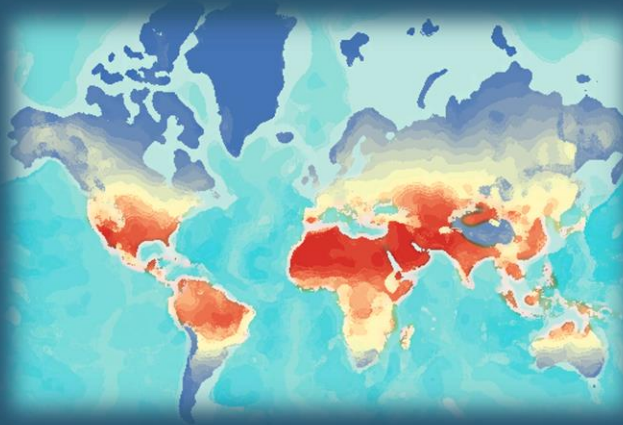


The Climate Crisis and Health: What We Know and How We Can Take Action



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Disclosures

Arianne Teherani, Ph.D., faculty for this educational activity, has no relevant financial relationships with ineligible companies to disclose, and has indicated that the presentation or discussion will not include off-label or unapproved product usage.

Sheri Weiser, M.D., MPH, faculty for this educational activity, has no relevant financial relationships with ineligible companies to disclose, and has indicated that the presentation or discussion will not include off-label or unapproved product usage.

2

OBJECTIVES



Identify the Human Health Impacts of the Climate Crisis



Explore Pathways Towards Worse Health Outcomes



Discuss Solutions and Opportunities for Action



3



Source: Gerdien

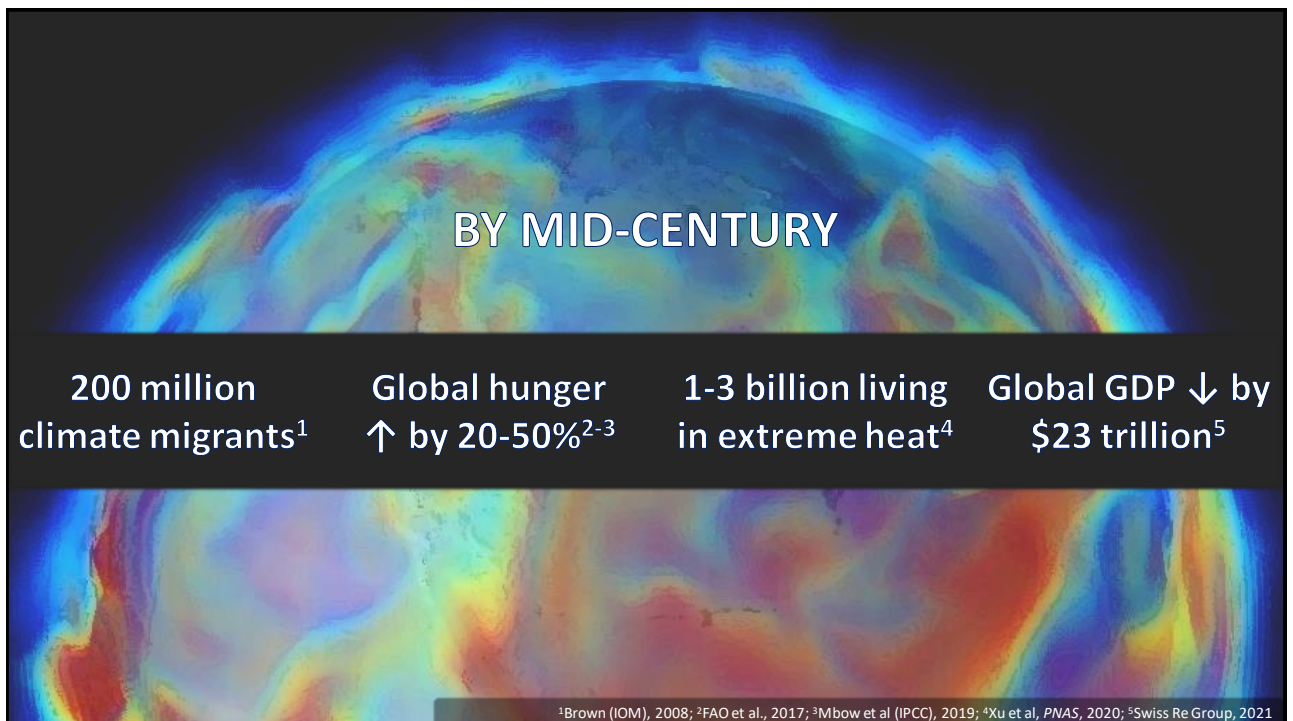
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“The life of every child born today will be profoundly affected by climate change. Without accelerated intervention, this new era will come to define the health of people at every stage of their lives.”

The Lancet Countdown, 2019

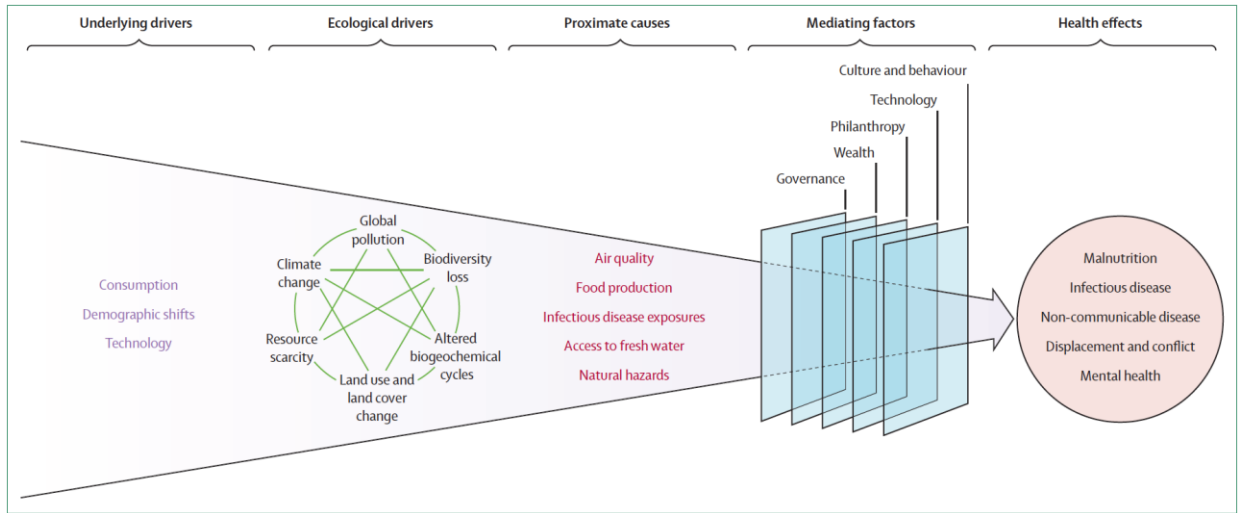


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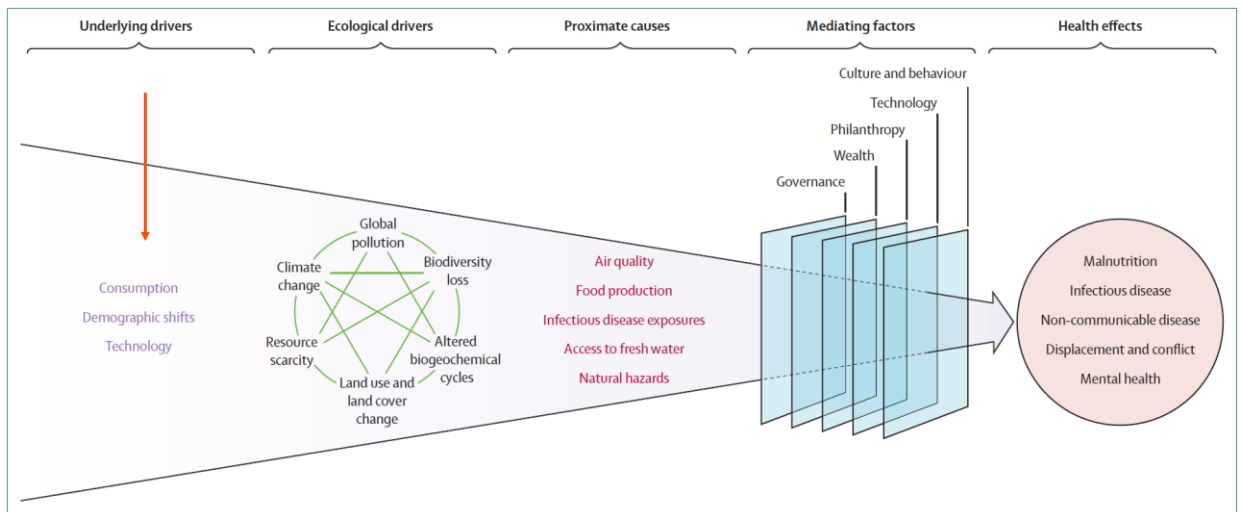
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

7

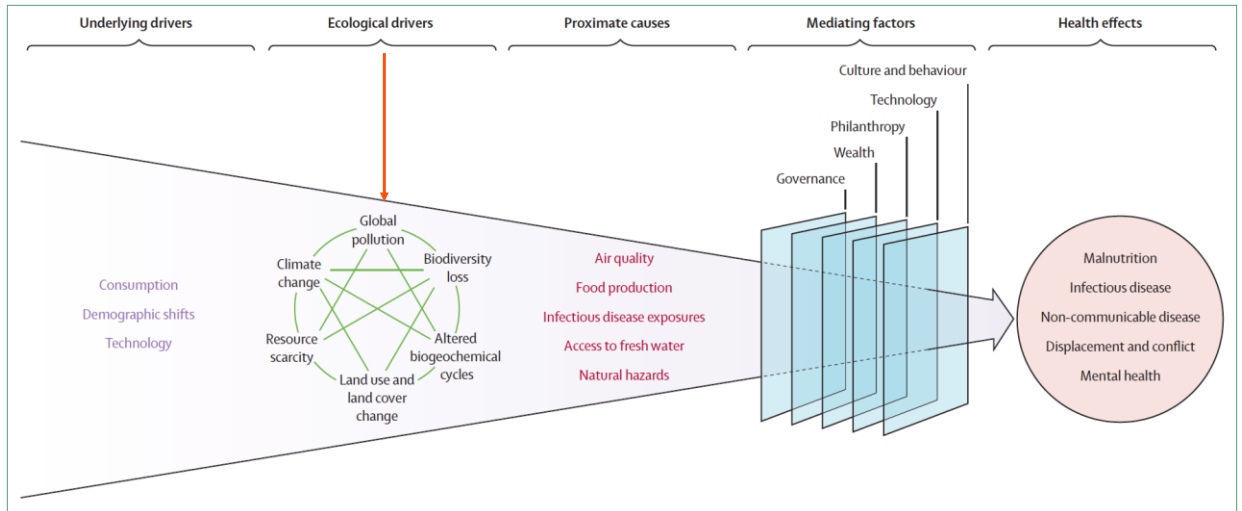
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

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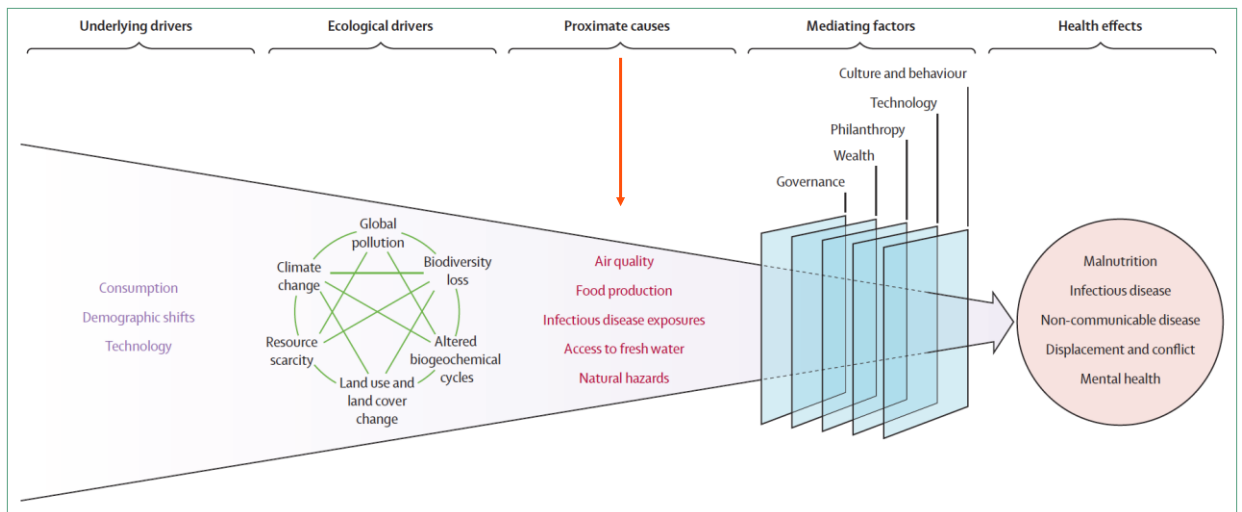
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

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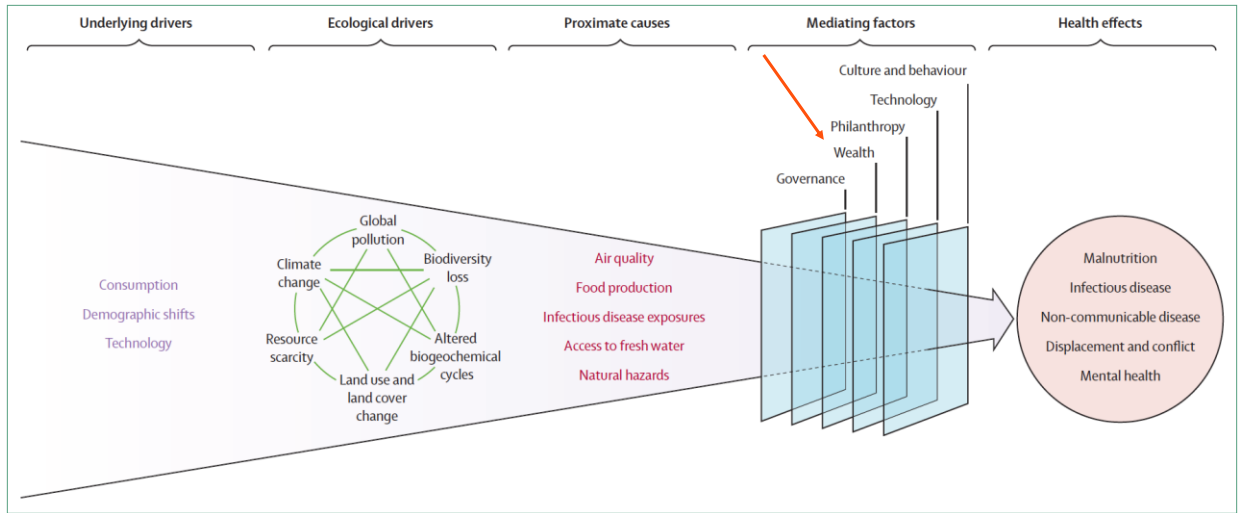
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

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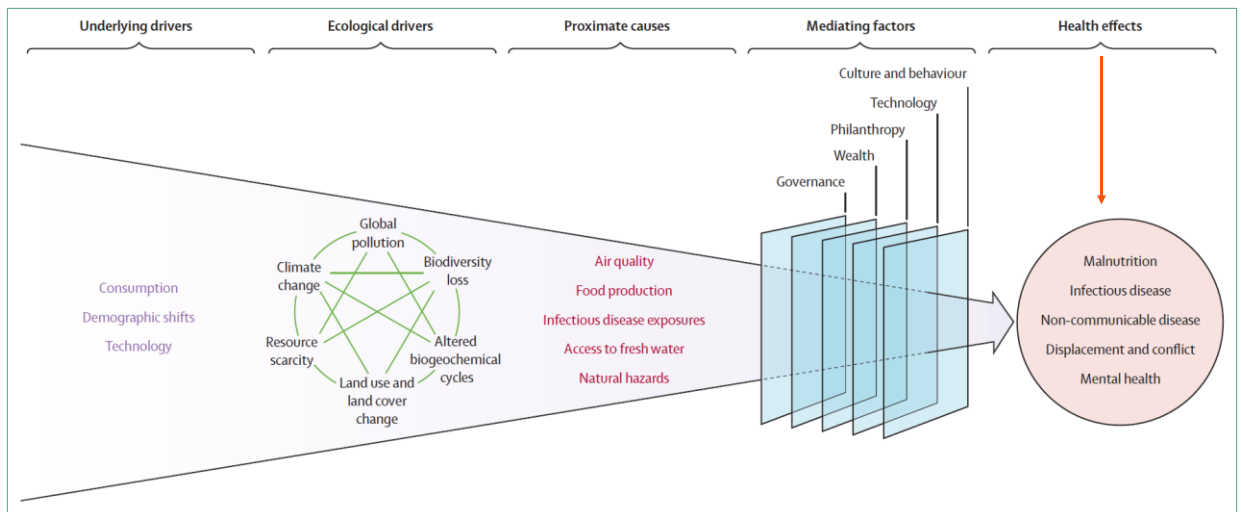
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

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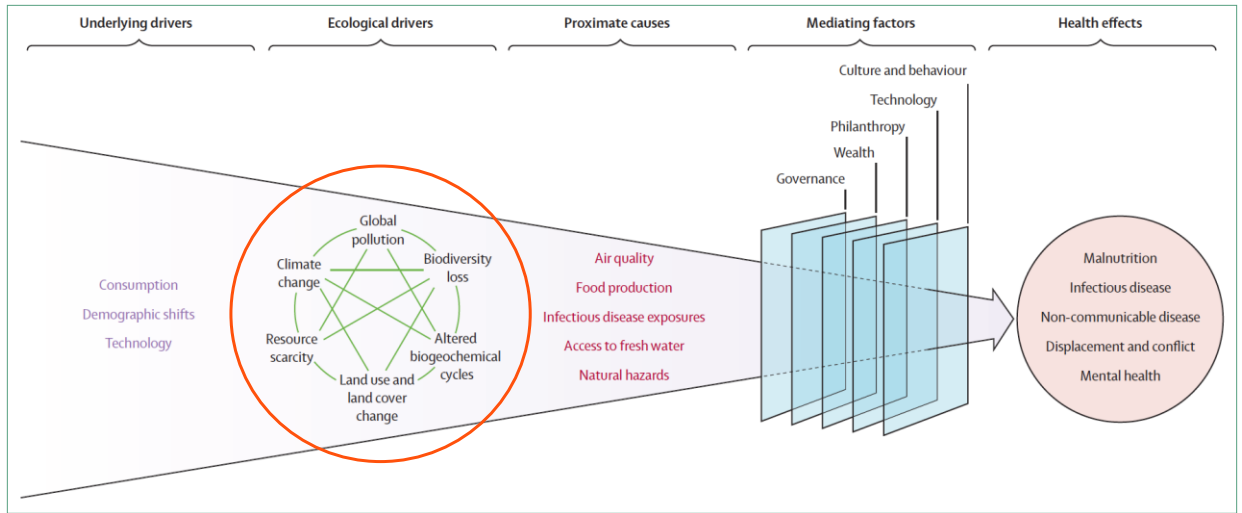
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

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IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH



Myers, Lancet, 2017

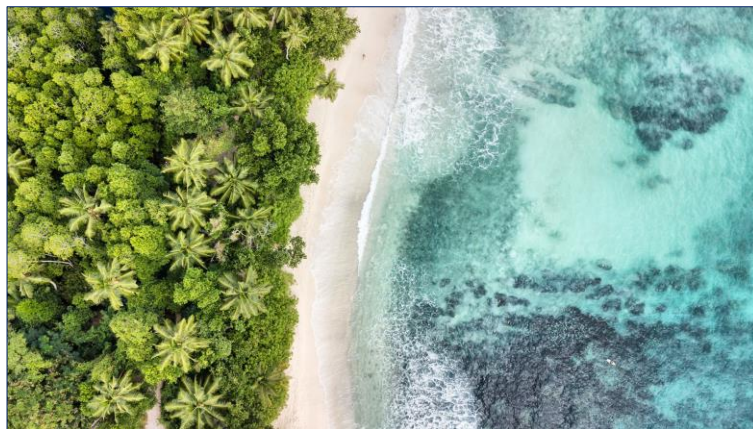
13

IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH

Fossil Fuels ↑
550%

CO₂ Levels ↑
24%

Half of
freshwater and
livable surface
for human use



Species loss
1,000X higher

60% rivers
dammed







Half of forests
cleared

Oceans 30%
more acidic than
Industrial
Revolution

www.planetaryhealthalliance.org

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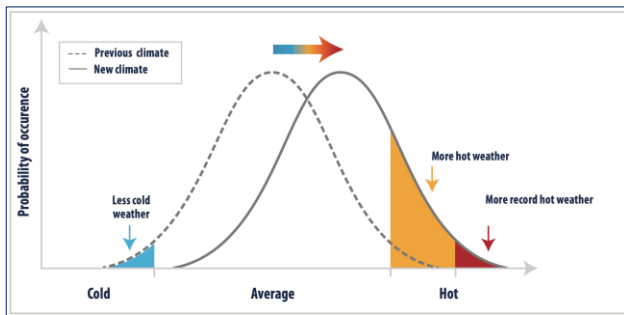
IMPACTS OF ANTHROPOGENIC CHANGE ON HUMAN HEALTH

| Extreme Heat | Natural Hazards | Food Supply & Quality | Water Supply & Quality | Air Quality | Changes in Vector Ecology |
|--|--|---|---|--|--|
|  |  |  |  |  |  |
| Heat-related illness & fatalities <ul style="list-style-type: none"> • CV failure • Exacerbated CKD • Worse mental health | Injuries & fatalities <ul style="list-style-type: none"> • Respiratory & CV problems • Psychological trauma • Toxin exposures | Malnutrition <ul style="list-style-type: none"> • Starvation • Increased NCDs & STIs • Increased IPV | Dehydration <ul style="list-style-type: none"> • Diarrheal disease • Harmful algal blooms • Poor maternal & newborn health | Asthma <ul style="list-style-type: none"> • Respiratory allergies • CVD • Preterm birth | Malaria <ul style="list-style-type: none"> • Dengue • Lyme disease • West Nile virus • Chikungunya |

CDC, 2020

15

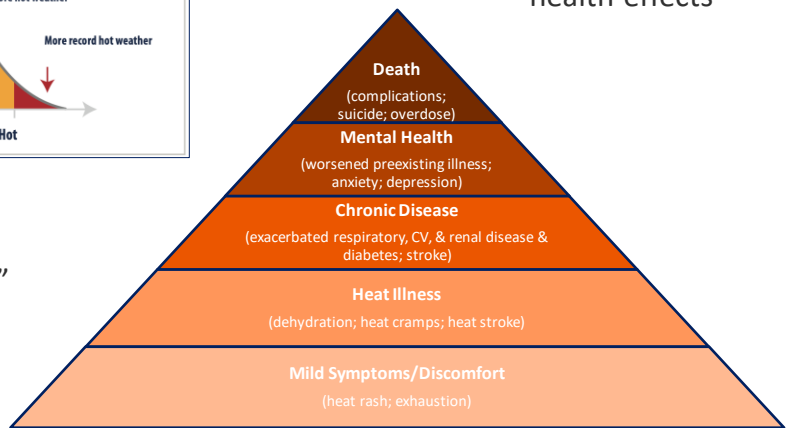
CLIMATE CHANGE & HEALTH: EXTREME HEAT



IPCC, 2001 via the CDC

Extreme heat has many negative health effects

As average temperatures increase, “hot” and “record hot” weather will intensify



CDC, 2020; WHO, 2018

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CLIMATE CHANGE & HEALTH: WILDFIRE SMOKE

More than half of Californians face unhealthy AQI for month of longer

Wildfire smoke is half of PM 2.5 in western US

Premature mortality, poor pregnancy and neonatal outcomes, asthma, COPD, CV disease, neurocognitive decline



Image: NASA CA wildfire smoke

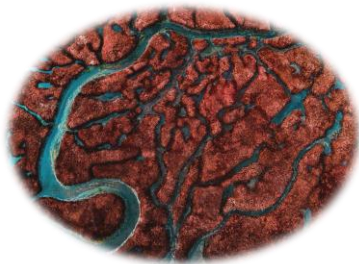
Childs et al. 2022; Burke et al. 2021; Cheng et al. 2021; Abdo et al. 2019; Heft-Neal et al. 2022; Heany et al. 2022; Borchers Arrigada et al. 2019; Reid et al. 2016; Cleland et al. 2022

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CLIMATE CHANGE & HEALTH DISPARITIES

Vulnerable Regions

- Highest levels of food insecurity & poverty
- Largest disease burdens (e.g., HIV)
- Less adaptive capacity
 - Underdeveloped PH infrastructure
 - Weak governance
 - Areas with climate risk



Vulnerable Populations

- Migrants, displaced persons
 - Elderly, children, women
- Farming & rural communities
 - Low-wealth communities
 - BIPOC individuals
- Marginally housed & homeless
- Individuals with mental illness

McMichael et al, *BMJ*, 2008; McMichael et al, *Lancet*, 2006; Weiler et al, *Health Policy Plan*, 2015; Rosegrant & Cline, *Science*, 2003

18

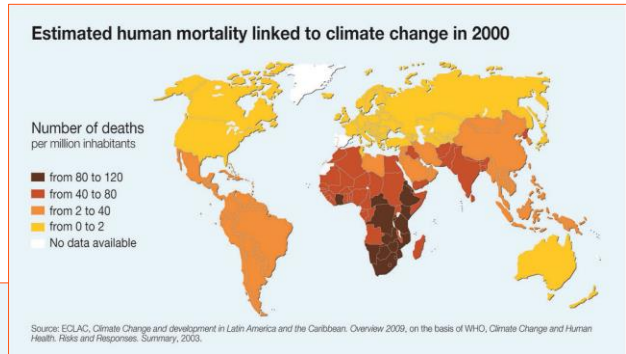
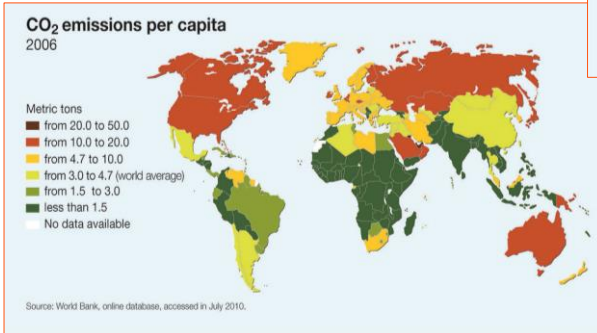
CLIMATE CHANGE & HEALTH DISPARITIES

Climate change amplifies structural injustices to worsen existing disparities

Those who contribute least to climate change bear the brunt of its harms

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CLIMATE CHANGE & HEALTH DISPARITIES



López Izquierdo, UNEP/GRID-Arendal, 2010
<https://www.grida.no/resources/616>

Highest mortality related to climate change among the lowest emitters

López Izquierdo, UNEP/GRID-Arendal, 2010
<https://www.grida.no/resources/6143>

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THE “CLIMATE GAP” & EXTREME HEAT

AfrAm adults in Los Angeles **2X** more likely to die from heat waves¹

Risk of occupational heat-related deaths in US²

- **35X** higher for agriculture
- **13X** higher for construction
- **3.2X** higher for LatinX & **1.5X** for AfrAm workers



Brian L. Frank via The New York Times



Frederic J. Brown/AFP Via Getty Images

Historically redlined neighborhoods across the U.S. are on average **5 degrees hotter** during the summer³

¹Cordova et al, 2006; ²Gubernot et al, *Am J Ind Med*, 2015; ³Hoffman et al, *Climate*, 2020

21

THE “CLIMATE GAP” & WILDFIRES

Disparities in wildfire smoke exposures¹

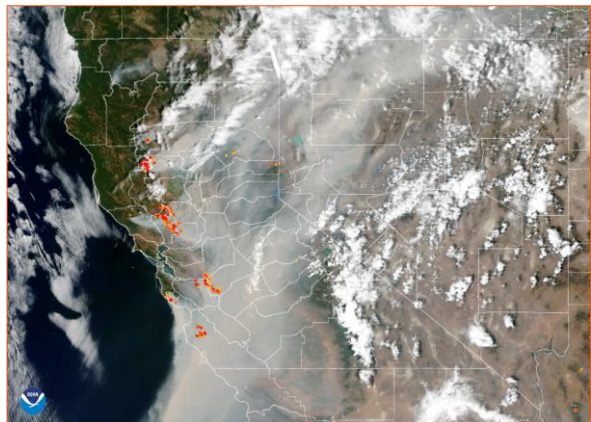
- Non-Hispanic whites → more exposure to ambient smoke-based PM_{2.5}

BUT

- Older, smaller & low SES homes → **higher infiltration of outdoor pollutants**
 - Wildfires → nearly **4X higher** indoor air pollutant amounts in low SES Denver homes²



Claremont-Bear Fire, Sept. 8, 2020, by Lori Mallory Eckhart



NOAA-20 satellite image, Aug. 20, 2020

¹Burke et al, *PNAS*, 2021; ²Shrestha et al, *Int J Environ Res Pub Health*, 2019

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THE “CLIMATE GAP”: NATURAL HAZARDS

Hurricane Katrina (Louisiana, 2005)

- NOLA mortality rates **1.7-4X** higher for AfrAm residents
- AfrAm men ≥75 years most affected¹

Hurricane Sandy (New York City, 2012)

- Larger AfrAm populations in flooded areas
- Higher poverty rates among AfrAm, Latino & elderly residents in flooded areas²



Win McNamee/Getty Images

Tropical Storm Harvey (Texas, 2017)

- Up to **100** toxic spills by water, land, air³

Hurricane Maria (Puerto Rico, 2017)

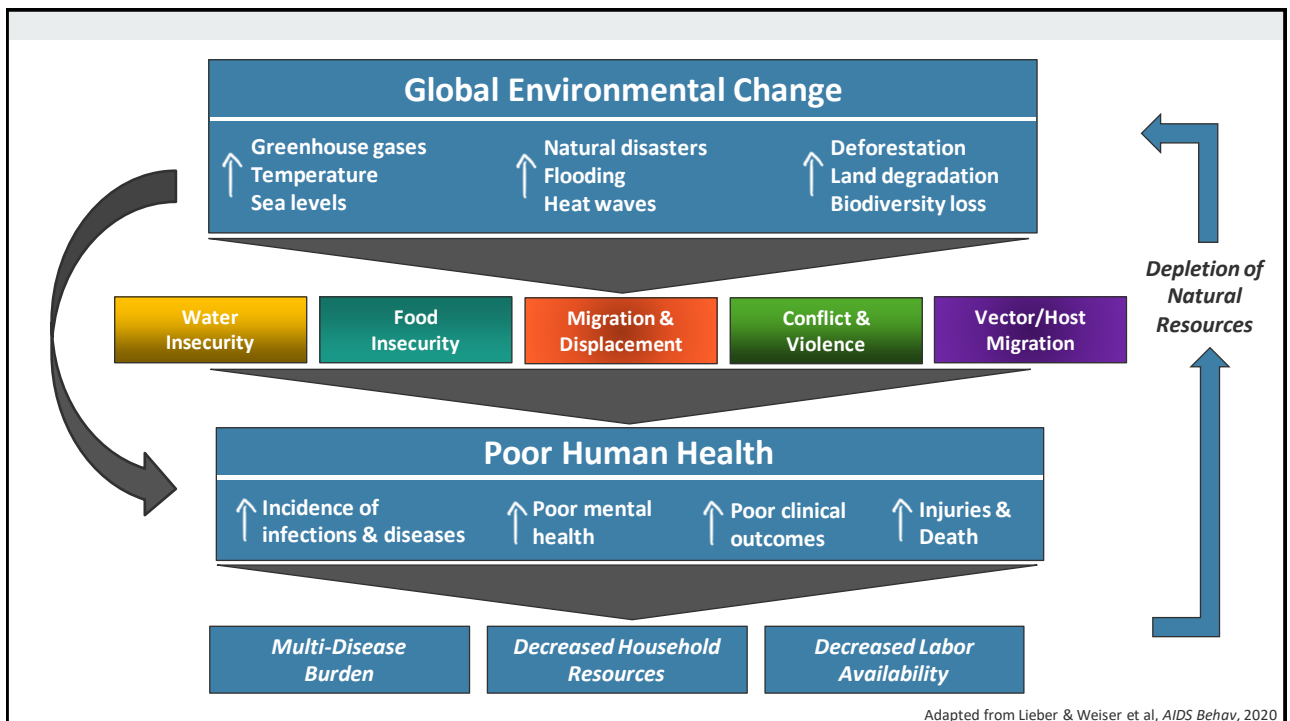
- Largest blackout in US history → health care, safe water crisis⁴



Joe Raedle/Getty Images

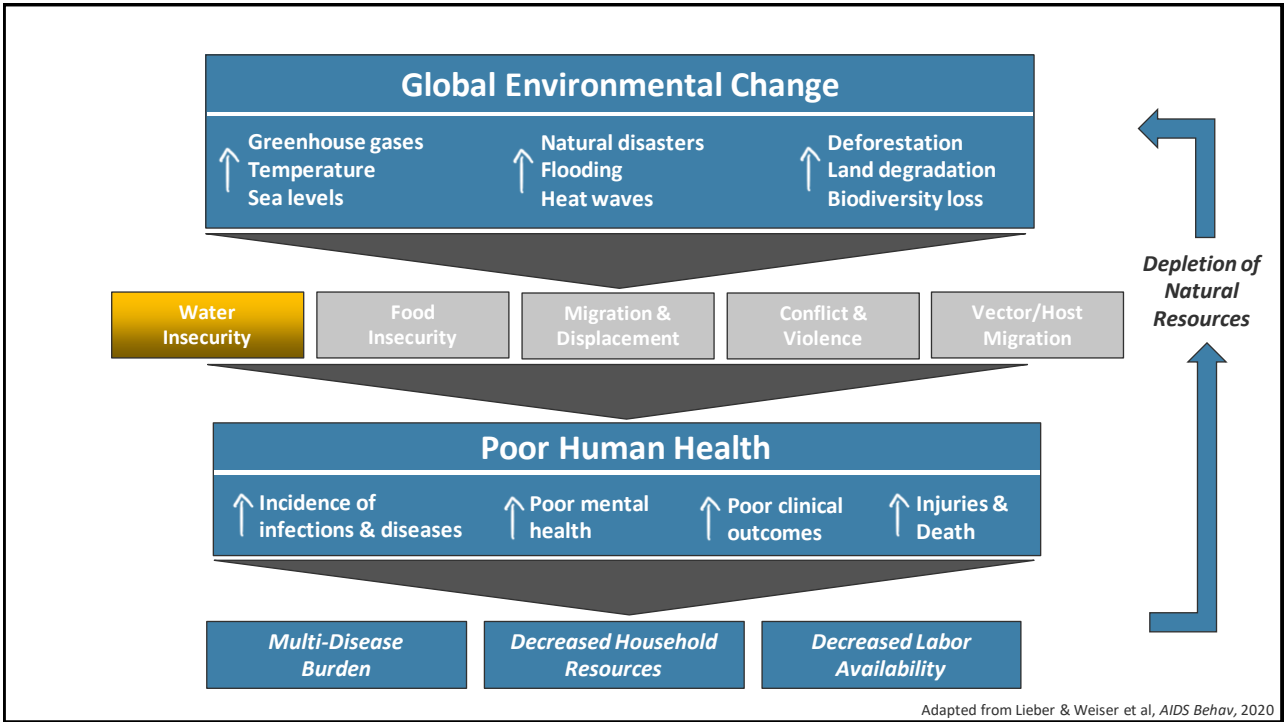
¹Brunkard et al, *Disaster Med Pub Health Prepared*, 2008 ; ²Faber, *Human Ecology*, 2015; ³Bajak (AP) & Ols (Houston Chronicle), 2018; AP, 2017; ⁴Levenson, 2017, CNN

23



Adapted from Lieber & Weiser et al, *AIDS Behav*, 2020

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CLIMATE CHANGE & HEALTH: WATER

By 2025, half of the world population will be living in water-stressed areas¹

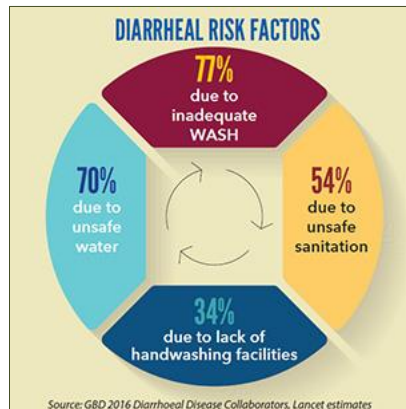
Water Quality, Amount & Accessibility – Impacts on Health²

- Dehydration
- Diarrheal disease & infections
- Undernutrition
- Maternal & newborn health
- Poor mental health/psychosocial stress
- Physical strain & injury
- Violence

¹Famiglietti, *Trend Magazine*, Spring 2019; ²Mills & Cumming (SHARE/UNICEF), 2016

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CLIMATE CHANGE & INFECTIOUS DISEASES: WATER STRESS & CONTAMINATION



Risk factors associated with diarrheal diseases are strongly linked with water availability

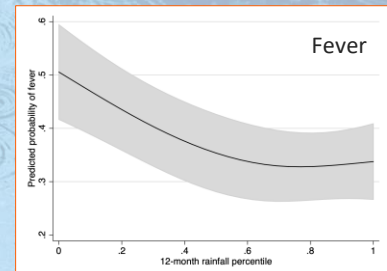
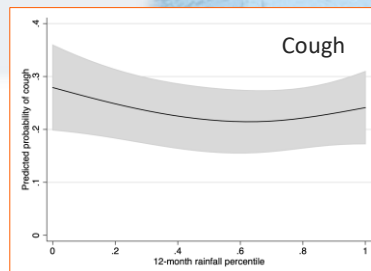
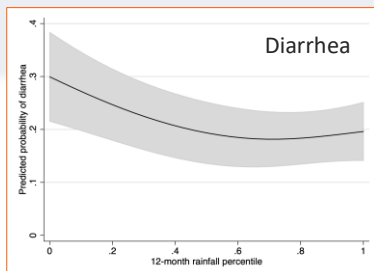
- Diarrheal diseases are 2nd greatest source of death & disability in LMICs
- 2nd leading cause of death in children < age 5
- Leading cause of malnutrition in children < age 5

Climate change may undermine progress made in reducing this significant burden of illness

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CLIMATE CHANGE & WATER INSECURITY: PRECIPITATION & INFECTIOUS DISEASE

- N=2,324 observations of children 0-24 months in Uganda
- Exposure: Rainfall deviation in past 12 months
- Outcomes: Caregiver-reported diarrhea, fever, and cough in past 2 weeks



Epstein et al, *Am J Trop Med Hyg*, 2020

28

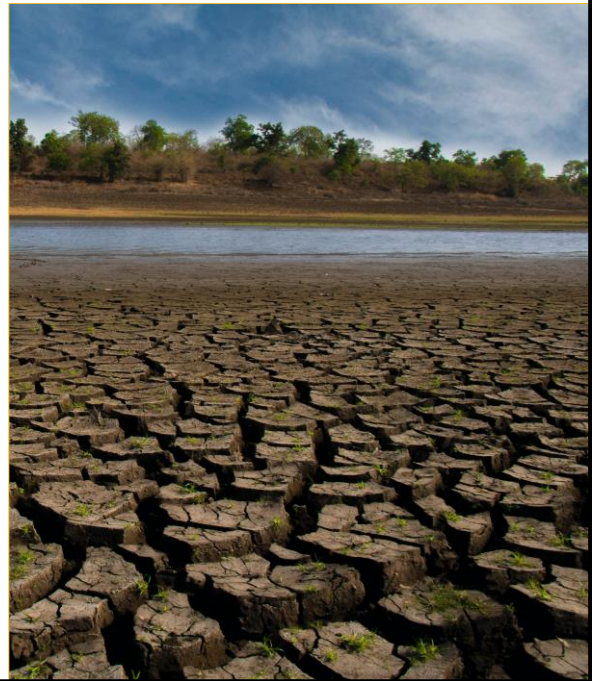
CLIMATE CHANGE & PRECIPITATION: HIV

DHS Data, 19 countries in SSA:

Each year of **drought** →
11% increase in HIV/AIDS prevalence¹

DHS Data, 23 countries in SSA

Each year of **extreme precipitation** →
14% higher odds of HIV and 11% higher odds of STD²



¹Burke et al, *Econ J*, 2015; ²Epstein, Nagata, & Weiser, *JAMA Open Network*, 2022

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CLIMATE CHANGE & HEALTH: FLOODING & INFECTIOUS DISEASE

- Increased **opportunistic infections** from cold, wet living conditions
- More **diarrhea outbreaks** from contaminated flood waters
- Increased incidence of **malaria** from standing flood waters
- All of these contribute to **worse HIV health**

“Even though we rarely face chronic diseases, **malaria and flu were common during this recent rainy season.** Malaria is more common now due to stagnant pools of water that breed mosquitoes during rains.”
[Woman, 39 years, Kenya]

Nicastro, Submitted, 2023

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CLIMATE CHANGE & HEALTH: FLOODING & CLINIC ACCESS

“When it rains, reaching such places is a challenge since the roads become muddy and impassable. Reaching Minyenya clinic is a hustle because the roads are in deplorable condition...The fare is hiked by motorcycle operators. It is very hard to find any means of transport.”
[Man, 40 years, Kenya]

Nicastro, IAS 2019

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CLIMATE CHANGE & HEALTH: DROUGHT & VACCINATION

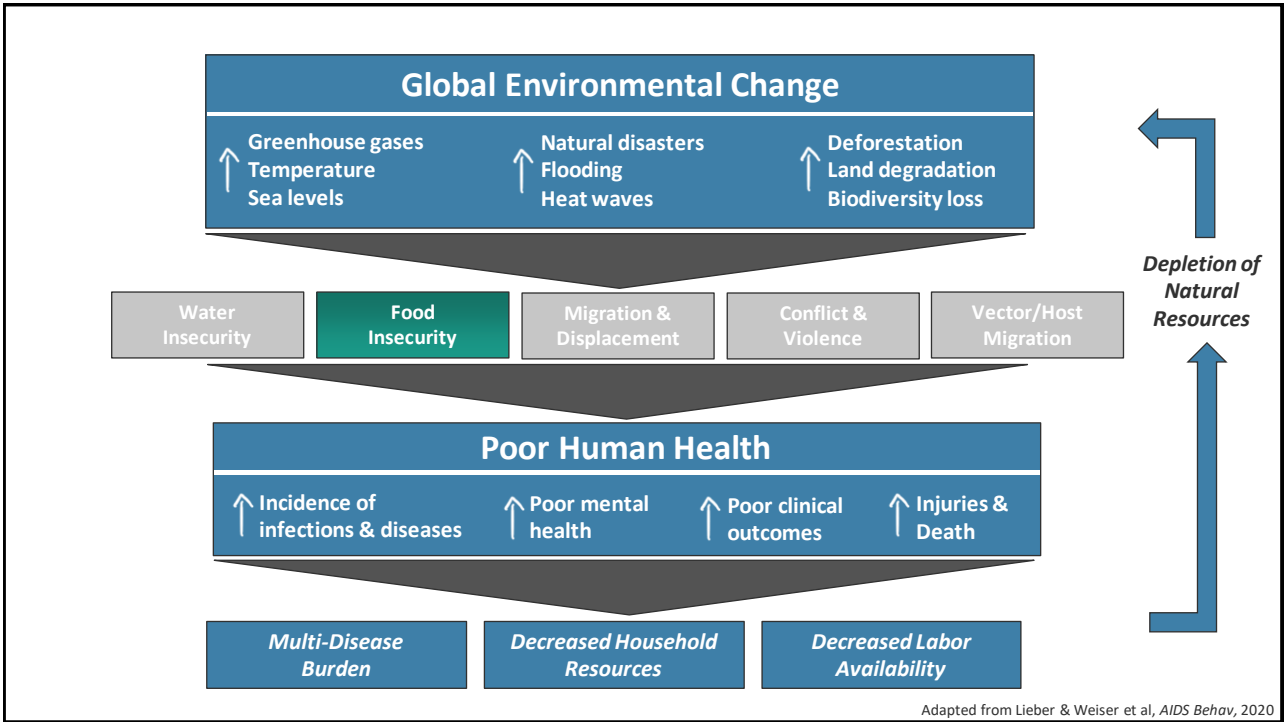
- Demographic and Health Surveys (DHS) data among 130,000 children from 22 SSA countries
- Exposure: Drought
 - <15% of 12-month rainfall from 30 years prior to survey
 - Assessed at birth (BCG, DPT, polio) and 12 mos (measles)
- Outcome: Vaccination status
 - Vaccination card or mother’s report

| Drought and Vaccination Coverage in sub-Saharan Africa | | | | |
|--|-------------------------|-------------------------|-------------------------|-------------------------|
| | BCG N=137,567 | | DPT N=114,138 | |
| | Unadj OR (95% CI) | Adj OR (95% CI) | Unadj OR (95% CI) | Adj OR (95% CI) |
| Drought | 0.83*** (0.78, 0.89) | 0.85*** (0.79, 0.90) | 0.89** (0.84, 0.95) | 0.90** (0.85, 0.96) |
| | Polio N=114,138 | | Measles N=90,331 | |
| | Unadj OR (95% CI) | Adj OR (95% CI) | Unadj OR (95% CI) | Adj OR (95% CI) |
| Drought | 0.92** (0.87, 0.97) | 0.92** (0.88, 0.97) | 0.87*** (0.82, 0.93) | 0.88*** (0.83, 0.94) |

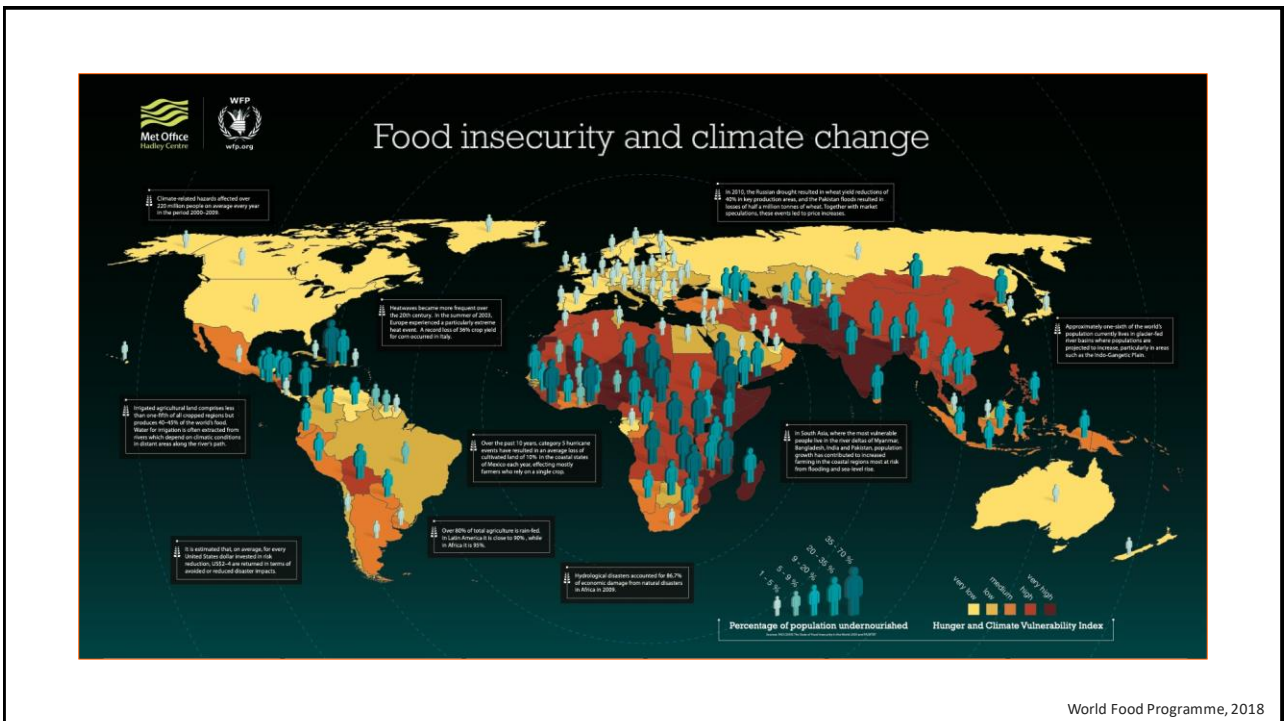
***p<0.001 **p<0.01 *p<0.05

Nagata, Epstein & Weiser, *PLoS Med*, 2021

32



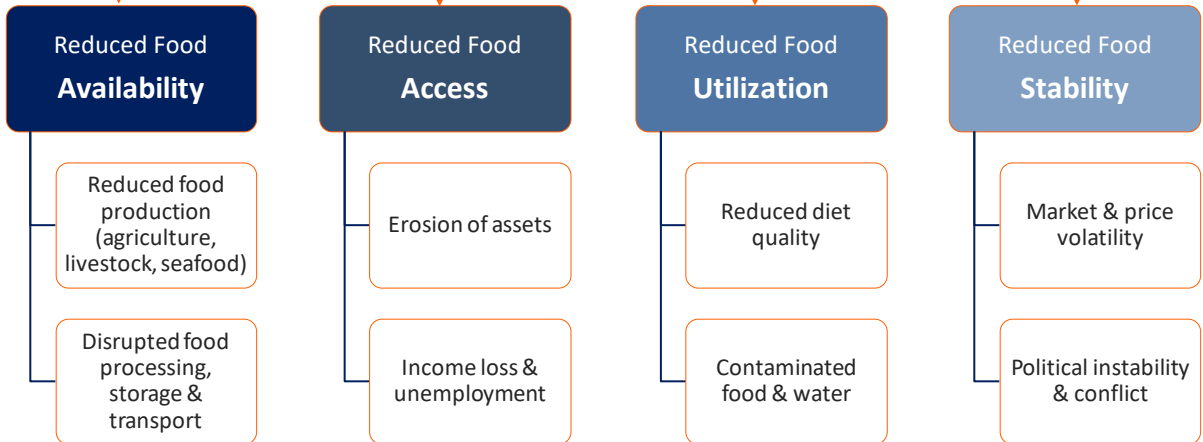
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CLIMATE CHANGE & HEALTH: FOOD INSECURITY

Climate change reduces consistent access to enough safe and acceptable foods for an active, healthy life.¹



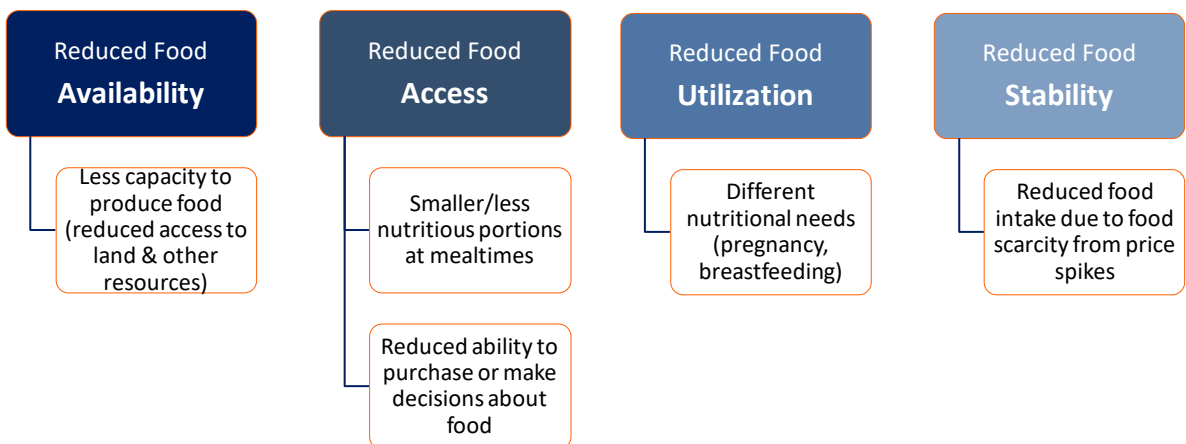
¹FAO, 2022; Wheeler & von Braun, *Science*, 2013; Schmidhuber, *PNAS*, 2007

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CLIMATE GAP:

GENDER DIMENSIONS OF FOOD INSECURITY

Climate change disproportionately reduces food security **among women.**



IPCC, 2019, Special Report on Climate Change and Land

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HEALTH IMPACTS: FOOD INSECURITY



Infectious Disease Risks

- Worse HIV cascade-of-care outcomes
- Higher acquisition risk¹
- Higher viral loads & lower CD4 counts²⁻³
- More acute care use⁴
- Poor ART adherence⁵ & engagement in care⁶
- Higher morbidity⁷ & mortality⁸
- Sexually transmitted infections^{1, 9-10}
- Higher Ebola virus disease mortality¹¹

Chronic Disease Risks

- Hyperlipidemia¹² & Hypertension¹²
- Diabetes¹³ & poor diabetes control¹⁴⁻¹⁵
- Non-alcoholic fatty liver disease¹⁶
- Obesity/Malnutrition¹⁷⁻²⁰
- Coronary artery disease²¹⁻²²
- Chronic kidney disease²³
- Obstructive airway disease²⁴

Neurologic and Mental Health Problems

- Neurocognitive decline²⁵
- Depression²⁸
- Substance abuse³⁰
- Migraines²⁶
- Stress, anxiety & PTSD²⁹
- Smoking³¹
- Poor sleep health²⁷

¹Palar et al, *AIDS*, 2016; ²Spinelli et al, *AIDS Behav*, 2017; ³Weiser et al, *AIDS*, 2013; ⁴Weiser et al, *J Gen Intern Med*, 2013; ⁵Leddy et al, *Clin Infect Dis*, 2020; ⁶Palar et al, *IAPAC*, 2017; ⁷Weiser et al, *AIDS*, 2012; ⁸Weiser et al, *JAIDS*, 2009; ⁹Tsai & Weiser, *AIDS Behav*, 2014; ¹⁰Tsai et al, *PLoS Med*, 2012; ¹¹Kelly et al, *Am J Trop Med Hyg*, 2018; ¹²Seligman et al, *J Nutr*, 2010; ¹³Nagata et al, *J Gen Intern Med*, 2019; ¹⁴Berkowitz et al, *Diabetes Care*, 2013; ¹⁵Berkowitz et al, *JAMA Intern Med*, 2015; ¹⁶Golovaty et al, *J Nutr*, 2019; ¹⁷Sirotnin et al, *PLoS One*, 2014; ¹⁸Rose & Oliveira, *Am J Public Health*, 1997; ¹⁹Lee & Frongillo, *J Nutr*, 2001; ²⁰Dixon et al, *J Nutr*, 2001; ²¹Palakshappa et al, *J Gen Intern Med*, 2019; ²²Stupplebeen, *Prev Chronic Dis*, 2019; ²³Crews & Powe, *Amer J Nephrol*, 2014; ²⁴Nagata & Weiser, *J Gen Intern Med*, 2019; ²⁵Tan et al, *AJCN*,

37

CLIMATE CHANGE & FOOD INSECURITY: NUTRITION

Micronutrient Deficiencies



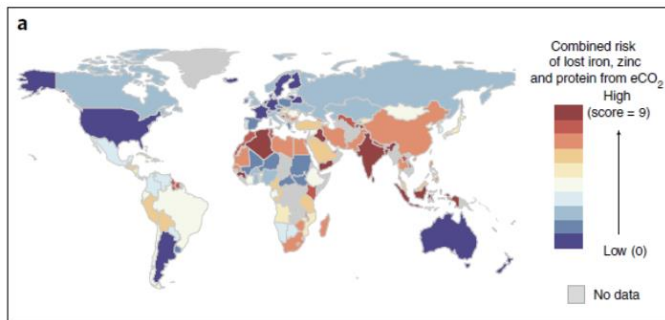
High CO² levels →
Nutrient changes in food crops¹⁻³



Pollinator declines →
Reduced fruit, nut & seed, vegetable intake⁴



Fishery declines →
Reduced fish consumption⁵

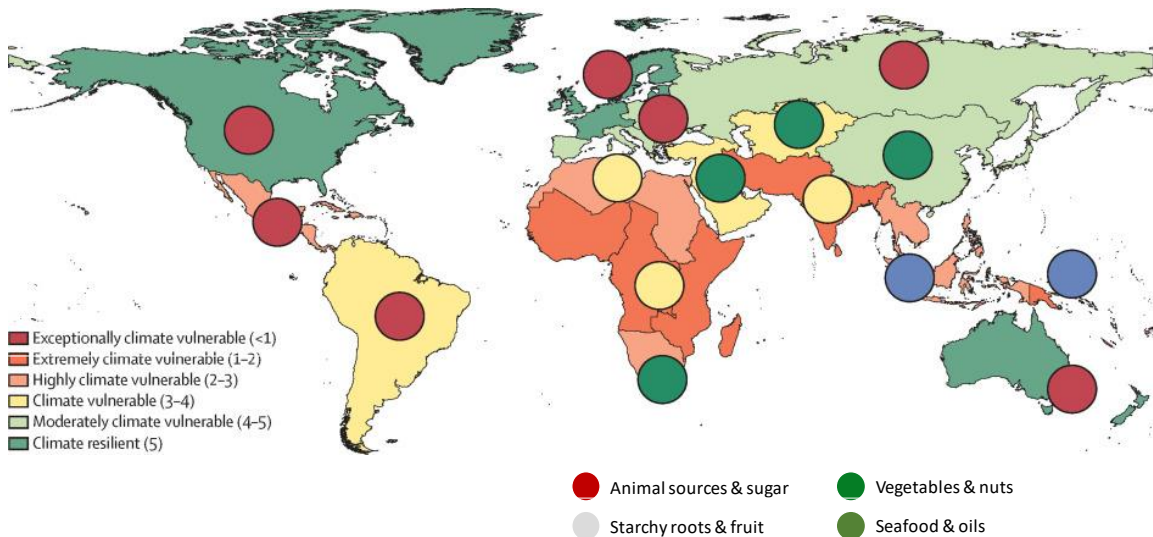


Smith & Myers, 2018

¹Smith & Myers, *Nat Clim Change*, 2018; ²Myers et al, *Nature*, 2014; ³Medek et al, *Environ Health Perspect*, 2017; ⁴Smith et al, *Lancet*, 2015; ⁵Golden et al, *Nature Comm*, 2016.

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CLIMATE CHANGE & FOOD INSECURITY: FOOD SUPPLY



Green et al., *Lancet Planetary Health*, 2022

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CLIMATE CHANGE & FOOD INSECURITY: NUTRITION

Systematic review/meta-analysis on climate change and malnutrition^a

- Drought → malnutrition in children & adults

Wasting

OR: 1.46
(95% CI: 1.05, 2.04,
 $p < 0.000$)

Underweight Prevalence

OR: 1.46
(95% CI: 1.01, 2.11,
 $p < 0.000$)

- Prediction model: climate change to increase malnutrition prevalence by >50% by 2050

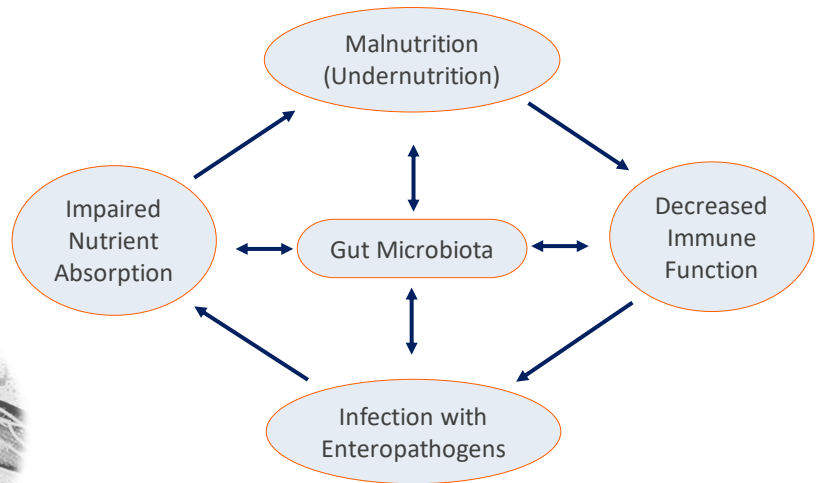
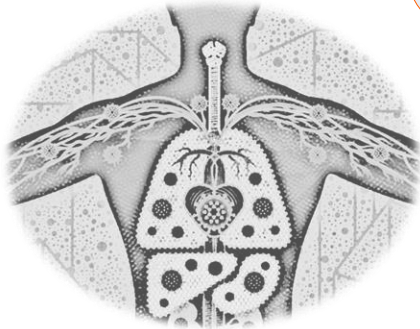
“Weather changes affects yield on my farm. Too much rain or drought interfere with the growth of plants and lowers the quality of yields... **This interferes with our children’s growth** since they are forced to eat food that are difficult to chew.”
[Woman, 54 years, Kenya^b]

“Recent rains and floods damaged all farm crops leading to scarcity at home and **increased prices** at the market. The **roads are flooded** so I can’t take anything to market to sell so my income is affected. Last year, the **rains destroyed all of our crops** which is the only way we get income, so we couldn’t buy any food or anything else.”
[Woman, 32 years, Kenya^b]

^aLieber, Weiser et al, *Glob Pub Health*, 2020; ^bNicastro, IAS, 2019

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DIET QUALITY & NUTRITION: MICROBIOME

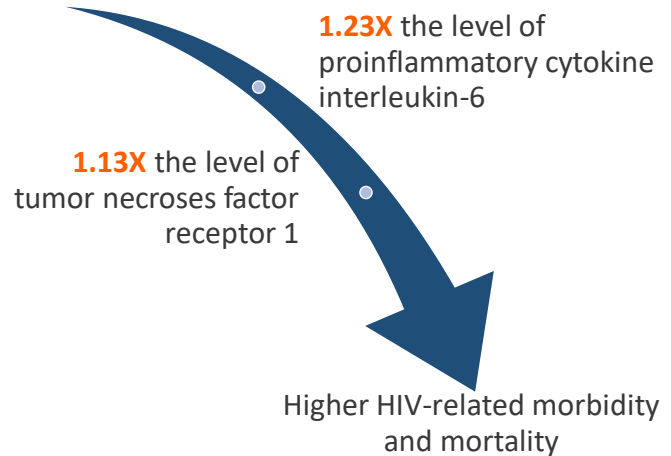


Kau et al, *Nature*, 2011; Leddy et al, *JID*, 2019; Image: Anna and Elena Balbusso/UCSF

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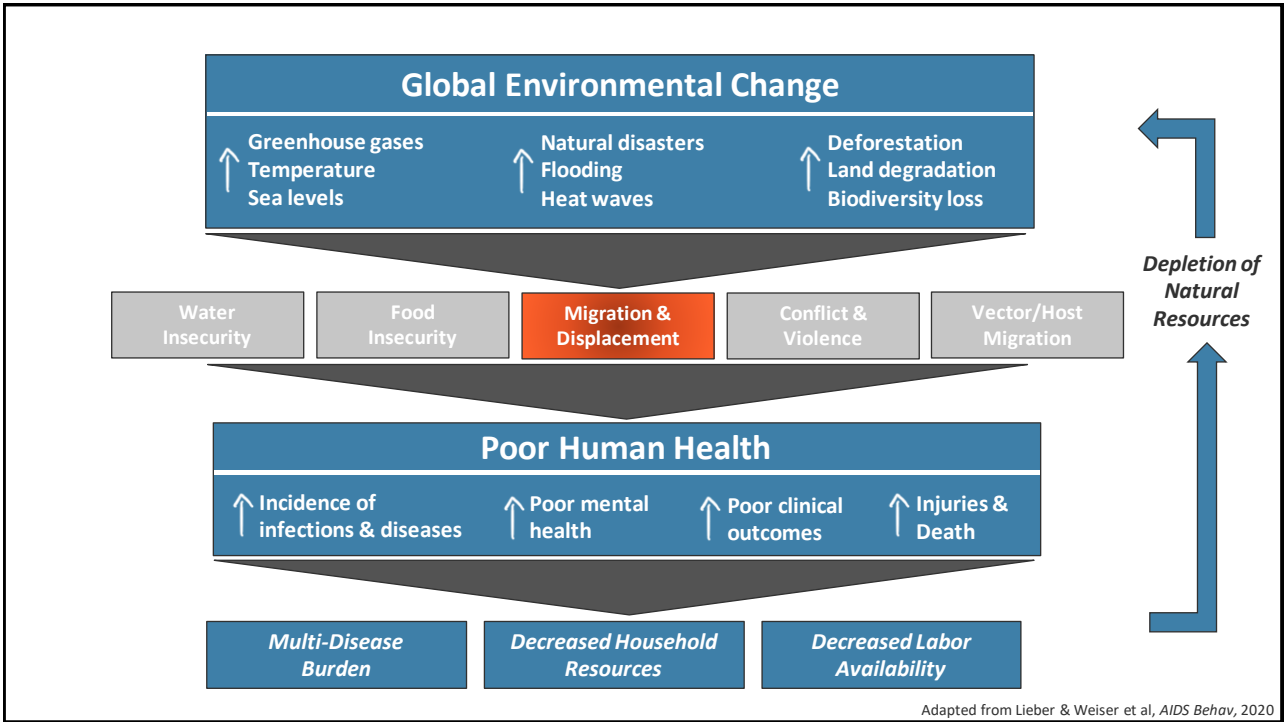
FOOD INSECURITY, INFLAMMATION AND HIV OUTCOMES

Food Insecurity among U.S.
Women Living with HIV



¹Leddy & Weiser, *J Infect Dis*, 2019; ²Decrion et al, *Curr HIV Res*, 2005

42

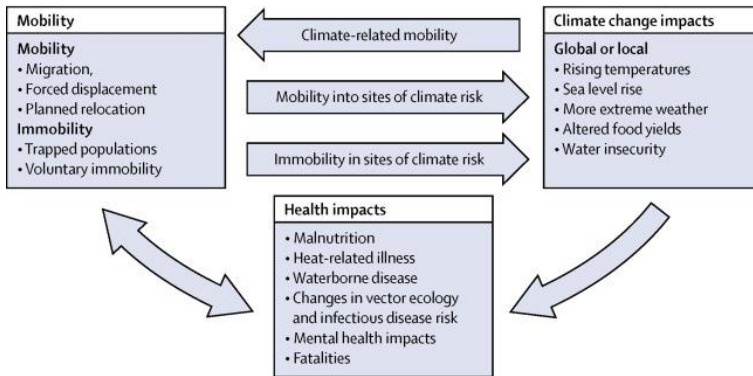


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CLIMATE CHANGE: IMPACTS ON MOBILITY



Social, economic, political, demographic, and environmental context



Climate change influences migration **directly** and via **threat amplification**¹

McMichael, Lancet Planet Health, 2020

¹Parrish et al, Int J Environ Res Pub Health, 2020

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HEALTH IMPACTS: MIGRATION¹⁻²



Infectious Disease Risks

- Increased HIV incidence & poor engagement in care³
- Sexually transmitted infections
- Infectious disease outbreaks
- Higher mortality

Chronic Disease Risks

- Increased chronic disease incidence
- Worse chronic disease outcomes

Other Health Risks

- Food & water insecurity
- Poor mental health
- Substance use, alcoholism
- Gender-based violence
- Increased maternal mortality
- Poor access to health services
- Injuries
- Increased mortality

Potential for Health Benefits

- Survival
- Safety from violence or conflict
- Reduced food & water insecurity
- Access to health care

¹McMichael et al, *Environ Health Perspect*, 2012; ²Schwerdtle et al, *BMC Med*, 2018; ³Camlin & Charlebois, *Curr HIV/AIDS Rep*, 2019

45

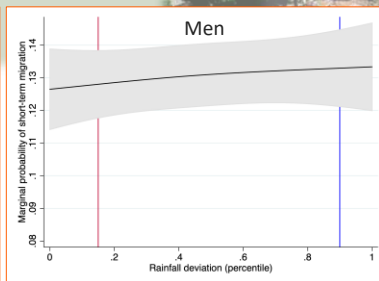
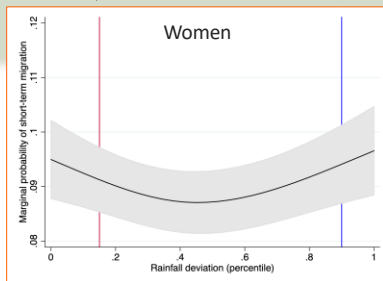
CLIMATE CHANGE & HEALTH: MIGRATION

DHS data from 23 countries in SSA¹

Rainfall deviation in past 12 months →
Higher odds of short-term migration among women

Drought

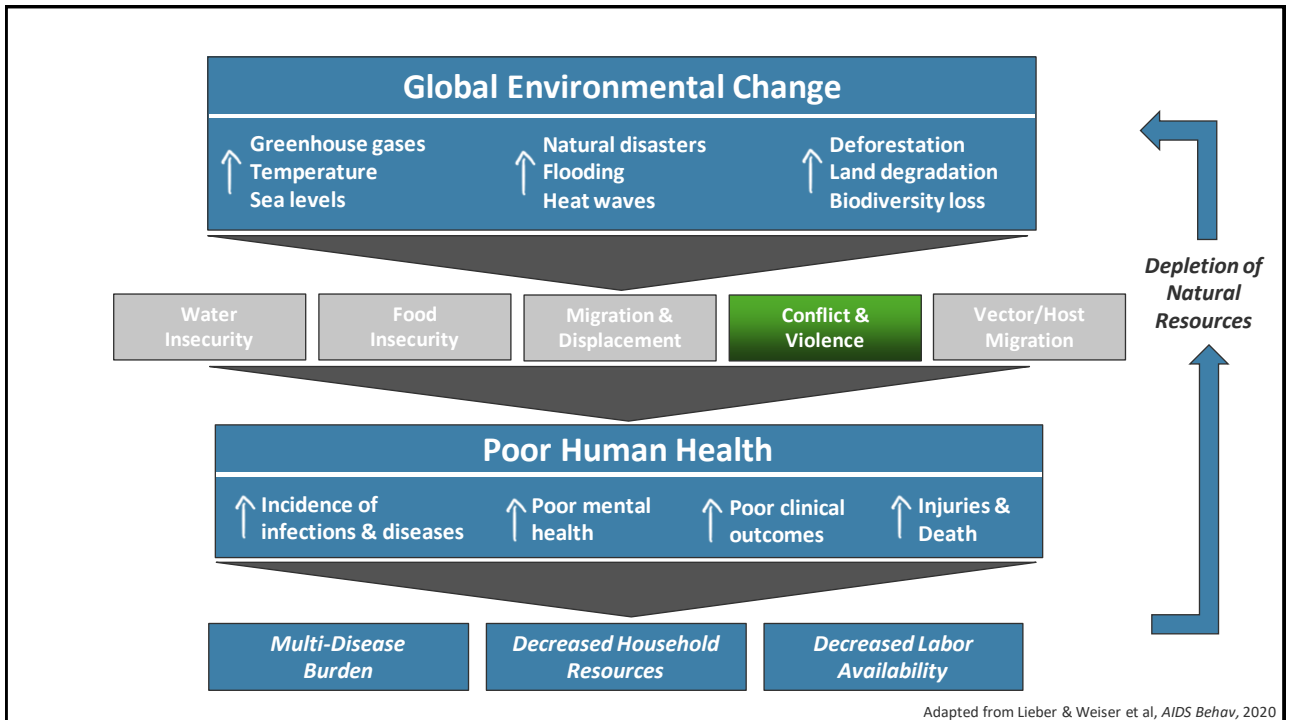
Extreme Rain



“Floods have increased because you find when it rained last--places like Modi (a place just within our village) were so affected to an extent that **those who live there were forced to relocate to other places...**There were some homes that were destroyed completely.”²

¹Epstein & Weiser, *BMC Public Health* 2023; ²Nicastro, submitted 2023

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CLIMATE CHANGE & HEALTH: VIOLENCE

Adjusted associations between severe drought & moderate/mild drought and IPV among women aged 15-49 in 19 SSA Countries (N = 83,990).

| | At least 1 control issue | Emotional Violence | Physical Violence | Sexual Violence |
|------------------------------|--------------------------|--------------------|---------------------|---------------------|
| Exposure | Adjusted | Adjusted | Adjusted | Adjusted |
| No Drought | REF | REF | REF | REF |
| Moderate/Mild Drought | 1.00 (0.95, 1.06) | 1.02 (0.96, 1.08) | 1.14** (1.05, 1.25) | 1.19** (1.07, 1.32) |
| Severe Drought | 1.15*** (1.06, 1.26) | 1.02 (0.93, 1.12) | 1.17* (1.03, 1.34) | 1.33** (1.12, 1.59) |

Coefficients are presented as odds ratio estimates from logistic regression models with 95% confidence intervals in parentheses. Adjusted for age category, literacy, marital status, number of births, household size, rural, husband/partner's age, and husband/partner's education. Standard errors are clustered at the EA level.

Asterisks denote level of significance ***p<0.001 **p<0.01 *p<0.05

Epstein & Weiser, *PLOS Med*, 2020

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CLIMATE CHANGE & HEALTH: VIOLENCE

Associations between disasters triggered by climate change and natural hazards and violence against women and girls¹

| Exposure | Setting | Effects |
|-------------------------------|---------|--|
| Heat waves | Spain | Increased risk of IPV (RR=1.12; p<.001) & IP femicide (RR=1.40; p=.048) |
| Hurricanes (multiple studies) | USA | Increased odds of physical (OR=3.19; p<.01) or sexual assault (OR=3.73; p<.01); 5-8X odds of IPV; increased lifetime IPV prevalence 1 year (12.5%) & 2 years (34.4%) postdisaster (p=.001) |
| Tsunamis | India | Higher odds of IPV in states severely (OR=1.98; p<.001) & moderately (OR=1.85; p<.001) affected |

¹Thurston et al, *BMJ Glob Health*, 2021

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CLIMATE CHANGE & HEALTH: INTIMATE PARTNER VIOLENCE

High ambient temperature associated with higher IPV against women

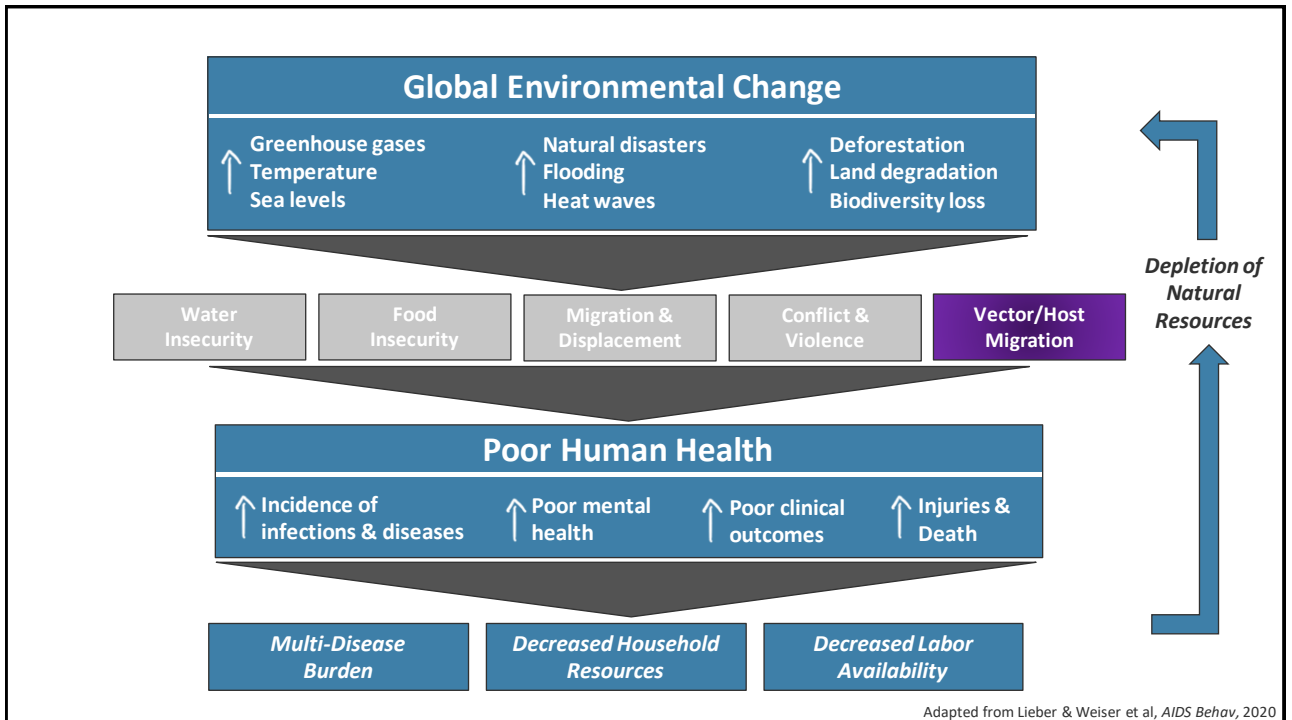
- 1°C increase in average annual temperature is correlated with a rise of more than **6%** of incidents of physical and sexual violence across India, Pakistan and Nepal
- Extreme heat is correlated with higher levels of stress, increases aggression, and exacerbates mental illness

Image: National Geographic



Zhu et al, *JAMA Psych*, 2023

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CLIMATE CHANGE & INFECTIOUS DISEASES: CHANGES IN VECTOR ECOLOGY & BIOLOGY



Vectors tend to prefer a warmer world:

- Rising temperatures accelerate viral replication, reduce incubation periods, increase biting, lengthen breeding periods & viral seasons
- Changing meteorological conditions expand or shift geographic range of vectors.
- Precipitation extremes increase availability of standing water for mosquito breeding

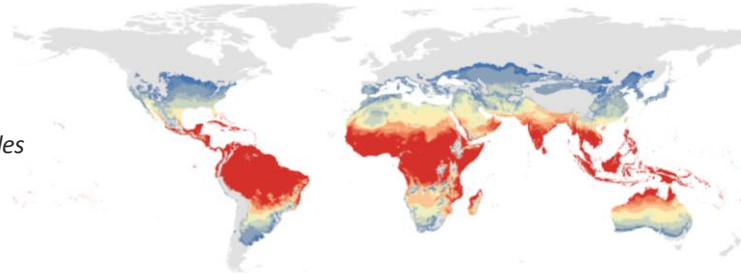


Rocklöv & Dubrow, *Nature Immunology*, 2020

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CLIMATE CHANGE AND VECTOR-BORNE ILLNESS

Current worldwide distribution of the *Aedes aegypti* mosquito



Projected worldwide distribution in 2080 of the *Aedes aegypti* mosquito under current emissions

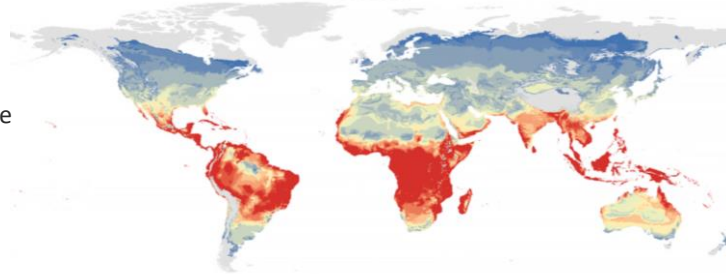


Image credit: Sadie Ryan via *Stanford News*

Erin Mordecai via *Stanford News*

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CLIMATE CHANGE & ZIKA VIRUS

- Zika outbreak in South America 2015-2016
 - related to background climate change combined with El Nino
- PNAS study: Mathematical modeling to simulate how climate-related factors affect the spread of Zika observed data for 1950-2015
- The risk of Zika transmission was higher in 2015 than at any time during the 1950-2015 period



Caminade, *PNAS*, 2017

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CLIMATE CHANGE & *ANOPHELES* DISTRIBUTION

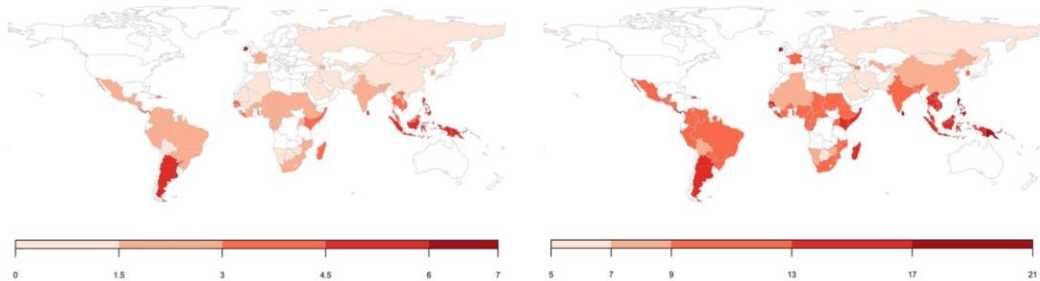


Fig. 5. Projected impact of climate change on malaria mortality; all-age (left-panel) and ages 0–4 (right-panel): Change in malaria mortality due to temperature change (RCP 8.5) by the end of 21st century. The median change in all-age malaria is projected to be 2.5% (maximum increase of 6.2%); while the median increase in child malaria mortality is projected to be 11.4%, with a maximum of 20.3%. Projections are computed using a population-weighted average of country-level temperature change under RCP 8.5.

Estimated global optimal temperature beyond which all age mortality increases is 20.8°C; for children 19.3°C

Dasgupta 2018 Int J Hyg and Env Health

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CLIMATE CHANGE AND ZOOONOTIC DISEASE

New & increased opportunities for **viral spillover**



- Geographic range
- Population density
- Pathogen spread

Increased **pathogen transmission**



- Heightened physiological stress in animals
- Pathogen load
- Viral mutation



Photo Credit: Stephen Belcher/Minden Pictures/FLPA via Nature

Rodó et al, *Nat Med*, 2021; Beyer et al, *Sci Total Environ*, 2021

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Advance **knowledge** on climate-health-equity links

Build health-based climate **adaptation & resilience**

Ensure **healthy & equitable** transition to clean economy

Advance **health equity & climate justice**

CLIMATE, HEALTH, EQUITY: RECOMMENDATIONS FOR DHHS

Achieve **climate-ready health systems**

Build a **climate-ready health workforce**

Educate **public & policy makers** on climate-health-equity links

Link climate change to **global health security**

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SHAMBA MAISHA

Farming for Life

Co-leads: Weiser, Cohen, Bukusi

Overview

- Adults living with HIV
- Targets root causes of FI and poverty
- Adaptive to climate change

Intervention Components

1. Finance loan
2. Kickstart human-powered water pump
3. Agricultural & finance training



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LEVERAGING SYNERGIES: WATER & FOOD INSECURITY, HIV, EMPOWERMENT



- Improved food security ($p < 0.001$)
- Decreased depression ($p < 0.001$)
- Improved self confidence ($p = 0.001$)
- Reduction in HIV stigma/discrimination ($p < 0.001$)
- Improved Social Support ($p < 0.001$)
- Improved Physical Health Status ($p = 0.02$)
- Improved women's empowerment (sexual relationship power, decision-making, gender role-conflict scale ($p < 0.001$))

"I used to be violent... **The violence would mostly relate to money issues and this is the root cause in many homes...**but right now my wife manages the farm and takes it as hers...so she has some few coins in the pockets and if I need some money...I can always ask her. So it has taken care of some form of domestic violence to some a very big extent..."

[Male participant, 42 years]

Cohen, Bukusi & Weiser, JAMA Open Network, 2022
Zakaras et al, Arch Sex Behav, 2016

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LEVERAGING SYNERGIES: URBAN GARDENING, CHRONIC DISEASE

Valley Verde: Urban garden intervention for migrant populations living with HIV or diabetes/pre-diabetes in San Jose, California

- 45-person qualitative study
- Intervention improved diet, exercise, stress/mental health, weight control, and management of chronic diseases.

“We’re cooking new things, losing weight, feeling healthier. We got blood pressures down. My oldest [daughter] was at risk for childhood diabetes. That’s gone....”

Nutrition

“Having the garden has gotten me through some pretty tough times..it’s like therapy. I got out there and I just garden and I plant. I find it very therapeutic...”

Mental Health

“We do more [exercise] because before we would just finish dinner and sit down and watch TV, and now we don’t. Now we go outside and cut the grass...clean up the garden...”

Health Behaviors

Palar et al, *J Nutr Educ Behav*, 2019

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LEVERAGING SYNERGIES: OCEAN FARMING & WOMEN’S EMPOWERMENT



BBC World Service, 2018

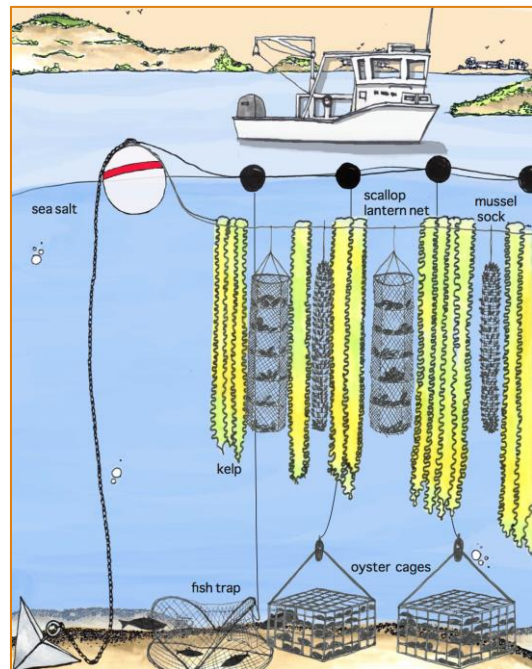


Illustration by Stephanie Stroud

NOAA, 2020; Gertz, IDEAS.TED.COM, 2017; Ash, BBC World Service, 2018

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LEVERAGING SYNERGIES: CLEAN COOKSTOVES, CHRONIC HEALTH & WOMEN'S EMPOWERMENT

>3B people burn biomass for cooking and warmth

→ 1/5 of world's black carbon (BC)¹

Transition to **clean cookstoves** yields triple benefit:

1. Decreased health burden
2. Reduced greenhouse gas emissions
3. Improved gender equality

Project Surya (India)

- Clean stoves → 40% reduction in BC during cooking²
- Conversion of stove usage into climate credits paid directly to women³

Other Studies

- Improved respiratory health-related quality of life⁴
- Reduced COPD & respiratory symptoms in women⁵



Project Gaia via Clean Cooking Alliance

¹Project Drawdown, *Improved Clean Cookstoves*; ²Patange et al, *Environ Sci Technol*, 2015; ³Ramanathan et al, *Nat Clim Change*, 2017; ⁴Alexander et al, *J Pub Health*, 2014; ⁵Thakur et al, *Thorax*, 2018

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RETROFITTING CEILINGS IN CAPE TOWN

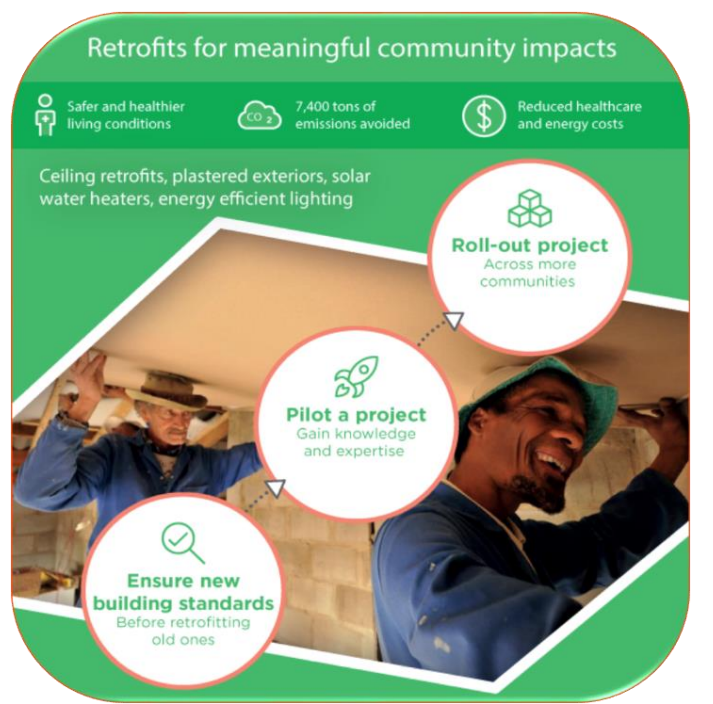
Focus: Low-income communities, extreme temperatures, and health impacts

Co-benefits

Mitigate: Susceptibility to TB and other illnesses

Mitigate: Energy efficiency buildings; 7400 tons of CO₂ each year saved

Source: City of Cape Town



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RECYCLING SEWAGE WATER INTO DRINKING WATER

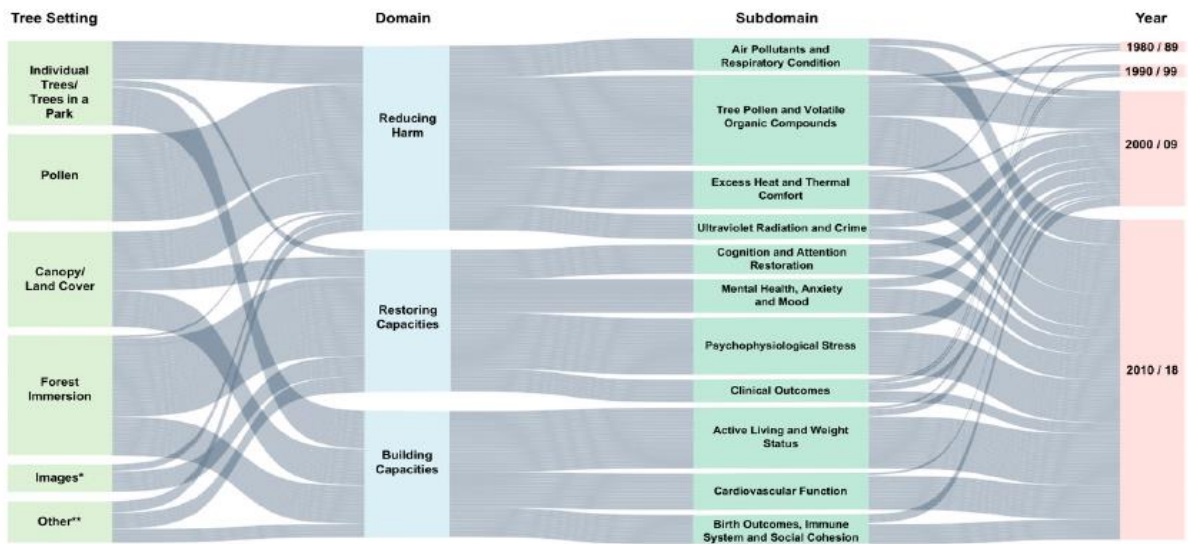


Image Credit: Los Angeles Times

- Drought-prone states including California, Colorado and Texas have recently approved **potable water reuse**.
- After its intensive treatment and purification process, the water may be the **highest quality, cleanest drinking water** available to the public.

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Nature Based Solutions and Health



*Images (e.g. photographs, video, constructed images, simulations)
 **Other (e.g. Volatile Organic Compounds, moss, multiple settings)

Urban Trees and Human Health: A Scoping Review, Wolf et al 2020

Figure 2. Scoping review of city trees and human health—synthesis of 201 studies.

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WHY CLIMATE CHANGE & HEALTH: WHY DOES THE HEALTH SECTOR HAVE A ROLE IN CLIMATE ACTION?

- Natural advocate for health benefits of action
- Potential to be community anchor for health
- Powerful lever to reduce emissions
- Mission to heal: first, do no harm



Image credit: The Medical Society Consortium on Climate & Health

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THE HEALTH RESPONSE

Growing momentum of health professionals' engagement

Health system adaptation

The rising up of the healthcare sector

Divestment

Clinical care

Media attention

Education

Policy/advocacy

Research

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LEVERAGING EDUCATION TO ADVANCE CLIMATE-HEALTH ACTION



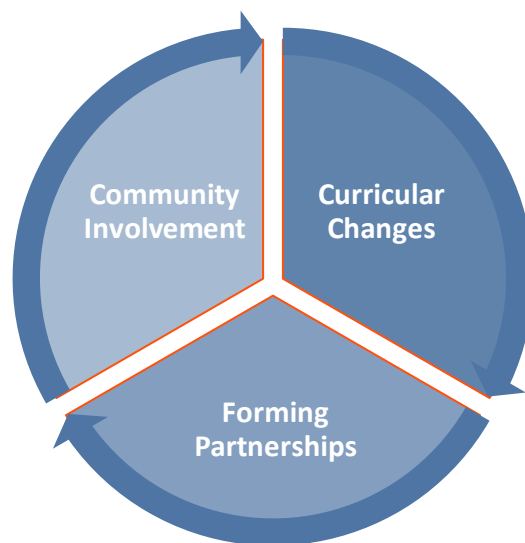
Image Credit: Pew Research Center

- Education is a core solution
- Education and societal change
- The vital role of the educational institution
- Environmental accountability

Hillygus, *Political Beh*, 2005; Pearson et al, *Med Teach*, 2018; Teherani et al, *Med Ed Online*, 2017; Wellbery et al, *Acad Med*, 2018

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COMMUNITY-ENGAGED CLIMATE HEALTH AND JUSTICE EDUCATION



Teherani et al, 2020

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Climate and Health (CH) Faculty Development Initiative

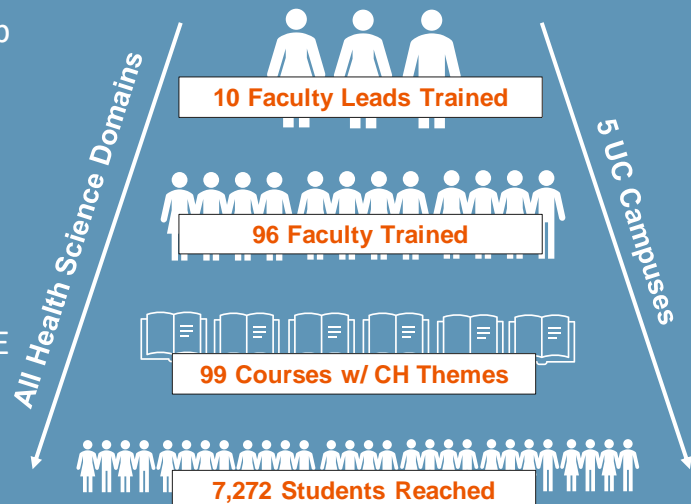
Goals: Advance UC leadership in CH education; educate health professional students on climate-health links

Model: Train the Trainer

Objectives:

Teach faculty to integrate SHE themes into courses

Build community of faculty educators & online tools



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CLIMATE & HEALTH EDUCATION: INNOVATIONS AND TRAINING PROGRAMS

Planetary Health Report Card

Global Consortium on Climate and Health Education (GCCHE)

Association for Medical Education in Europe

NURSuS



Photo Credit: Sarah Schear/UCSF

Physician Fellowships in Climate Medicine (U Colorado)
National Climate and Health Policy Fellowship (U Colorado)
Climate & Human Health Fellowships (BIDMC)
Climate & Health Organizing Fellows (CHA)
Climate and Health Equity Fellowship (MSCCH)

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VALUES TO GUIDE ACTION ON CCHE

- ⌘ Research acknowledges, repairs structural discrimination
- ⌘ Measure success for the most effected
- ⌘ Justice and equity – starting point
- ⌘ Center voices and solutions
- ⌘ Foster healing and repair
- ⌘ Take a solidarity-driven approach

Deivanayagam, et al., Lancet, 2023

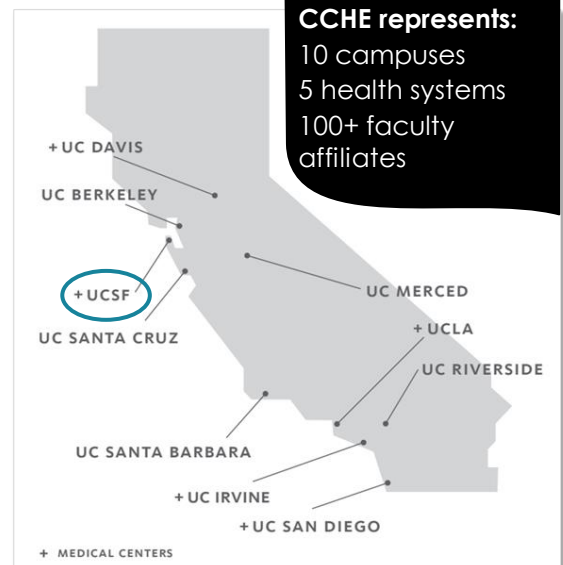
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Advance equitable and just climate solutions that promote **human health and a healthy planet**

Founded in 2020, Based at UCSF



UNIVERSITY OF CALIFORNIA Center for Climate, Health and Equity



<https://climatehealth.ucsf.edu/>

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Leveraging the Power of Education to Incite Change

- Trained >100 faculty in CHE & reached 7,000 students
- New courses: climate justice
- Wildfire patient care materials (English, Spanish, Mandarin)
- Sustainable development for health fellowship in Kenya

Generating Actionable Evidence for Policy & Community Needs

- Climate-adaptive interventions in Kenya & California
- Seed grant program (46 LOIs)
- Climate & Health Data Dashboard for California

Challenging Healthcare Sector to Become Climate Smart

- Decarbonizing UC Hospitals (desflurane gas & nitrous oxide reductions)
- Clinical Sustainability Fellowship

<https://climatehealth.ucsf.edu/>

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TAKE HOME MESSAGES

- Climate change is an unprecedented threat to health & equity
- Climate-health impacts occur along several pathways
- Opportunities for solutions that are co-beneficial to climate, health, & equity



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Thank you



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