Climate Determinants of Health, Racial Discrimination, and Our Future

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M | PUBLIC HEALTH

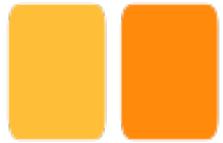# Envision the future:
Health & justice as a core values

The routine outcome of our environmental laws and policies at all levels of government must be equal protection, not environmental inequalities.

Overview

- What the science says
  - Climate determinants of health
- Cumulative risk frameworks
  - Health equity and solutions

What the science says
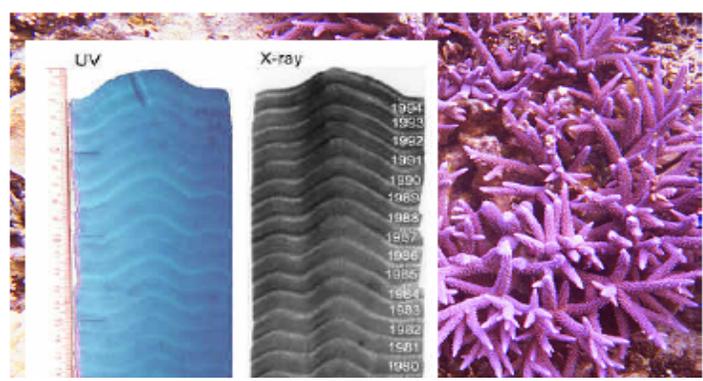
Climate Determinants of Health

"The world's climate system is fundamental to our life-support."
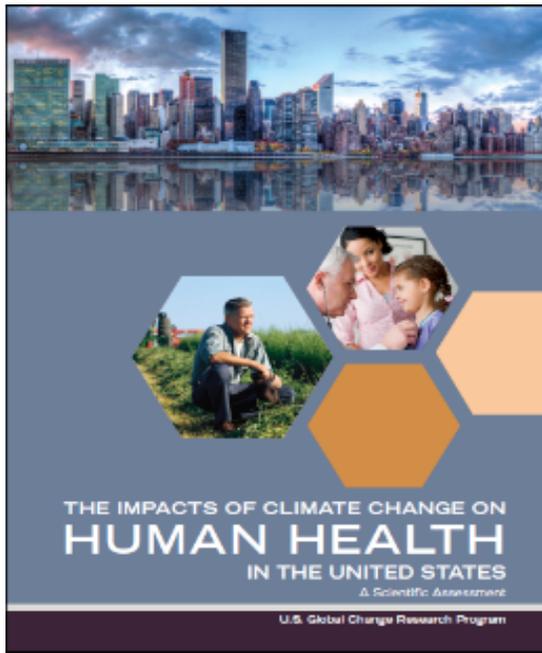
World Health Organization 2003
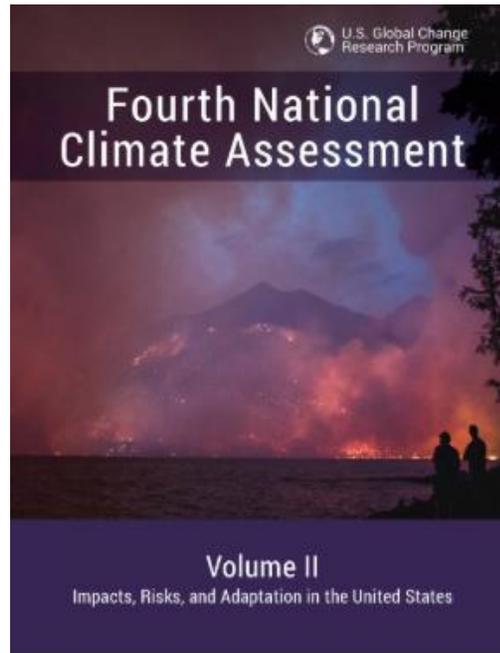
Warming: Measuring Previous Climate

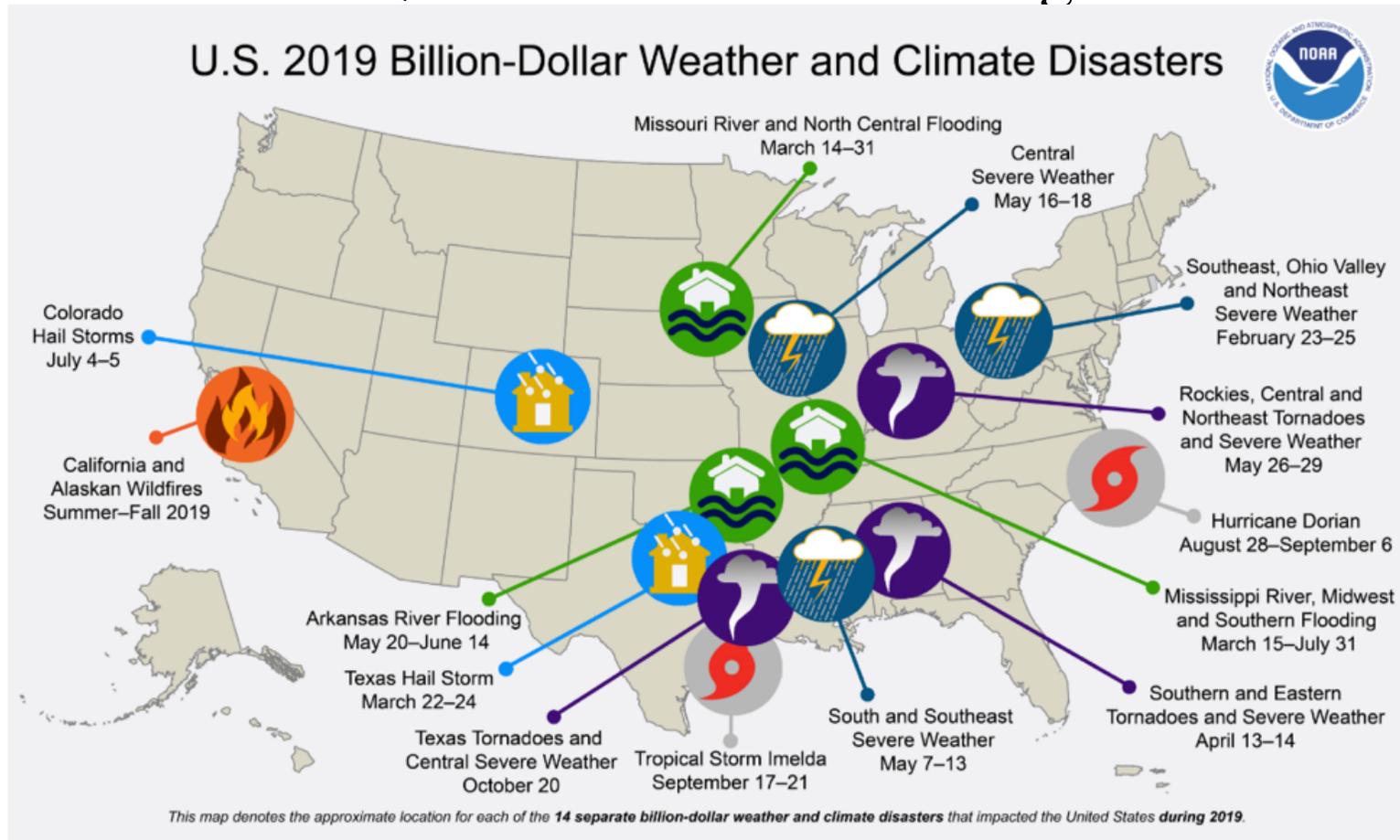# Climate Change: Key Authoritative Reviews

https://health2016.globalchange.gov/

www.nca2018.globalchange.gov

IPCC 1.5 Degree C

Significant Impacts : 258 Climate-related Disasters $1.75 Trillion in Damages

U.S. 2019 Billion-Dollar Weather and Climate Disasters

Missouri River and North Central Flooding March 14–31

Central Severe Weather May 16–18

Southeast, Ohio Valley and Northeast Severe Weather February 23–25

Colorado Hail Storms July 4–5

California and Alaskan Wildfires Summer–Fall 2019

Rockies, Central and Northeast Tornadoes and Severe Weather May 26–29

Hurricane Dorian August 28–September 6

Mississippi River, Midwest and Southern Flooding March 15–July 31

Arkansas River Flooding May 20–June 14

Texas Hail Storm March 22–24

Texas Tornadoes and Central Severe Weather October 20

Tropical Storm Imelda September 17–21

South and Southeast Severe Weather May 7–13

Southern and Eastern Tornadoes and Severe Weather April 13–14

This map denotes the approximate location for each of the **14 separate billion-dollar weather and climate disasters** that impacted the United States *during 2019*.

Source: NOAA

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Houghton, Michigan, Father's Day Flood, June 2018
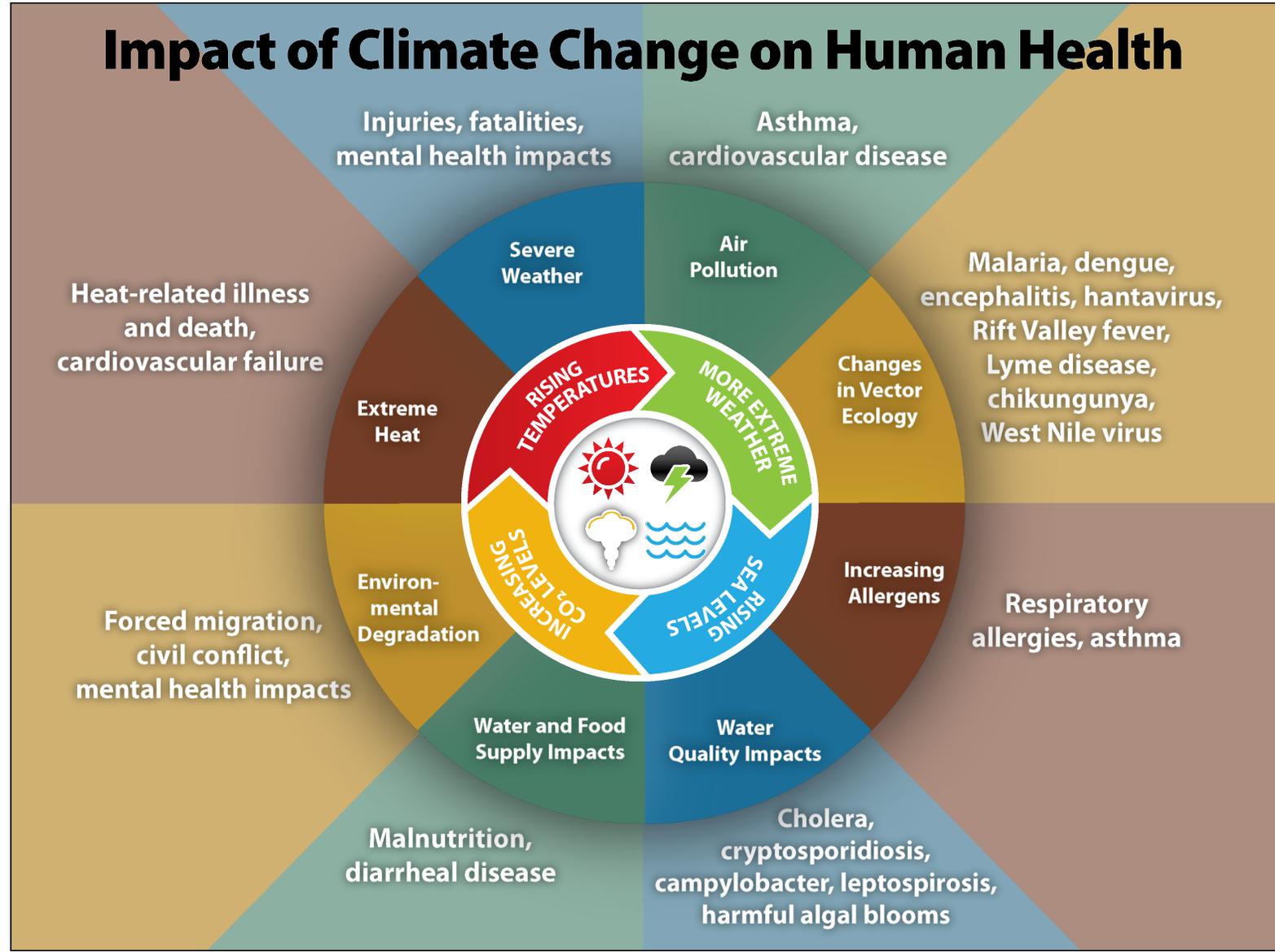

Photo Credit: Sonya Lampre
Detroit Free Press

Houghton

Impact of Climate Change on Human Health

Source: Centers for Disease Control
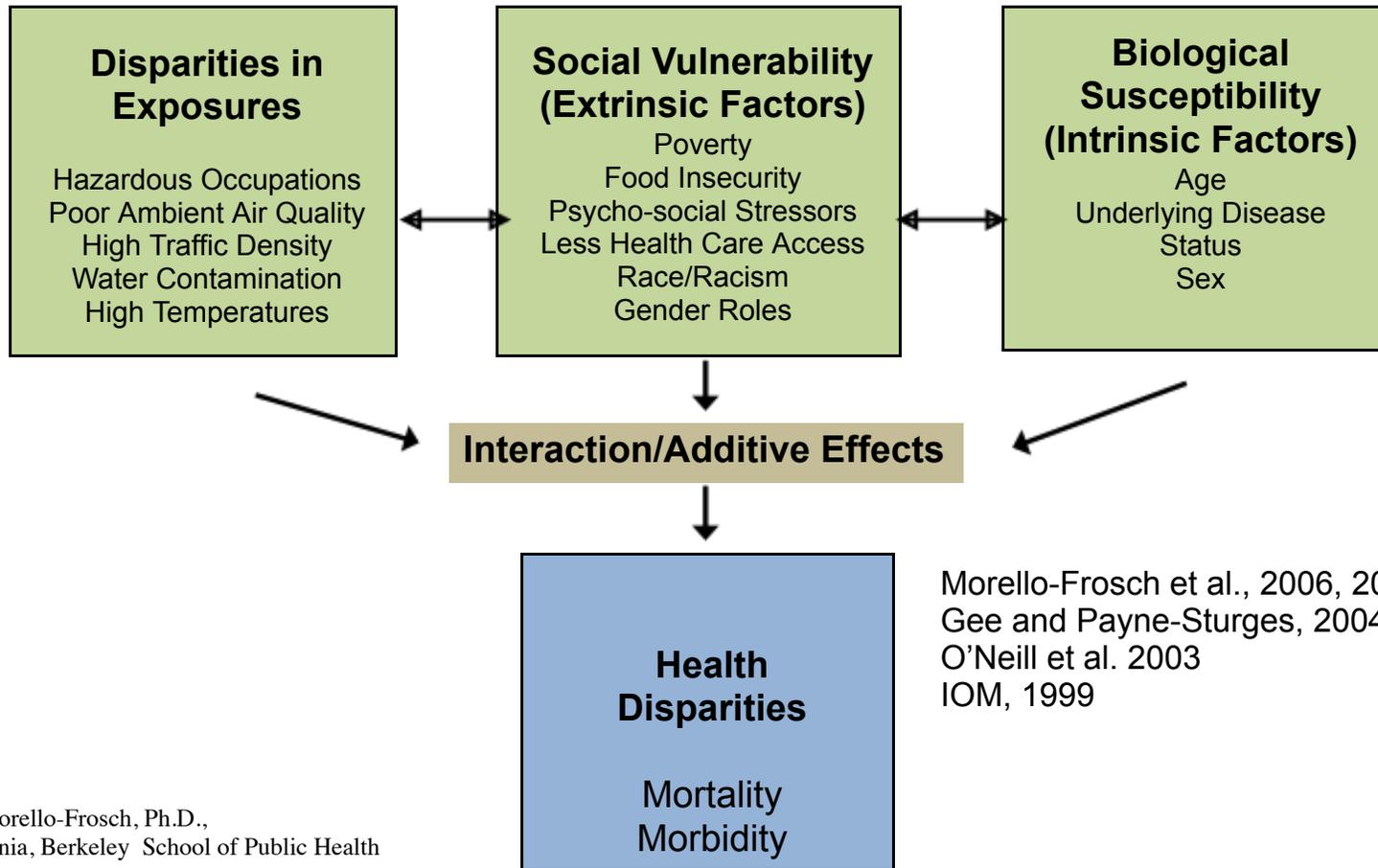
Failing to act will have major costs in U.S.

- Extreme Heat and Cold
  - $140 billion economic impact in 2090 under RCP 8.5
  - $60 billion under RCP 4.5 (lower emissions)
- Lost Labor Productivity
  - 2 billion hours lost under RCP 8.5 in 2090
    - $160 billion in lost wages
- West Nile Virus Neuroinvasive Disease
  - $3.3 billion healthcare costs by end of century

Source: NCA www.nca2018.globalchange.gov
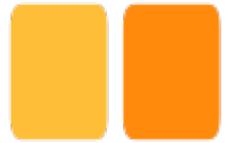
Cumulative Risk Frameworks

Health Equity & Solutions

Opportunity to Address
Triple Jeopardy of Social Inequality

Disparities in Exposures

Hazardous Occupations
Poor Ambient Air Quality
High Traffic Density
Water Contamination
High Temperatures

Social Vulnerability (Extrinsic Factors)
Poverty
Food Insecurity
Psycho-social Stressors
Less Health Care Access
Race/Racism
Gender Roles

Biological Susceptibility (Intrinsic Factors)
Age
Underlying Disease
Status
Sex

Interaction/Additive Effects

Health Disparities

Mortality
Morbidity

Morello-Frosch et al., 2006, 2011
Gee and Payne-Sturges, 2004
O'Neill et al. 2003
IOM, 1999

Slide from Rachel Morello-Frosch, Ph.D.,
University of California, Berkeley School of Public Health

Environmental Inequality and Cumulative Impacts in Richmond, CA

Marine Port

Interstate

Liberty/ Atchison Villages

General Chemical Corp

Richmond Parkway
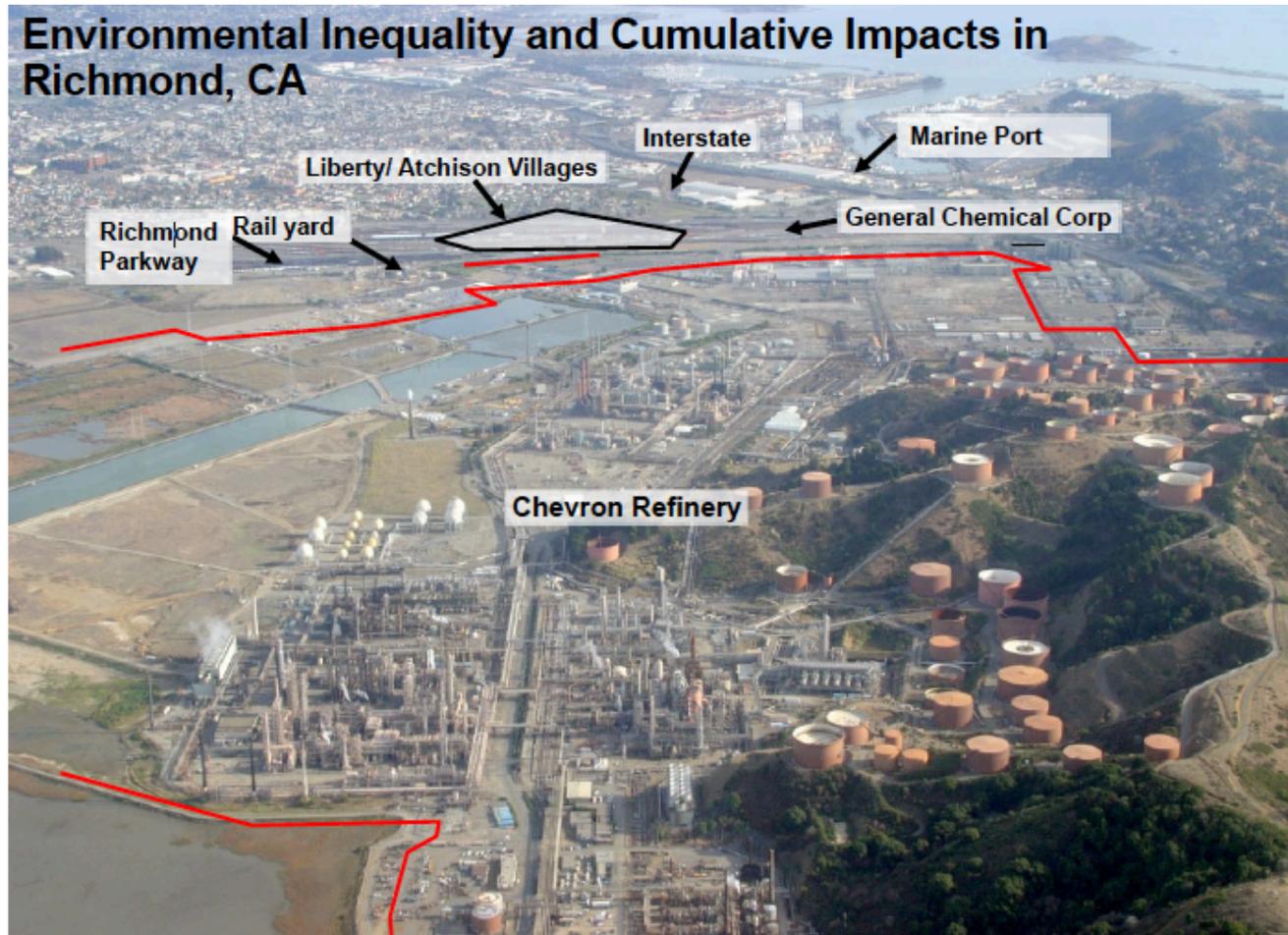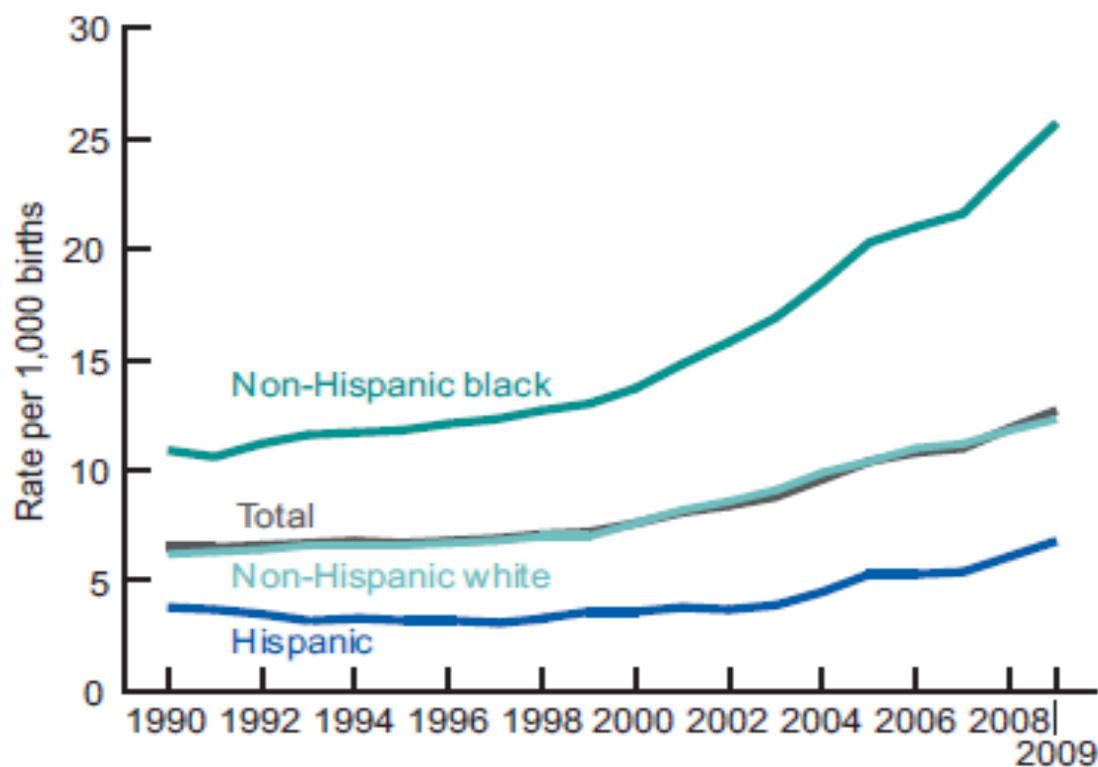
Rail yard

Chevron Refinery

Photo credit: Prof. Rachel Morello-Frosch, UC Berkeley

Communities experience many sources of exposure

Chronic hypertension rates increasing among U.S. pregnant women with differences by race/ethnicity

NOTE: The Hispanic reporting area for 1990 excludes New Hampshire and Oklahoma, and for 1991 and 1992 excludes New Hampshire.
SOURCE: CDC/NCHS, National Vital Statistics System.

Koman et al., 2018. Examining Joint Effects of Air Pollution Exposure and Social Determinants of Health in Defining "At-Risk" Populations Under the Clean Air Act: Susceptibility of Pregnant Women to Hypertensive Disorders of Pregnancy. World Med. Heal. Policy 10, 7–54. https://doi.org/10.1002/wmh3.257

Neighborhood assets that impact health differ by

Differences In Tree Cover In Baltimore

One of the reasons low-income areas of cities are often hotter is that they tend to have less green cover than do wealthier areas.
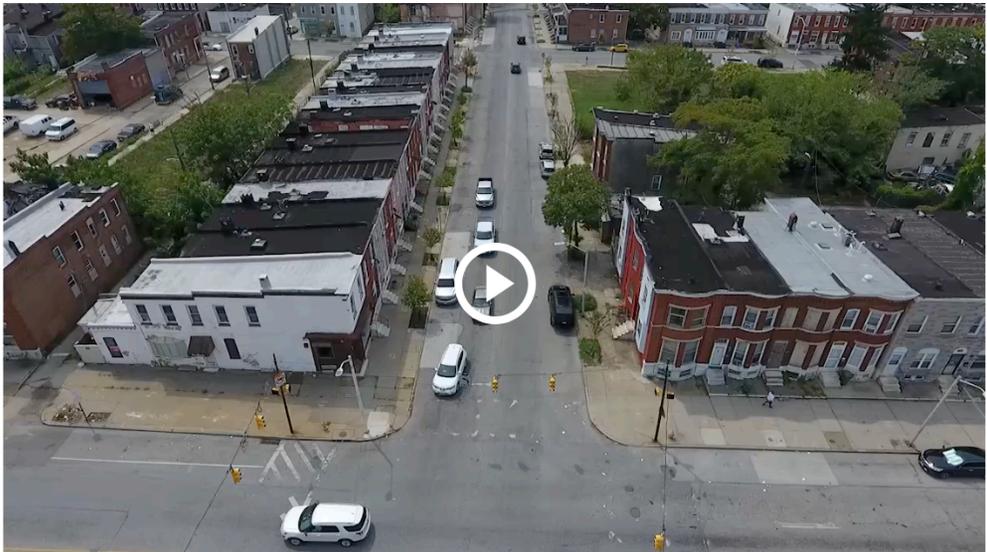
This is a street on the edge of Broadway East, one of the city's hottest neighborhoods. It's also in one of

Roland Park is a cooler neighborhood in a more affluent part of the city.

Baltimore Code Red Heat Stress Vulnerability

Integrating Equity and Sustainability Goals in CA's Climate Policy-- Greenhouse Gas Reduction Fund

Revenue from regulation of industrial greenhouse gas emissions targeted for investment in projects ($11 billion so far):

Reduce pollution and greenhouse gas emissions in disadvantaged communities

Enhance co-benefits of GHG reductions

- 35% of funds to benefit vulnerable groups
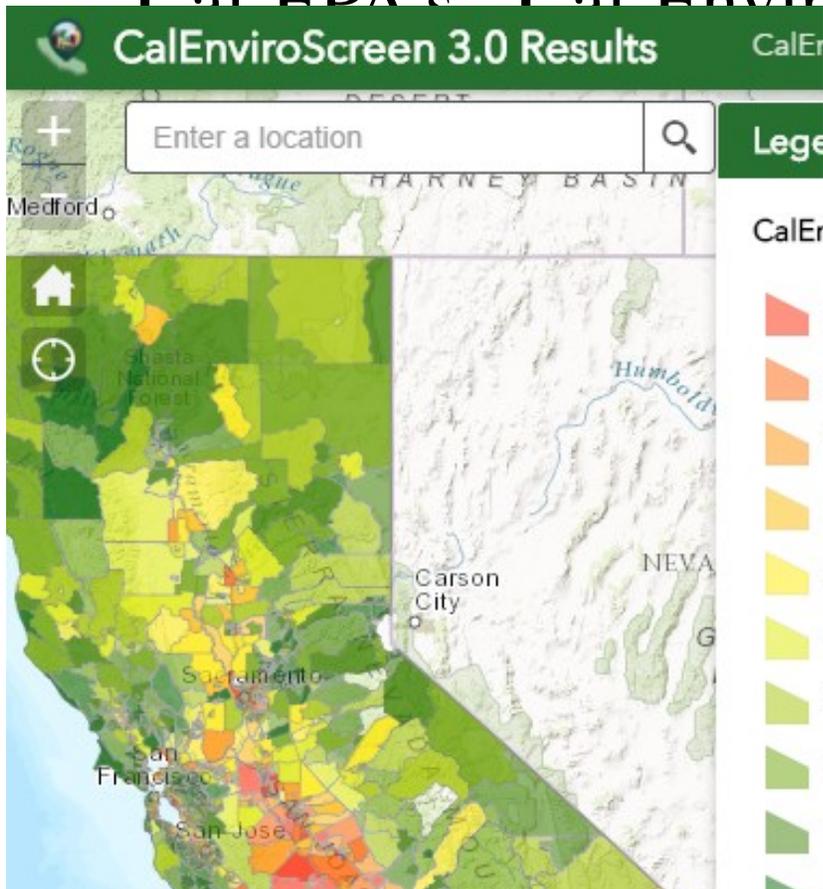
- 20% invested in vulnerable neighborhoods directly
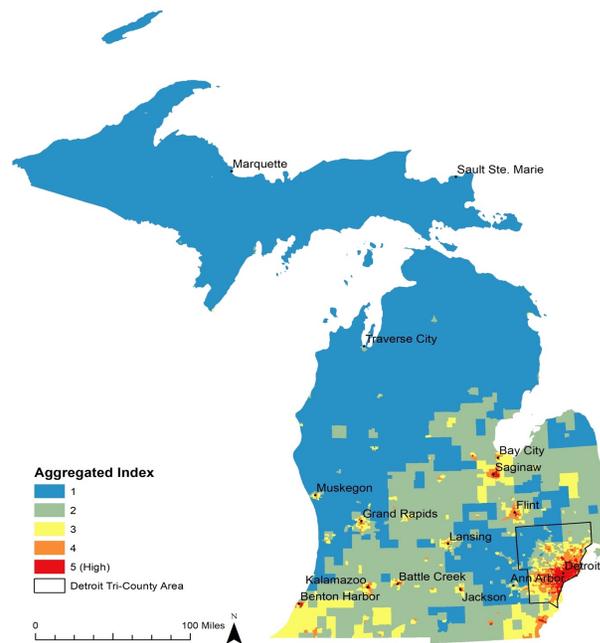
Cal EPA's CalEnviroScreen v 3.0

CalEnviroScreen 3.0 Results

Enter a location

About

The Office of Environmental Health

Community engagement in tool development

http://oehha.ca.gov/ej

MI-Environment
Cumulative Environmental Exposures

1)   Characterize cumulative exposures to environmental and social vulnerabilities in Michigan via GIS tools

2)   Examine disparities in exposures

Aggregated Index
- 1
- 2
- 3
- 4
- 5 (High)
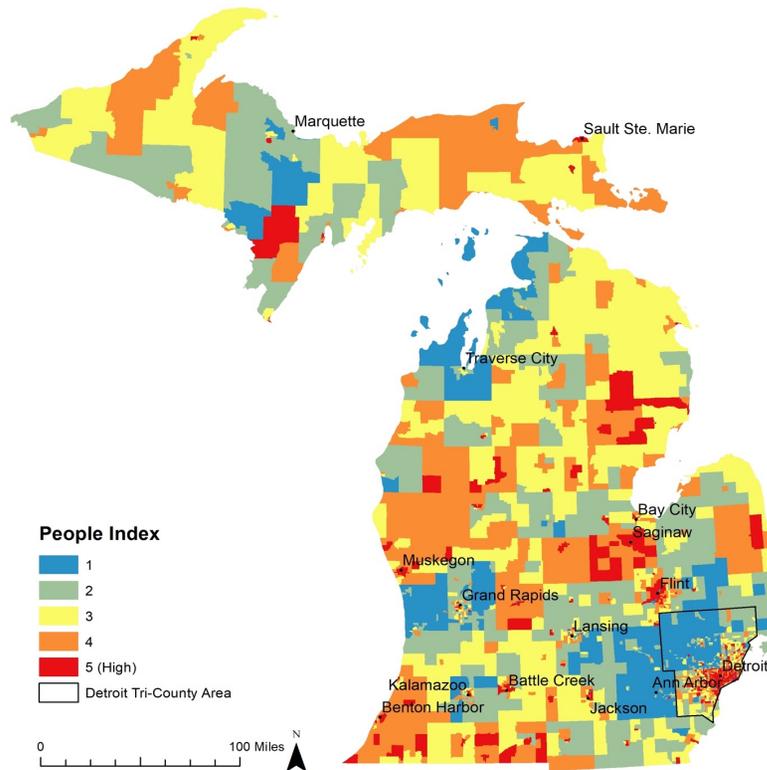- Detroit Tri-County Area

0   100 Miles

Source: Koman et al., 2019 MI-Environment: Geospatial Patterns and Inequality of Relative Heat Stress Vulnerability in Michigan

MI-Environment Heat Stress

Place and Temperature

People

People Index
- 1
- 2
- 3
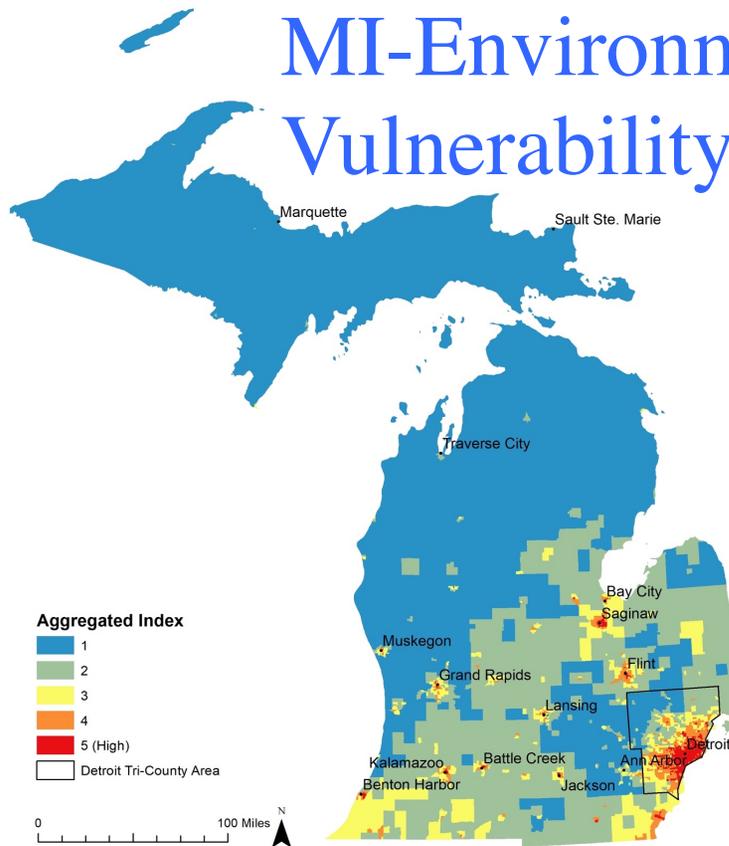- 4
- 5 (High)
- Detroit Tri-County Area

0 — 100 Miles N
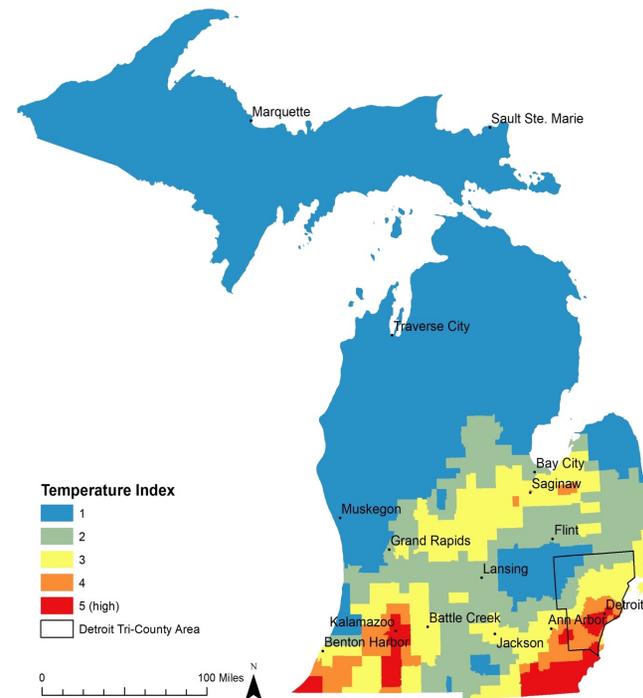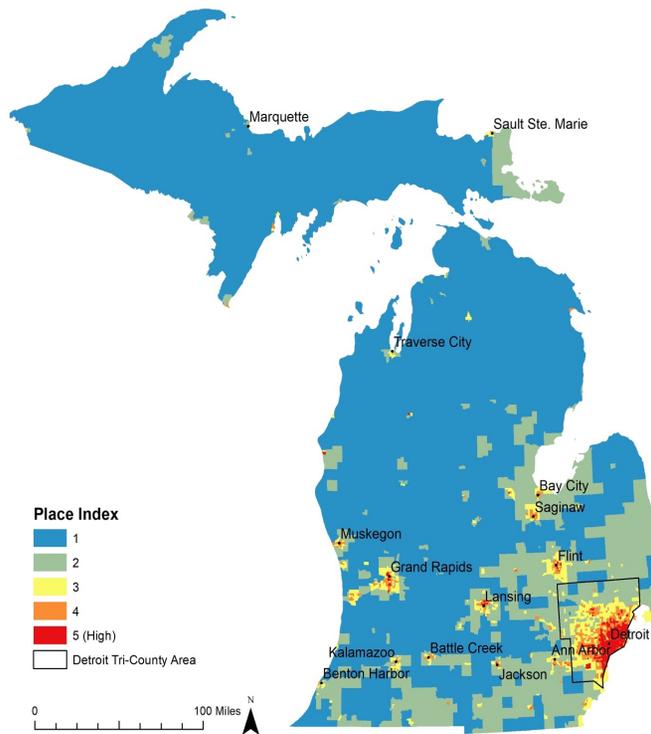
Data at Census Tract Level

- Percent children < 5 years
- Percent elderly and living alone
- Age-adjusted prevalence of obesity (Body mass index (BMI)   30 m/kg2)
- Percent households without vehicle
- Percent population below the poverty line*
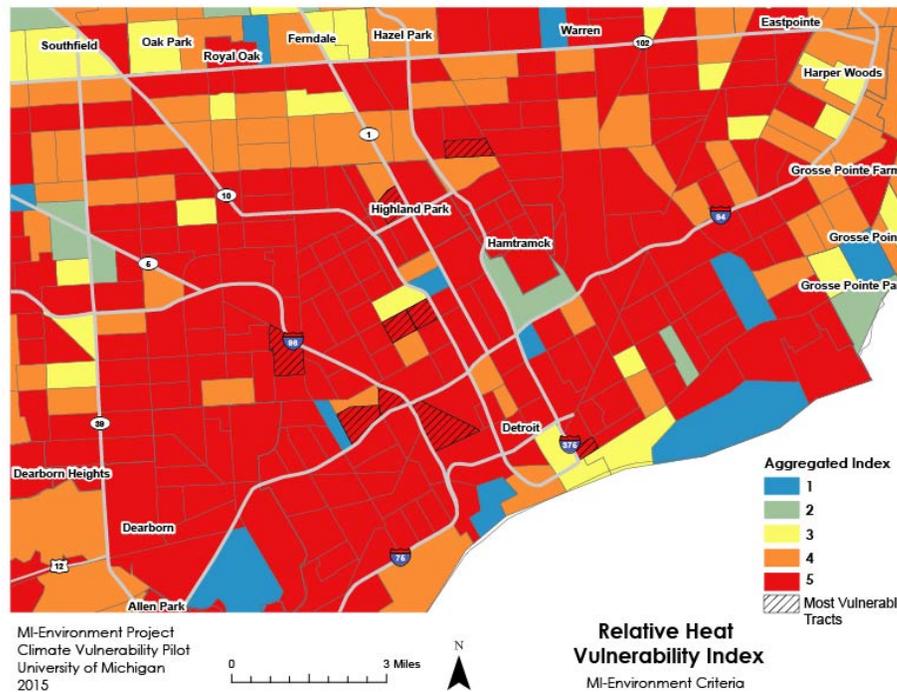
MI-Environment Heat Vulnerability Index (HVI)

Relative Heat Stress Vulnerability Ranking by Census Tract

Tool available on-line

https://michiganview.org/MI_Environment_Tool.html

Heat and Health Equity: Detroit

MI-Environment Project
Climate Vulnerability Pilot
University of Michigan
2015

Relative Heat Vulnerability Index
MI-Environment Criteria

Aggregated Index
1
2
3
4
5
Most Vulnerable Tracts

Disparities in environmental quality of communities is actionable.

Detroit has several of the highest vulnerability areas for heat stress, even among tracts with top index of '5.'

Aim 2: Results

Michigan

| Vulnerability Index	Category of Vulnerability Indicator	Inequality Indexa	95% CI
Analytic Heat Stress Vulnerability Index (Excluding Poverty)	Proportion people of color	-0.115	(-0.108,-0.122)***
	Proportion residents living below poverty line	-0.101	(-0.094,-0.107)***
	Proportion residents living 2X below poverty line	-0.106	(-0.099,-0.113)***
	Proportion living in rented households	-0.103	(-0.096,-0.110)***
	Median house value	-0.142	(-0.134,-0.150)***
	Proportion over age 24 without high school completion	-0.099	(-0.093,-0.106)***
	Linguistic Isolation	0.065	(-0.121,0.252)*

* 0.1<p<0.05, ** 0.05<p<0.001, *** p<0.001

aA negative inequality score indicates that less advantaged groups bear a disproportionate burden of exposure. The highest level of inequality, where disadvantaged groups bear the burden of all the exposure is -1 (Kakwani et al., 1997).

Discussion

- **Strengths**
- Future climate projections incorporated
- Low-cost model to create Heat Vulnerability Index
- Can disaggregate three elements
- Community-driven project

- **Limitations**
- Only 10 climate regions
- Scenario assumed Paris accord achieved
- No Great Lakes in modeling
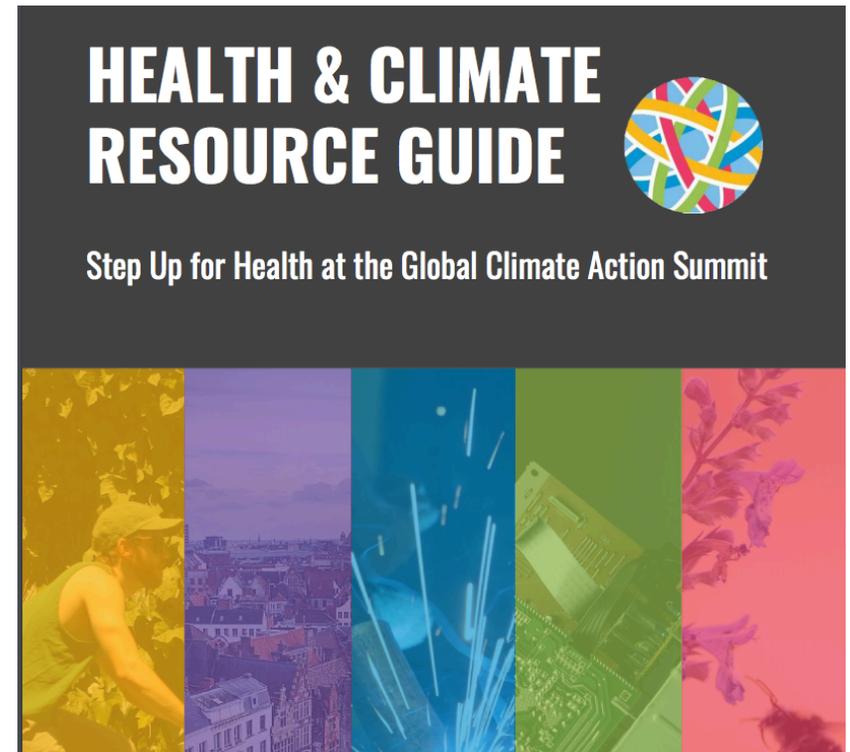- Challenges for validation with health outcomes
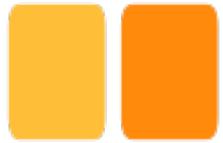
Future Directions

Health and Justice as Core Values

Reshaping the climate determinants of health

- Unprecedented need for rapid global and local solutions to decarbonize the economy

- Cost-effective solutions exist and can be applied

Deregulatory efforts harm public health

Ignoring expertise

Undermining the science

Politicizing the science
 review process

Cutting resources

Rolling back protections
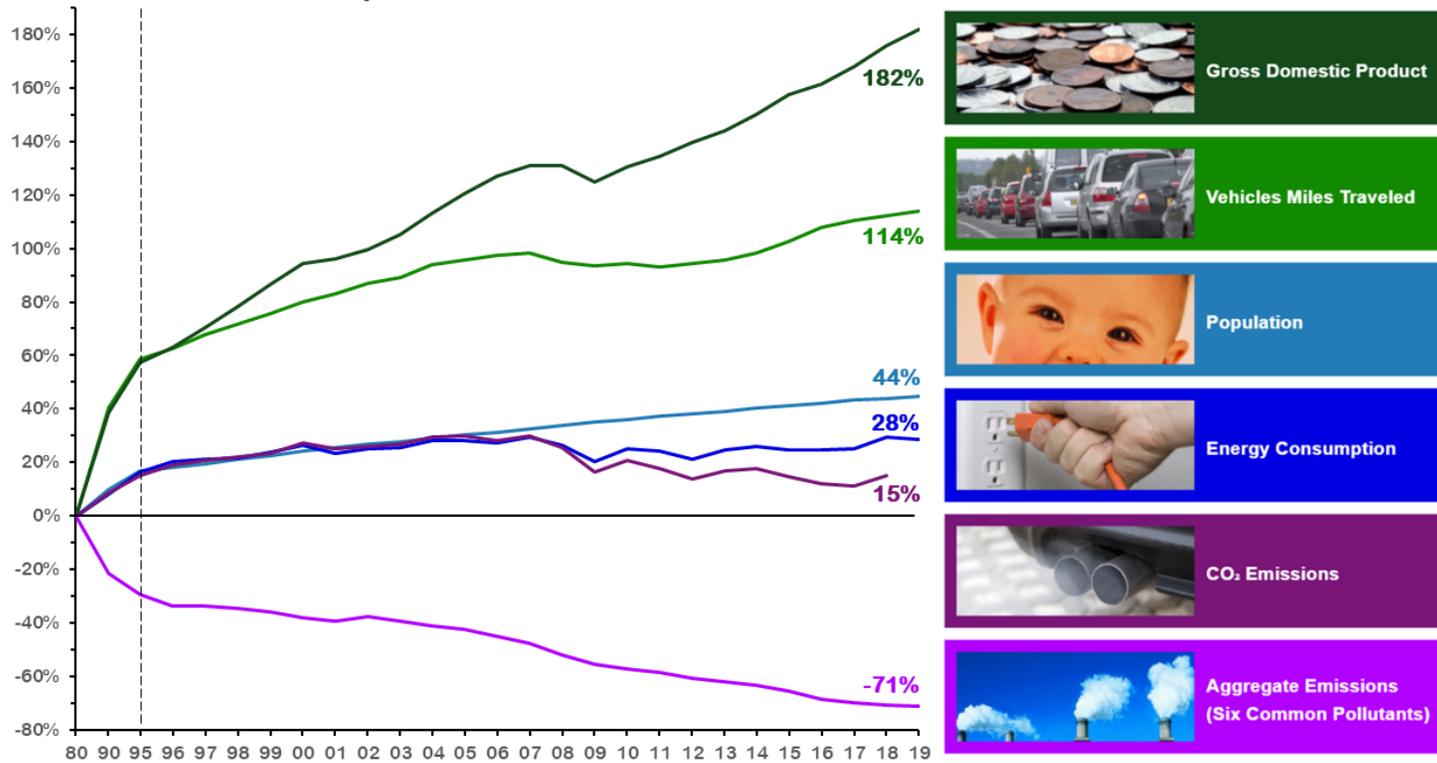
Blocking state/local action

Creating procedural hurdles

Rule reversals	Completed	In progress	Total
Air pollution and emissions	21	5	26
Drilling and extraction	11	9	20
Infrastructure and planning	12	1	13
Animals	11	2	13
Water pollution	6	3	9
Toxic substances and safety	6	2	8
Other	5	5	10
All	72	27	99

Source: NY Times https://www.nytimes.com/interactive/2020/climate/trump-environment-rollbacks-list.html

Clean Air Act: Reducing air emissions while we grow

Comparison of Growth Areas and Emissions, 1980-2019

- Gross Domestic Product — 182%
- Vehicles Miles Traveled — 114%
- Population — 44%
- Energy Consumption — 28%
- CO₂ Emissions — 15%
- Aggregate Emissions (Six Common Pollutants) — -71%

Source: US EPA

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Health & justice as a core values

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Acknowledgements

Thank you!
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Graphic: Reuben Wu 2016 Project Drawdown

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