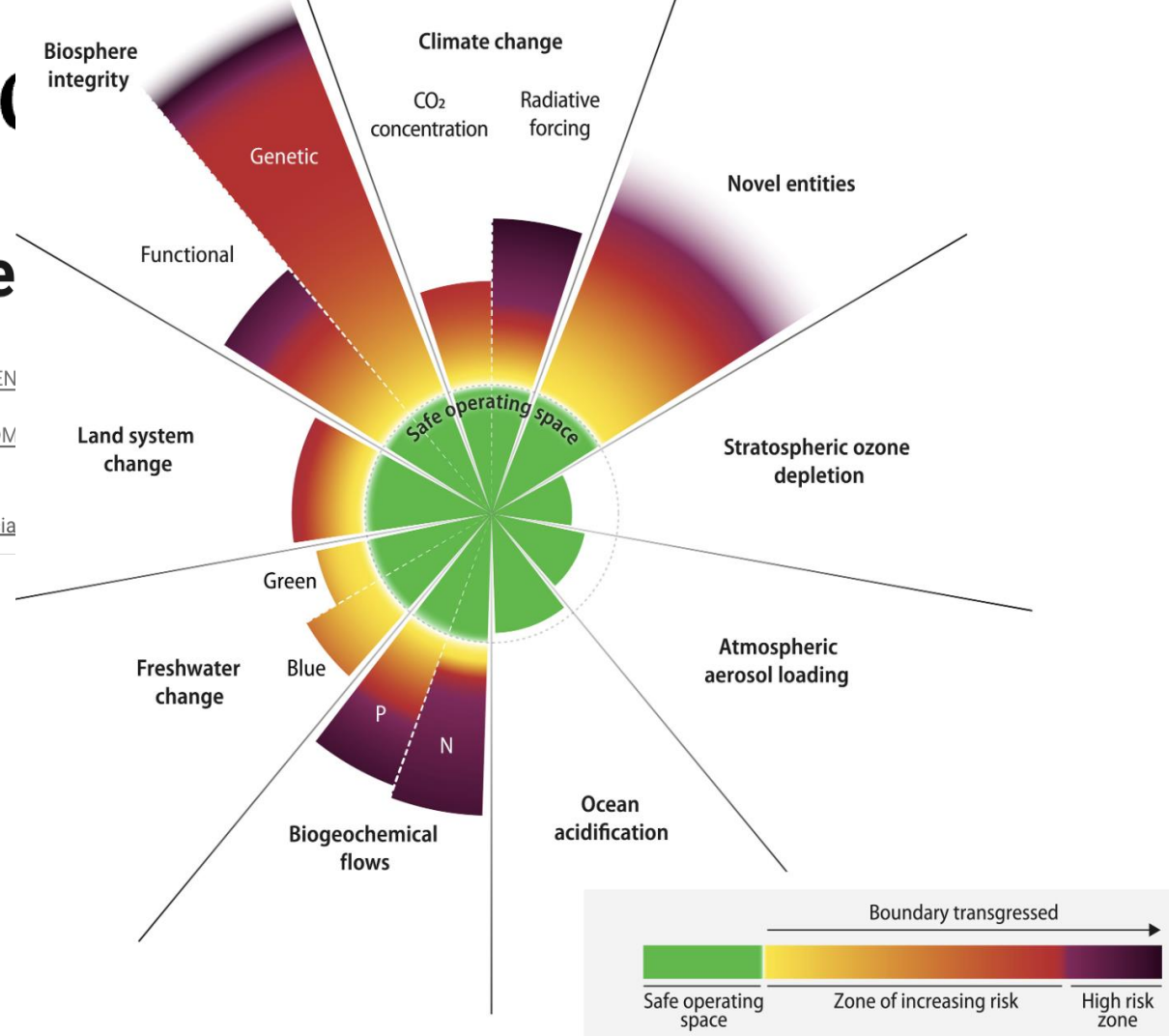


Earth beyond six of nine

KATHERINE RICHARDSON , WILL STEFFEN, WOLFGANG LUCHT, JØRGEN

INGO FETZER , GOVINDASAMY BALA , [...], AND JOHAN ROCKSTRÖM

SCIENCE ADVANCES • 13 Sep 2023 • Vol 9, Issue 37 • DOI: 10.1126/scia





Coordinating a consortium of **over 472 universities, organizations, and government entities** from 79+ countries committed to understanding and addressing the impacts of global environmental change on human health and wellbeing.



JOHNS HOPKINS
UNIVERSITY

**Institute for Planetary
Health**

“Planetary Health is a rapidly growing transdisciplinary field focused on understanding and addressing the human health impacts of our degradation of Earth’s natural systems. It is also a global social movement that calls for deep systemic change centering on social justice and intergenerational equity.”

Core principles in Planetary Health education

Faerron Guzmán CA, et al. *Lancet Planet Health*, 2021.

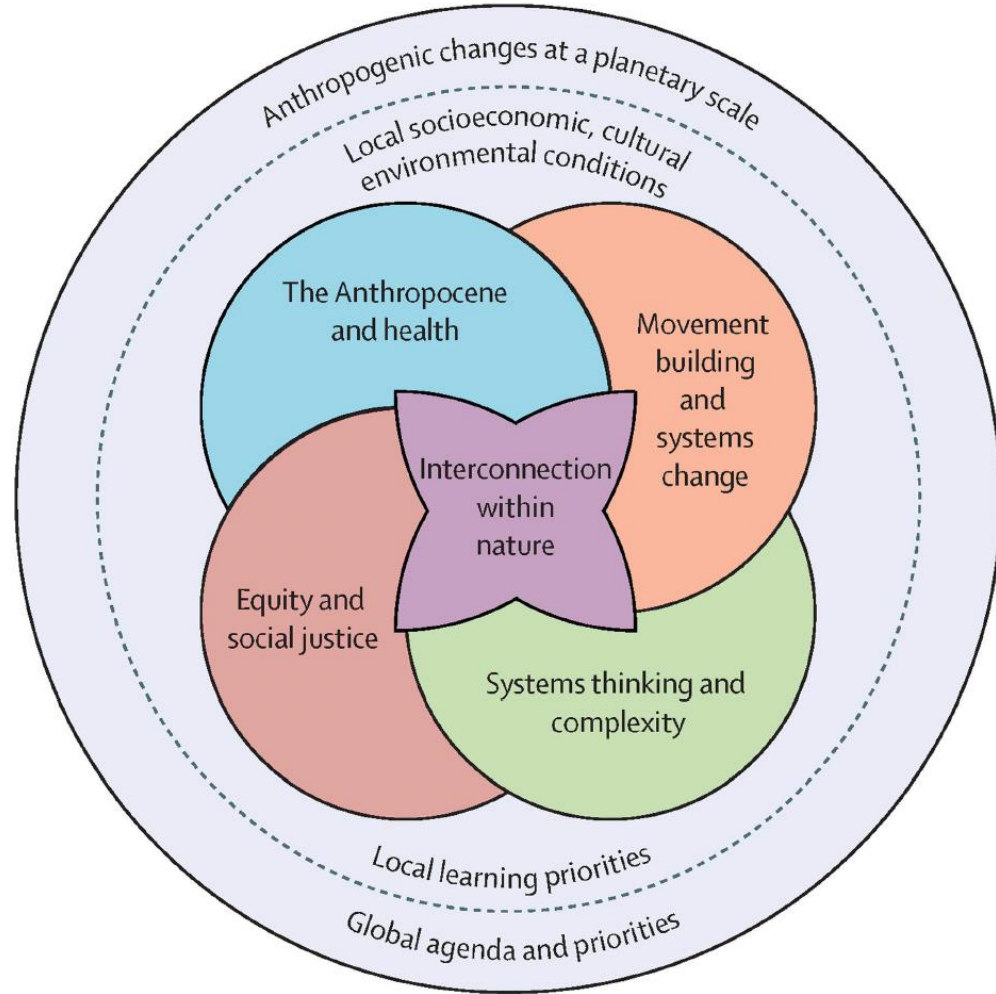


TABLE 2 Alignment of melioidosis case study with planetary health education framework and key planetary health concepts.

Planetary health education framework domain	Key concept	Alignment with example of melioidosis
Anthropocene and health	Climate change	<ul style="list-style-type: none">Increased rainfall and temperature linked to higher melioidosis risk (89)Geographic expansion of melioidosis during La Niña events (90)
	Land-use change and ecosystem disruptions	<ul style="list-style-type: none">Urban expansion and construction associated with melioidosis cases (91)
	Globalization and other human activities	<ul style="list-style-type: none">Melioidosis spread to non-endemic areas through commercial products (92) and pet animals (93)
Systems thinking	Dynamic interactions among complex systems	<ul style="list-style-type: none">Complex interactions between risk factors (e.g., diabetes), socio-economic conditions, healthcare system capacity and disease risk and outcomes
Equity and social justice	Uneven distribution of disease impacts	<ul style="list-style-type: none">Disproportionate impact on rural poor populations in low- and middle-income countries (70)Variation in mortality rates reflecting differences in healthcare access and risk factor prevalence (70)

TYPE Curriculum, Instruction, and Pedagogy
PUBLISHED 23 October 2024
DOI 10.3389/fmed.2024.1437632

Integrating planetary health education into tertiary curricula: a practical toolbox for implementation

Zerina Lokmic-Tomkins^{1,2*}, Liza Barbour³, Jessica LeClair⁴, Jeneile Luebke⁴, Sarah L. McGuinness^{2,5}, Vijay S. Limaye^{6,7}, Parvathy Pillai⁷, Maxfield Flynn⁸, Michael A. Kamp⁶, Karin Leder^{2†} and Jonathan A. Patz^{6,7†}



NATIONAL ACADEMY of MEDICINE
**GRAND CHALLENGE ON
CLIMATE CHANGE,
HUMAN HEALTH & EQUITY**

NAM Roadmap for

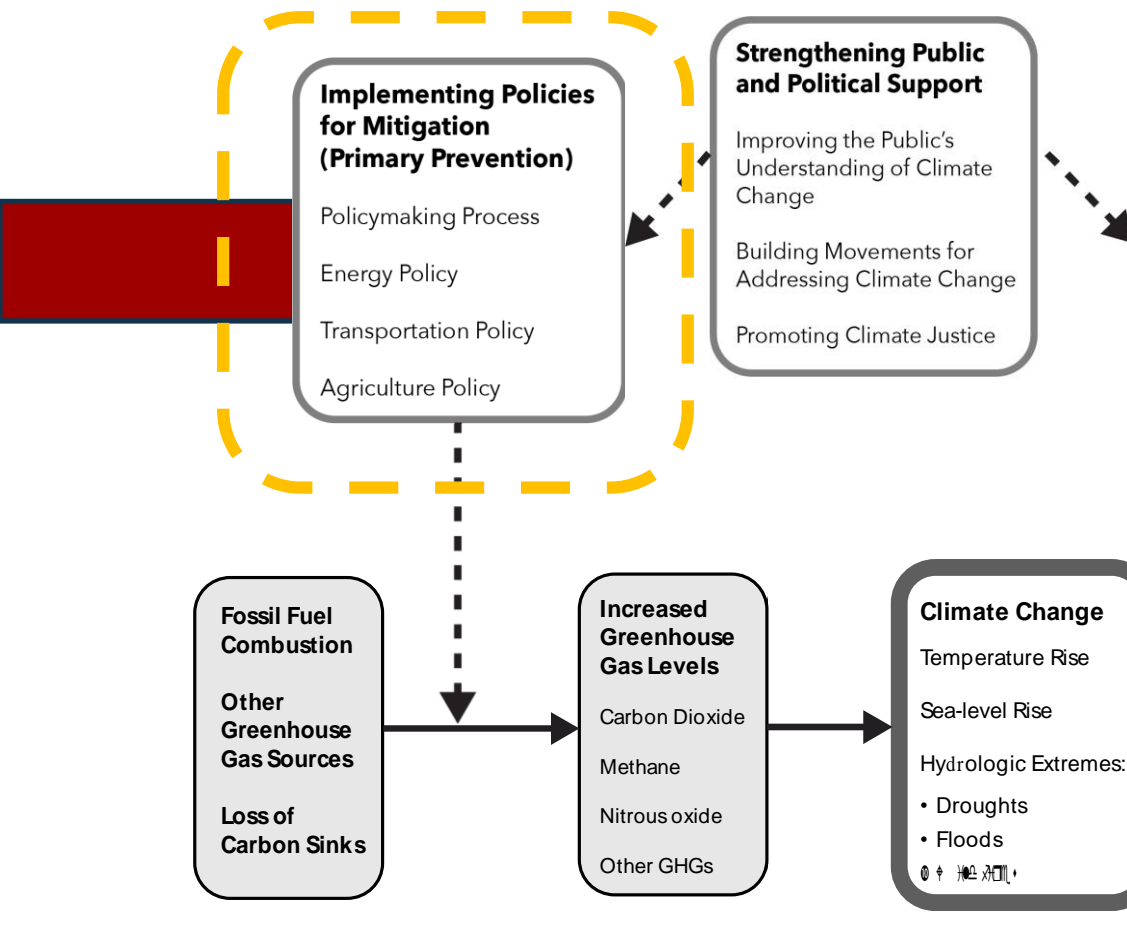
to Achieve

Zero Emissions

**Planetary Health: Systems approaches
can offer multiple health benefits**

Scientists:

Judith Rodin, Andy Haines, Jonathan Patz, Cathie Woteki,
Victor Dzau, Grace Robbins, Liz Finkelman, Kimber Bogard,
Jenny Bratburd (UW-Madison) & Sarah Whitmee (London SHTM)



Climate Change and Public Health Second Edition



CLIMATE CHANGE AND PUBLIC HEALTH

SECOND EDITION

EDITED BY BARRY S. LEVY AND JONATHAN A. PATZ



FOREWORD BY GRO H. BRUNDTLAND

Climate Change and Public Health comprehensively covers the health impacts of climate change, including heat-related and respiratory disorders, vectorborne and waterborne diseases, malnutrition, mental disorders, and violence. It provides a thorough understanding of the policymaking process and energy, transportation, and agriculture policies for mitigation. It covers health adaptation, sustainable built environments, and nature-based solutions to address climate change. And it describes ways of strengthening public and political support, including communicating the health relevance of climate change, building movements, and promoting climate justice.

THE EDITORS:

Barry S. Levy, M.D., M.P.H., is an environmental and occupational health specialist with more than 40 years of experience in this field. He has edited and written 21 previous books. He is an Adjunct Professor at Tufts University School of Medicine and a past president of the American Public Health Association.

Jonathan A. Patz, M.D., M.P.H., has taught and conducted research on the health effects of climate change for 30 years and has authored major national and international reports on this subject. He is a Distinguished Professor and Endowed Chair of Health and the Environment at the University of Wisconsin – Madison.

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\$52.47

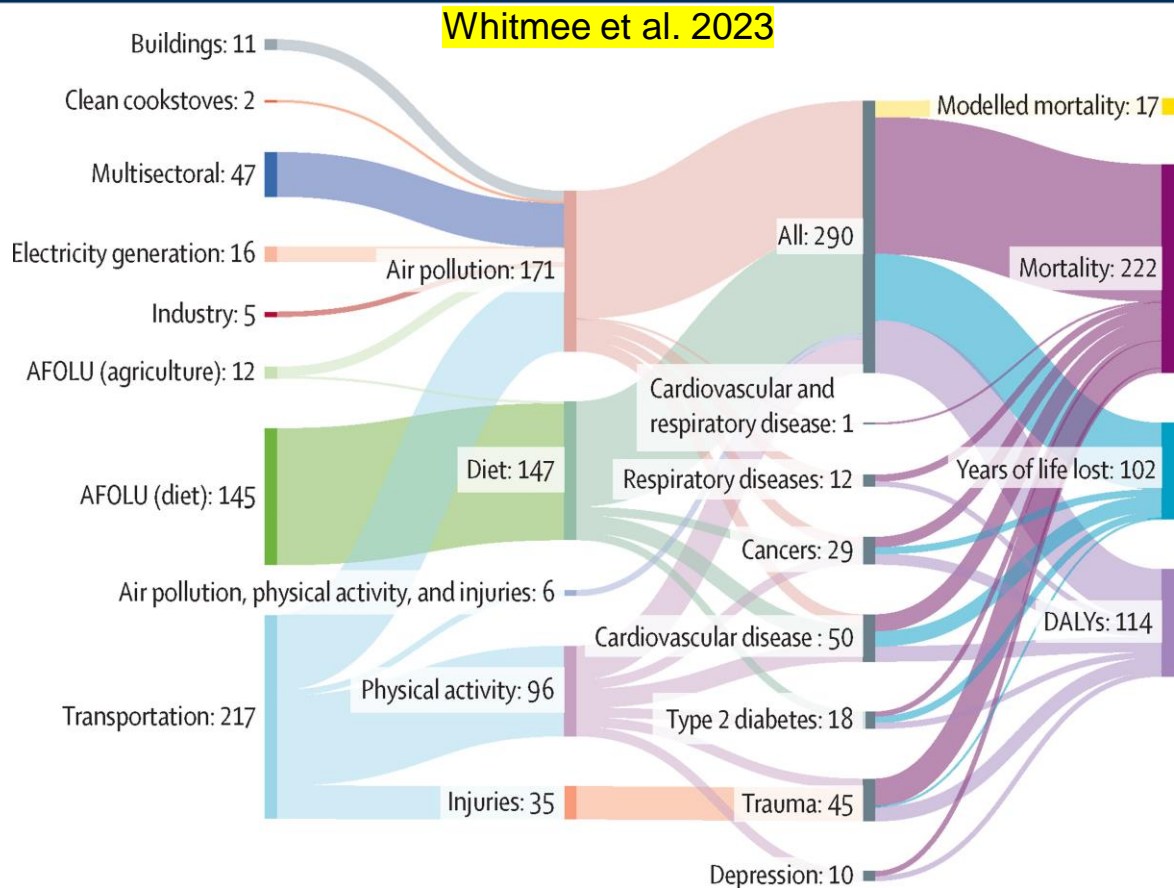
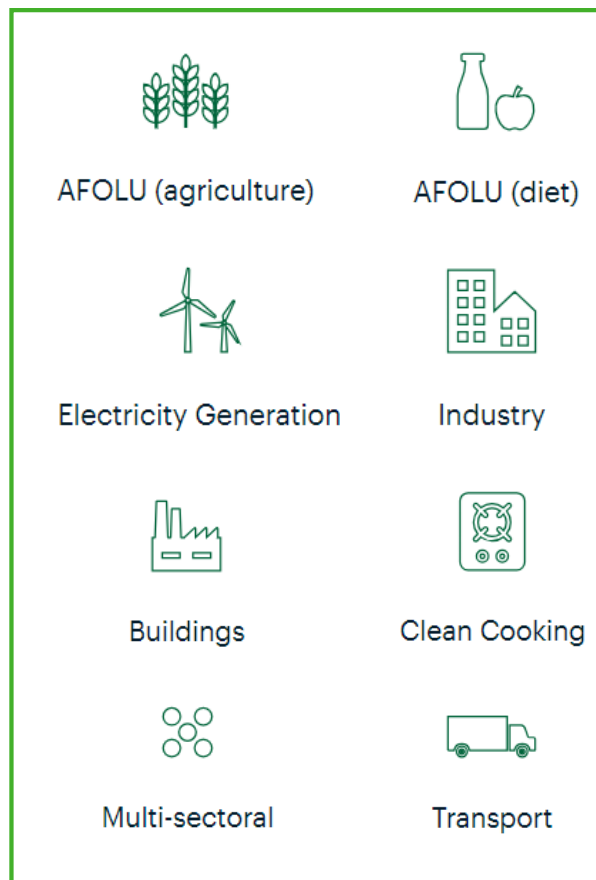
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Patz and
and Pub

Mitigation actions by sector & pathways to health

~90% modelled actions



Action on climate change: Opportunities for Health

Energy Sector

Air pollution (attributed to burning fossil fuels):

5.1 million premature deaths/year (Lelieveld et al, 2023)



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)



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

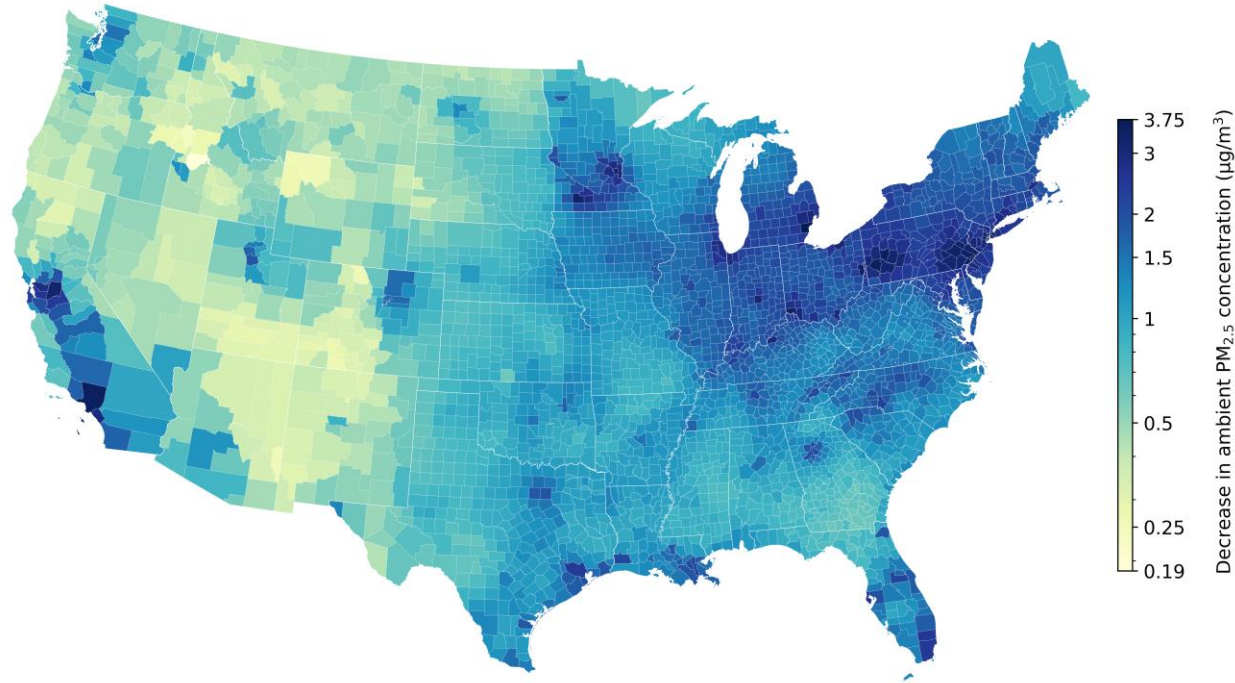
May 16, 2022 at 9:00 a.m. EDT

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

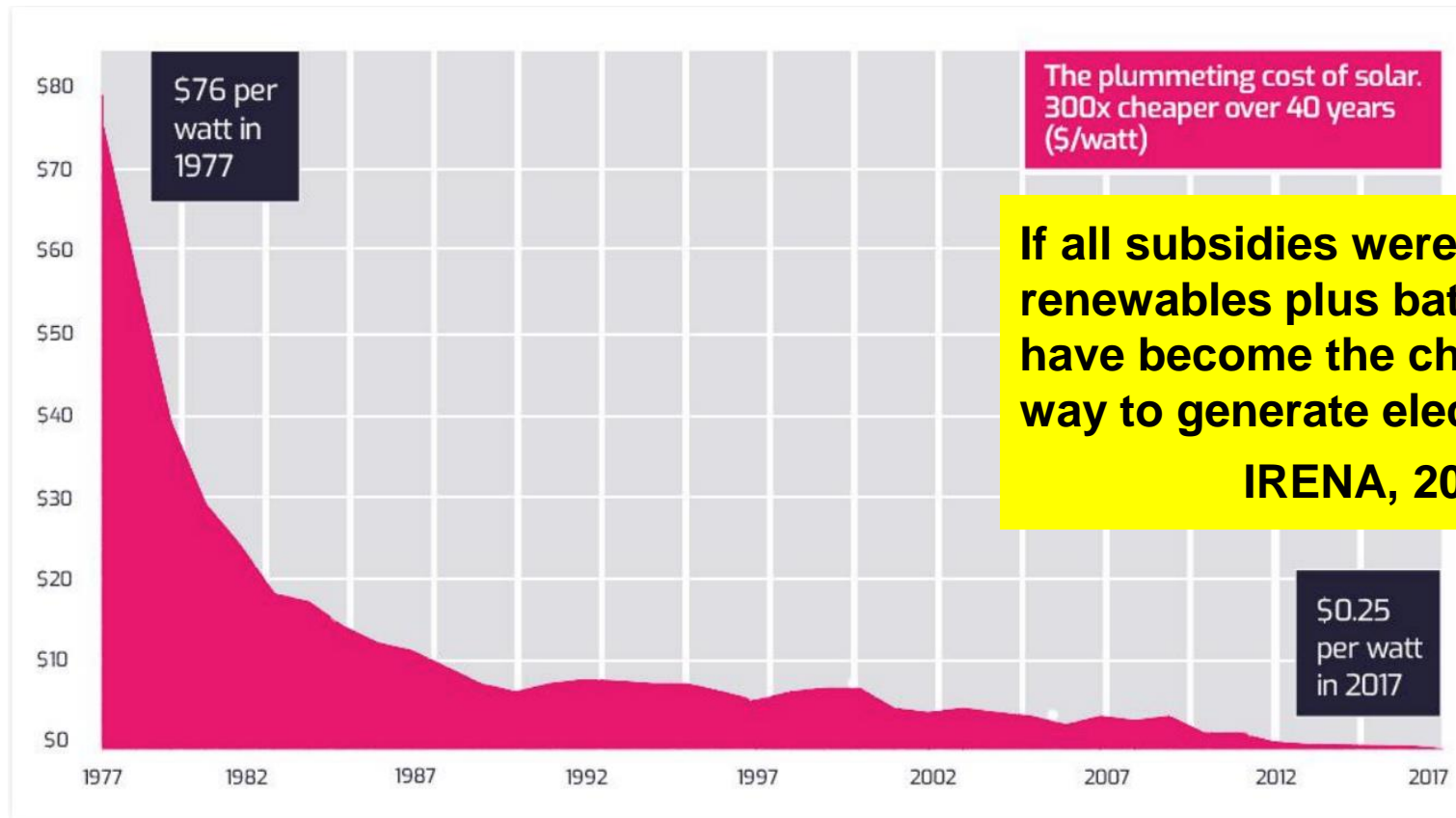
First published: 16 May 2022 | <https://doi.org/10.1029/2022GH000603>

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

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



**If all subsidies were removed,
renewables plus batteries
have become the cheapest
way to generate electricity.**

IRENA, 2019 Report



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.”

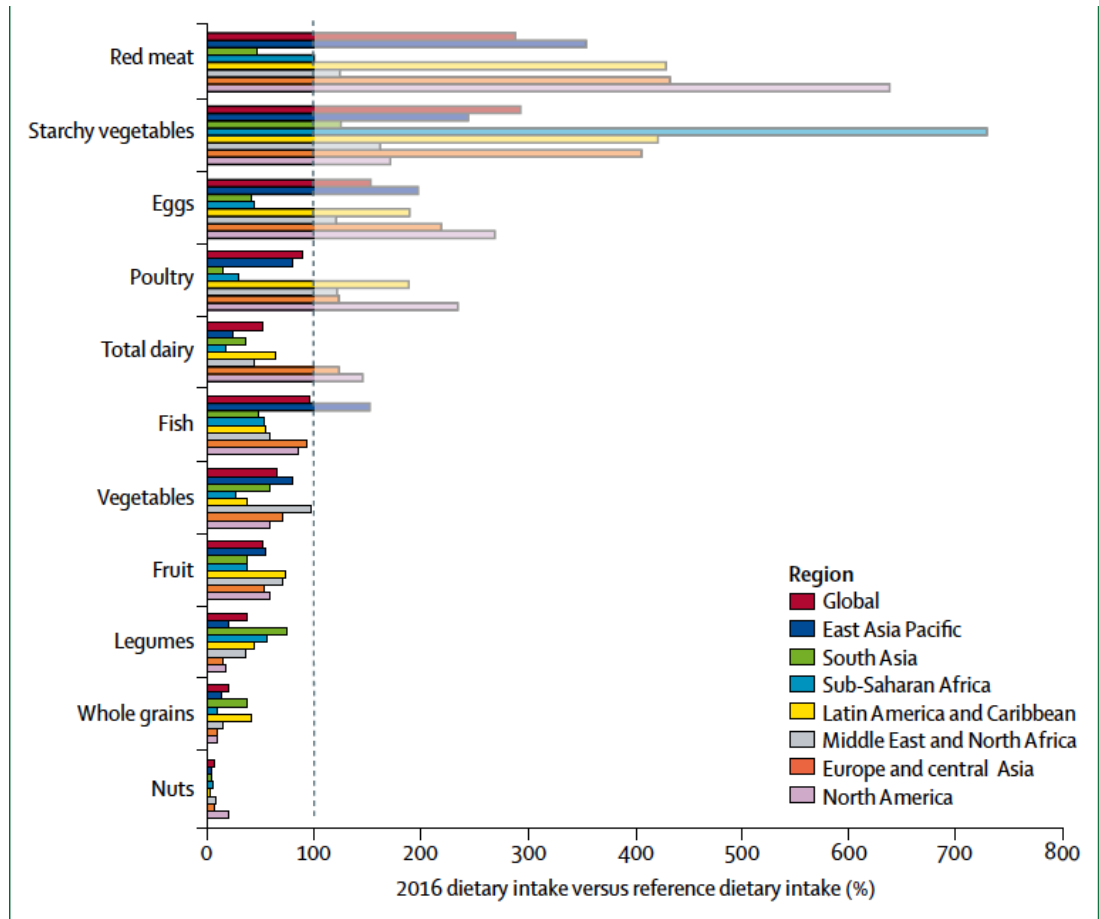


Figure 1: Diet gap between dietary patterns in 2016 and reference diet intakes of food

	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:

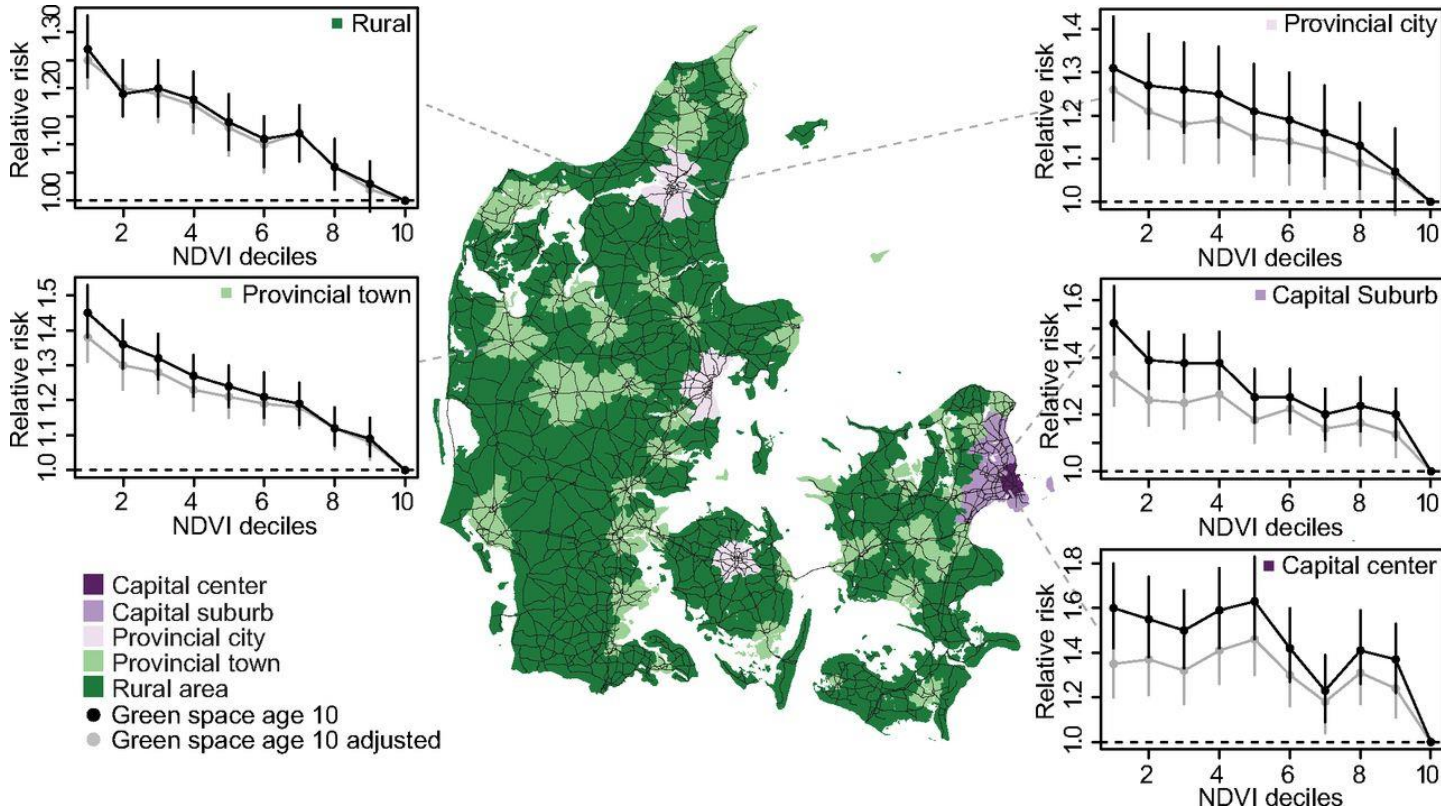
- Heart disease
- Cancer
- Dementia
- Depression



Brisbane, Australia

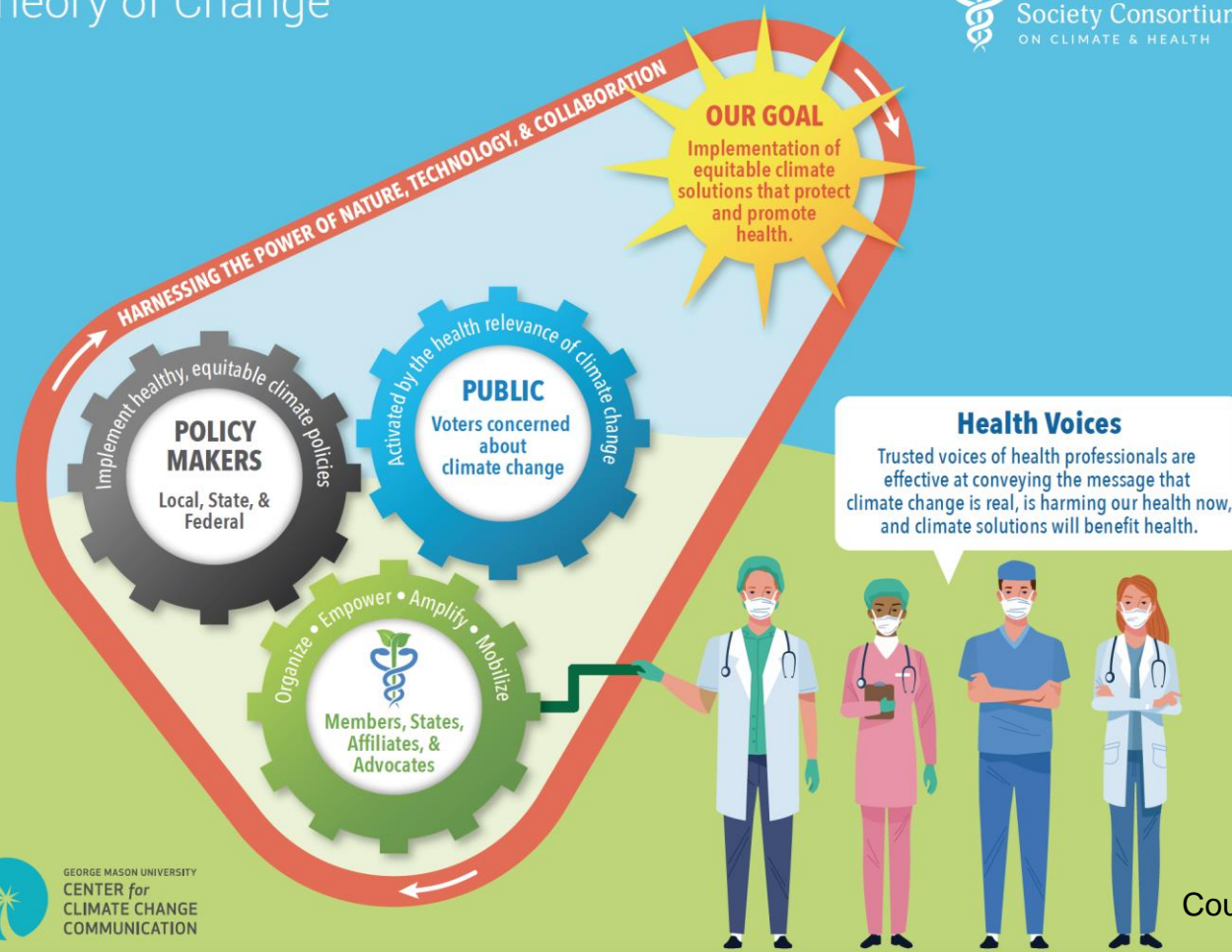
Image courtesy of Shutterstock

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



Because nurses and doctors are the top most trusted professionals

Theory of Change



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

Conclusion

Considering the broad health implications of today's Triple Planetary Crisis, systems-based PLANETARY HEALTH education is needed to better prepare our medical/health practitioners.



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

 University of Wisconsin-Madison



Climate
Solutions
for Health

THANK YOU

<https://www.climatesolutionsforhealth.org/>