

# Clean Air: Climate and Health Considerations

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 @DrDeJarnett



[www.neha.org](http://www.neha.org)

# About NEHA

## OUR MISSION

*To advance the environmental health professional for the purpose of providing a healthful environment for all.*

## ABOUT NEHA

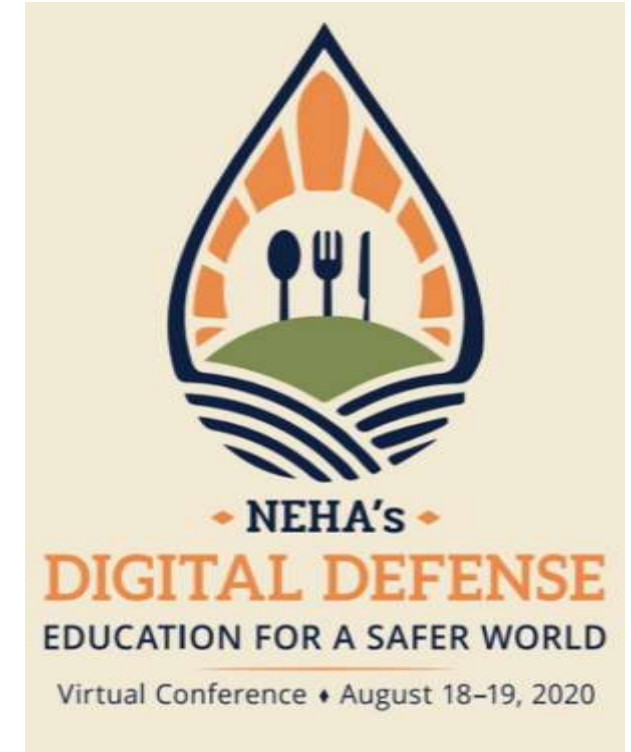
NEHA empowers and educates environmental health professionals, providing them the tools and resources they need to make the greatest contributions possible in creating healthy environments that we all seek.

## OUR MEMBERS

The success of NEHA depends on the success of nearly **7,000 members**, who serve as the “boots on the ground” in their communities, possessing the knowledge and experience to address and respond to issues.

## OUR COMMITMENT

NEHA provides the highest quality trainings, courses, tools, and resources to empower professionals to become trusted leaders and experts in their profession.



# Climate and Health at NEHA

## Government Affairs

Helped secure:

- **\$1.1 billion** for Zika
- **\$10 million** for CDC's Climate and Health Program
- **\$200 million** for CDC's hurricane recovery
- Pandemic and All Hazards Preparedness Act (**PAHPA**)

## Local Support

Climate and Health Mini Grants



## Informing Policy

Emergency Preparedness report

American Climate Metrics Survey paper

Climate Ambassador Training workshops

100% Clean Energy Declaration

## Member Engagement

Policy statements



# NEHA Endorses the US Call to Action



**Builds on the 2018 Global Call to Action on Climate and Health.**

**U.S. CALL TO ACTION  
ON CLIMATE, HEALTH, AND EQUITY:  
A POLICY ACTION AGENDA**

2019



## Themes:

Climate change is a health emergency -- one of the greatest threats to world health.

We are dedicated to improving the health of our patients, communities, and planet.

Action to reduce climate change can dramatically improve health – but it must be at policy-level scale.

Equity must be central to climate action.



**With the right policies and investments, we have the opportunity to realize our vision of *healthy people in healthy places on a healthy planet.***

<https://climatehealthaction.org>

Sign for your Organization

Sign Individually

U.S. Call to Action On Climate, Health, and Equity

A Policy Action Agenda



# Earth Day 2020

## Theme

Climate **Action**

## Declaration



### What Earth Day Means to Me

In honor of the 50th Anniversary of Earth Day, the National Environmental Health Association has a social media campaign to celebrate! Part of the campaign will include a series of activities for affiliates and members to join in. One activity is called "What Earth Day Means to Me."

### Example:

"Earth Day means I must use my voice to ensure that vulnerable populations have a seat at the table regarding environmental health burdens that inequitably threaten their health. #NEHAis4U@EarthDay"

### How to Join:

Brief message to explain what Earth Day means to you!  
Include a photo and #NEHAEarthDay

Join NEHA in celebration of Earth Day with environmental health professionals all over the world! Stay tuned for more NEHA Earth Day activities.

Contact: Maddie Gustafson  
Mgustafson@neha.org



## Emissions Survey

Total gallons of gas saved per day of teleworking **30**



Based on the NEHA Emissions Survey of staff's monthly and weekly commutes.

Total distance NEHA staff commute everyday



## Twitter Chat



### Earth Day Twitter Chat (#EarthDayChat)



The National Environmental Health Association is proud to partner with **Earth Day Network** in celebrating Earth Day 2020. For the 50th anniversary of Earth Day, NEHA will host an **Earth Day Twitter Chat** on Tuesday, April 21, from 2:00-3:00 p.m. EDT. The theme for the Twitter Chat is "Climate Action for Environmental Health."



Environmental health professionals work closely with their communities to ensure the safety of the resources we use every day, from the air we breathe to the food we eat and the water we drink. These resources are being affected by climate impacts. Let's take this opportunity to initiate a conversation about how climate impacts health and what can we do to fight the effects of climate change and build resilience. Join us in leading the conversation on how **#ClimateChangesHealth!**



**Hashtags**

- Primary: **#EarthDayChat**
- Secondary: **#ClimateChangesHealth**



To participate and receive live updates from the chat, **RSVP to the event here** and follow **@NEHAorg** on **Twitter**.



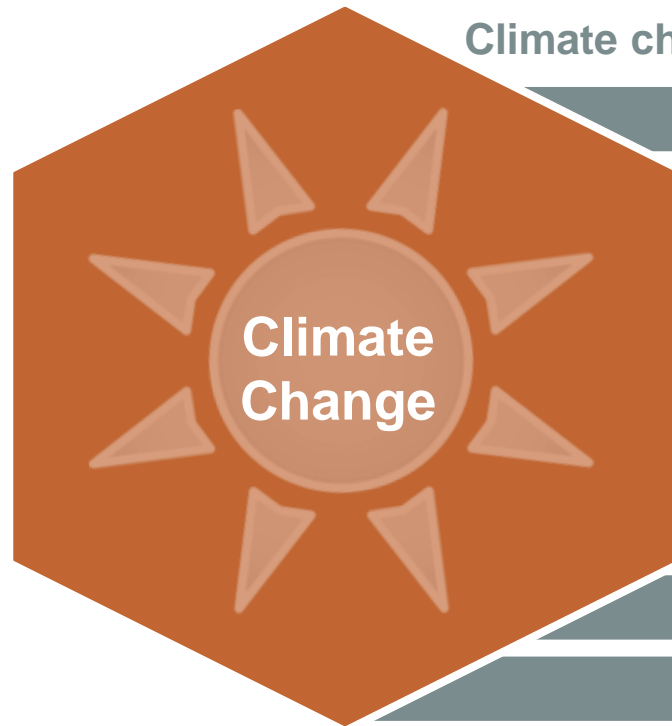
# | Climate Change is Inherently Local

“Impacts are experienced **differently** within segments of the population and between **geographic** locations based on **biological, social, and economic** vulnerabilities as well as the nature of the climate **hazard.**” (Patz and Thomson 2018)



# Climate Change Multiplies Threats

Climate change **intensifies** health risks for the vulnerable.



Children

Older adults

Impoverished communities

Communities of color

Indigenous communities

People with a disability

Undocumented residents

LGBTQ+



# I Vulnerable Populations

People of color are more likely to be exposed to environmental threats than are Caucasians of the same social class. **Race is a powerful predictor of many environmental hazards** including the distribution of air pollution, location of municipal solid waste facilities, location of abandoned toxic waste sites, toxic fish consumption, and lead poisoning in children.

Bullard, 1993





# Vulnerable Populations

Most communities located next to, and directly affected by the operations of, corporate, industrial, or service facilities are **low-income, communities of color, and other systemically oppressed groups.**

Franklin, 2018

The percentage of **African Americans** in fence-line zones is **75% greater** than for the U.S. as a whole, while the percentage of **Latinos** is **60% greater** than for the U.S. as a whole.  
Orum et al., 2014



# Children are Uniquely Vulnerable

The World Health Organization estimates that **88%** of the global burden of climate change falls on children **younger than 5 years old.**

(Ahdoot and Pacheco 2015)



# Children are Uniquely Vulnerable

**Children aren't just little adults, they:**

**Have  
developing  
organ systems**

**Breathe in more  
air and take in  
more water for  
their size**

**Are dependent  
on adults to  
make decisions  
for them**

**Have unique  
behaviors:  
hand-to-mouth  
and crawling  
activities**

**Closer to  
ground level  
pollutants**



# Climate Threats to Health



# | Air Quality

## EXPOSURES



Air Pollution



Extreme Heat



Wildfire Smoke



Allergens

Poor air quality exposure can harm human health and wellbeing

## HEALTH OUTCOMES



Asthma



Heart Disease



Allergies



School/Work Absences

# Air Quality

## Asthma in Alabama

**8.6%**  
**adults**

**11.3%**  
**children**

10.5%  
African  
American

7.8%  
Caucasian

7.0%  
Hispanic

17.3%  
African  
American

8.1% of  
Caucasian

11.9% of  
Hispanic

Birmingham-Hoover-Talladega metro ranked tied for **14th most polluted city** in the nation for year-round particle pollution.

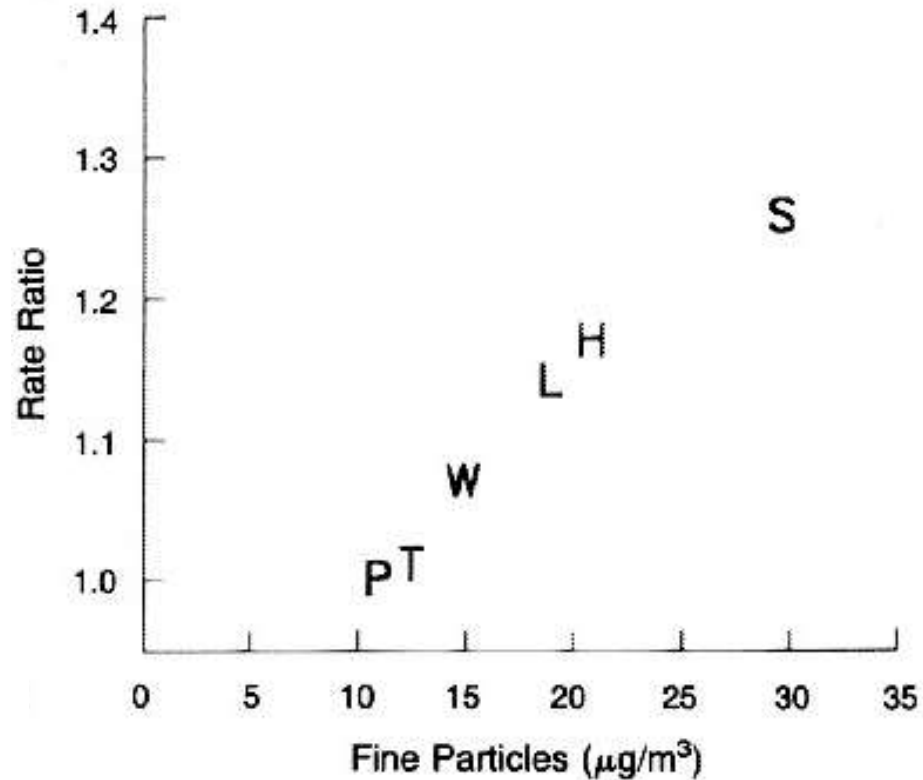
ADPH, 2012

ALA., 2020



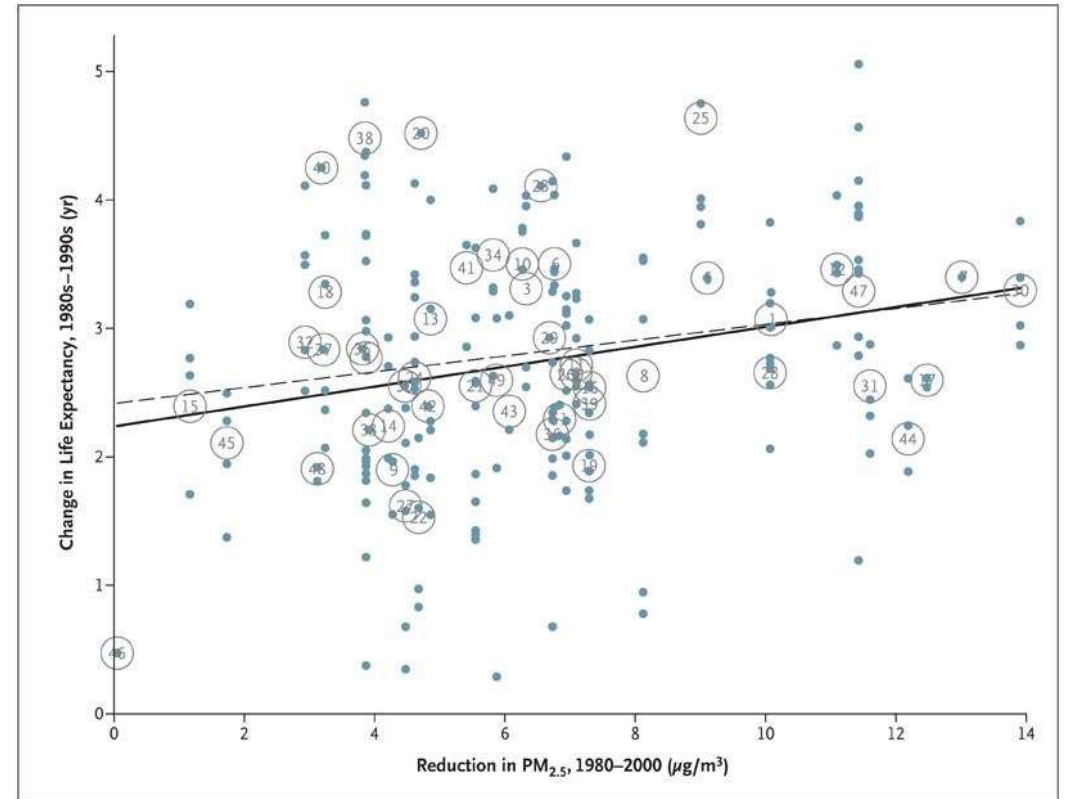
# Air Quality

More polluted cities have **higher mortality** rates



Dockery et al. 1993

Higher pollution is associated with **shorter** life expectancy



Pope et al. 2009



# Air Quality

Air pollution exposure **increases** risk of cardiovascular disease **mortality** from **5-15%**.

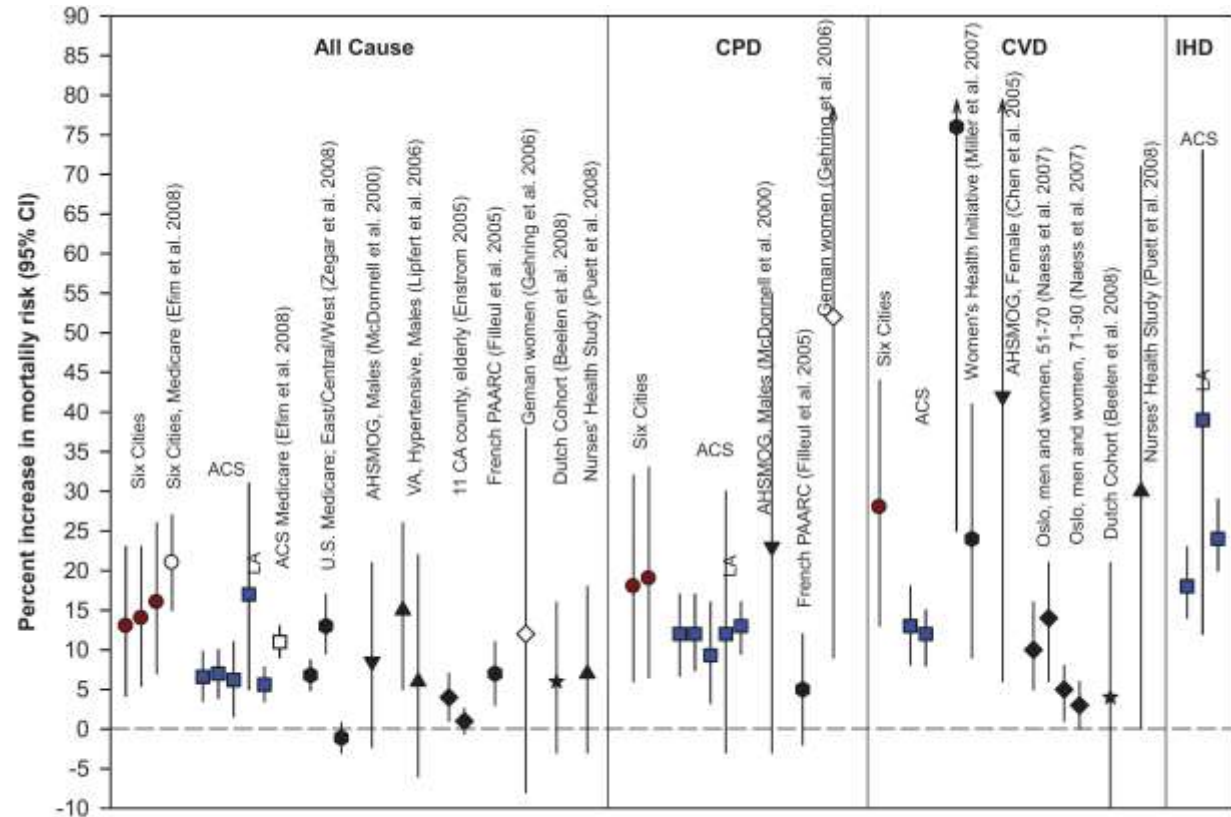


Figure 1. Risk estimates provided by several cohort studies per increment of  $10 \mu\text{g}/\text{m}^3$  in  $\text{PM}_{2.5}$  or  $\text{PM}_{10}$ . CPD indicates cardiopulmonary disease; IHD, ischemic heart disease.

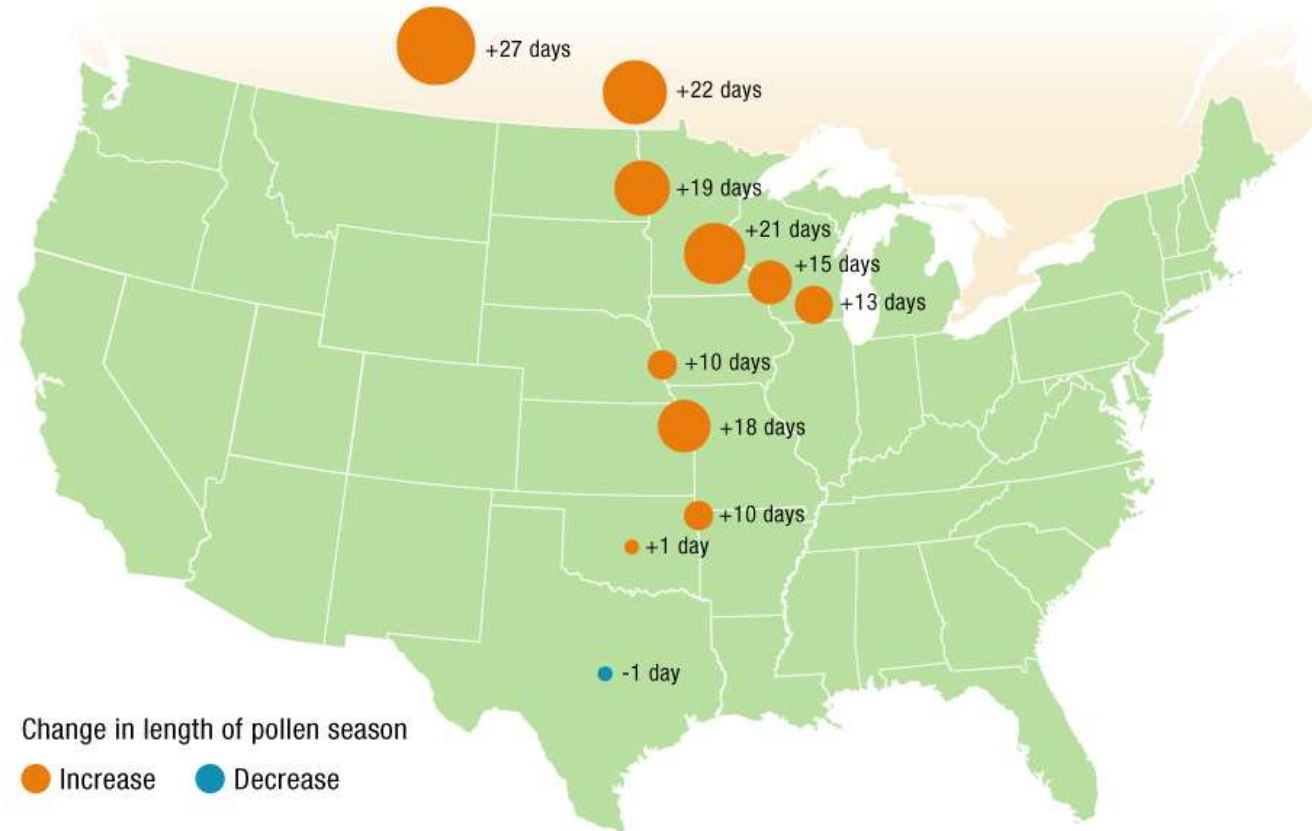
Brook et al. 2009





# Air Quality

Change in ragweed pollen season, 1995-2013



Source: U.S. Environmental Protection Agency

Source: <https://www.mprnews.org/story/2015/02/05/climate-change-health>



# Air Quality



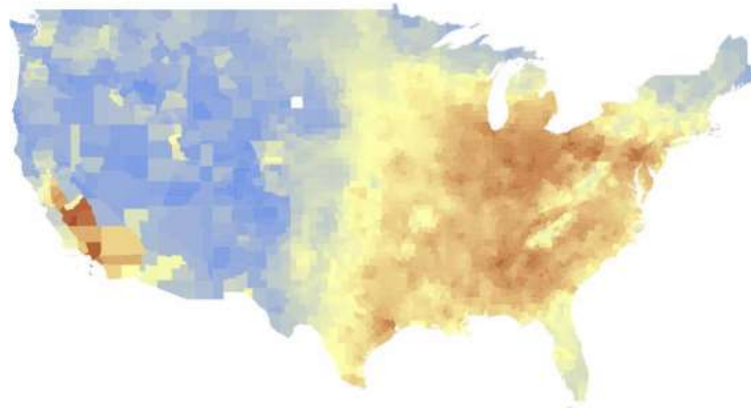
Previous global estimates were:

- 6.5 million in 2016
- 4.5 million in 2015

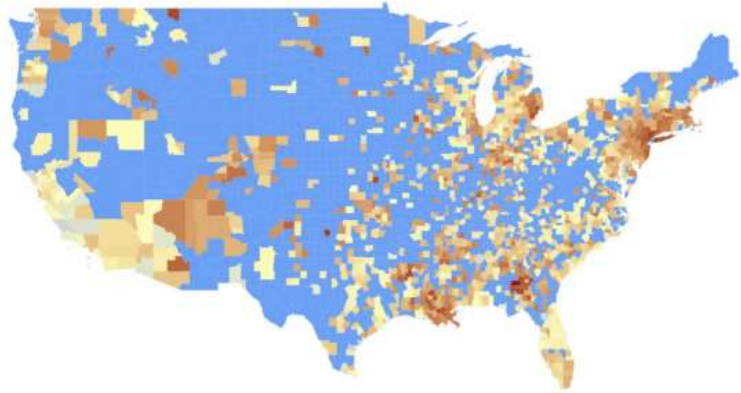
Source: <https://www.usnews.com/news/national-news/articles/2019-03-12/air-pollution-causes-88-million-extra-deaths-worldwide-each-year-study-says>



# COVID-19 Air Pollution

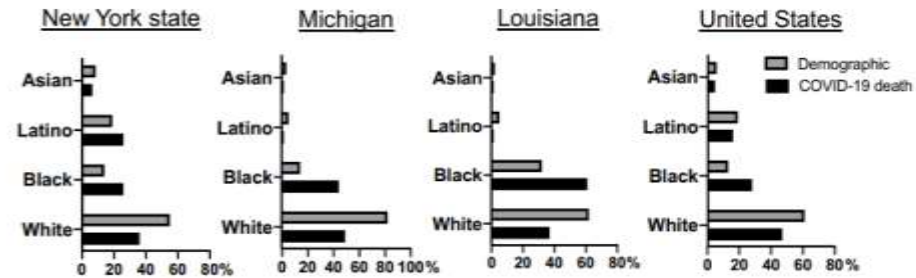


PM<sub>2.5</sub> 0 3 6 9 12<sup>+</sup>



# COVID-19 deaths per 1 million 0 1 10 100 1000<sup>+</sup>

## COVID-19 fatality rates



## Contributing socioeconomic, racial & environmental factors:

- Structural racism
- Crowded living conditions, multi-generational homes
- Limited access to health care and healthy foods
- Working in low paying "essential" jobs
- Chronic exposure to air pollution

## COVID-19 risk factors

- Age > 65
  - Living in nursing home
- Sex (male)
- Severe obesity
- Diabetes
- Serious heart conditions
  - pulmonary hypertension
- Immunocompromise (cancer...)
- Chronic kidney disease
- Chronic liver disease
- Chronic lung disease
  - COPD
  - Severe Asthma



Yearly average PM<sub>2.5</sub> (g/m<sup>3</sup>) levels



# of COVID-19 deaths per 1 million

Brandt, Beck, Mersha, 2020

Fig 1: Maps show (a) county-level 17-year long-term average of PM<sub>2.5</sub> concentrations (2000–

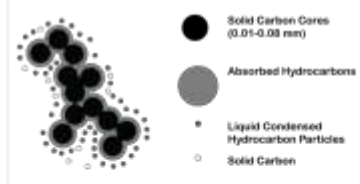
Wu et al., 2020



# Air Quality Adaptation

## HOW PLANTS CAPTURE PARTICULATE MATTER (PM)

### DIESEL EXHAUST PARTICLE



**Vegetated barriers are most effective if planted close to the pollution source in highly polluted areas.**

### Vegetation Barrier

Greenbelt scenarios in which vegetation acts as a barrier to air flow, altering airflow patterns and pollution plume trajectory in addition to deposition (Staffens et al. 2012) (Lin et al. 2012)

### Deposition

The physical capture of particulate matter on the leaves and bark of trees and plants. The greater surface area and the rougher or stickier the leaf and bark, the higher the deposition rate (Fulker 2009).



## Air Quality

- Test air quality
- Disseminate alerts
- Enforce air quality regulations

Source: <https://louisville.edu/greenheart/about>



# Extreme Heat

Heat is the **top cause** of natural weather-related death in the US. (NOAA 2017)

Climate change increases the frequency and severity of heat waves.

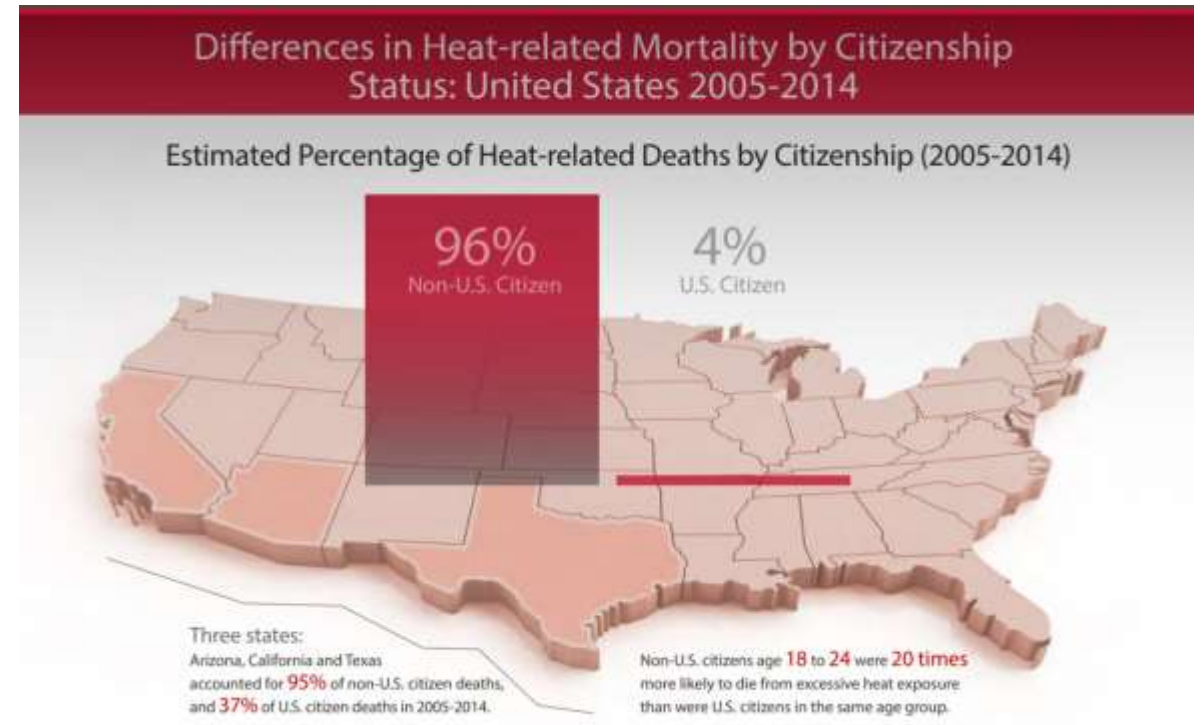


# Extreme Heat

TABLE 2. Number and rate of heat-related deaths,\* by race/ethnicity and level of urbanization — United States, 2004–2018†

Characteristic	No. of deaths (rate)§
<b>Race/Ethnicity¶</b>	
Hispanic	1,349 (0.2)
American Indian/Alaska Native, non-Hispanic	241 (0.6)
Asian/Pacific Islander, non-Hispanic	194 (0.1)
Black, non-Hispanic	1,965 (0.3)
White, non-Hispanic	6,602 (0.2)
Not stated**	176 (N/A)
<b>Level of urbanization††</b>	
Large central metro	4,402 (0.3)
Large fringe metro	1,607 (0.1)
Medium metro	1,764 (0.2)
Small metro	990 (0.2)
Micropolitan	879 (0.2)
Noncore	885 (0.3)
<b>Total</b>	<b>10,527 (0.2)</b>

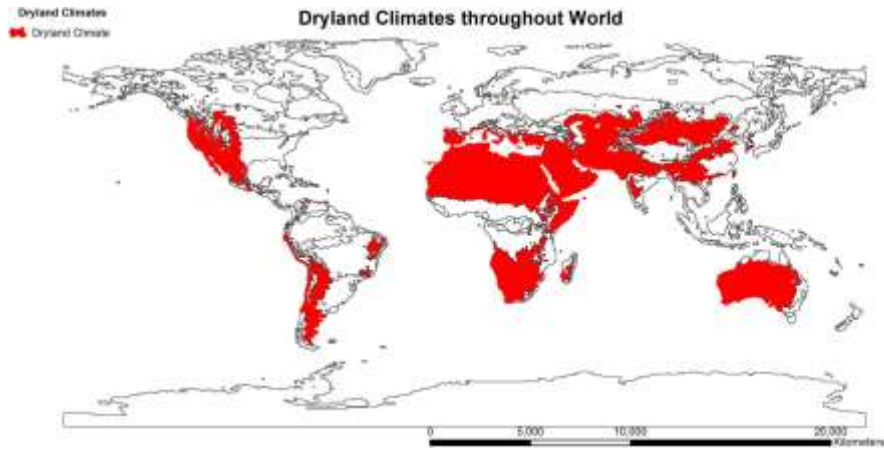
Vaidyanathan et al., 2020



APHA, 2018  
Taylor et al., 2018



# Extreme Heat Adaptation



**Table I.** Research Findings Related to Strategies to Cool Dryland Cities.

Category	Finding (Study Cities in Parentheses)	Authors
Vegetation	Trees have greater daytime cooling benefit than lawns (Phoenix)	Wang et al. (2016)
	Lawns can increase daytime air temperatures and humidity compared to surrounding urban areas (Tel Aviv)	Potchter, Cohen, and Bitan (2006)
	Irrigated turf leads to lower air temperatures than desert vegetation (Phoenix)	Hall et al. (2016)
	Tree canopy has strong cooling benefits in daytime but not at night (Tel Aviv and Cairo)	Cohen, Potchter, and Matzarakis (2012); Mahmoud (2011); and AboElata (2017)
	Tree canopy has only small air cooling benefit on very hot days (Athens)	Tsiros (2010)
	At night dense, low tree canopies decrease wind and increase air temperatures and humidity (Tel Aviv)	Potchter, Cohen, and Bitan (2006)
	Tree canopies that leave sky view can increase nighttime cooling (Cairo)	AboElata (2017)
	Total area of vegetation matters more than distribution (Denver)	Rhee, Park, and Lu (2014)
	Clustered vegetation cools surface temperatures more than dispersed vegetation (Phoenix and Las Vegas)	Fan, Myint, and Zheng (2015) and Myint et al. (2015)
	Parks in dryland cities typically produce park cool island effects	Bowler et al. (2010)
Built form	The cooling impact of parks extends well beyond their borders	Dimoudi and Nikolopoulou (2003) and Akbari et al. (2016)
	Shade-producing built form (close buildings with narrow streets) can cool dryland cities	Emmanuel and Fernando (2007) and Nassar et al. (2016, 2017)
	Street canyons (narrow streets and tall buildings) reduce daytime air temperatures through shade and reduced sky view	Johansson (2006)
	Street canyons lead to warmer nighttime temperatures since heat escapes more slowly with reduced sky view	Nassar, Blackburn, and Whyatt (2016, 2017) and Jamei et al. (2016)
	Replacing pavement with buildings leads to lower nighttime temperature (Phoenix)	Gober et al. (2012)
Materials	The roughness of urban landscapes leads to less wind and more heating	Golden (2004)
	Tall buildings and straight streets can promote air flow and redirect wind	Golany (1996)
	Cool roof materials reduce urban heating in all climate zones	Roman et al. (2015) and Santamouris (2014)
	Phase change materials can spread heating out through the daily cycle	Roman et al. (2015)
Highly reflective surfaces may heat other spaces nearby	Vardoulakis, Karamanis, and Mihalakakou (2014)	



- Educate
- Disseminate alerts
- Assure cooling center access

Wheeler et al. 2019



# Extreme Weather





# Extreme Weather



Displacement

Property Loss

Infrastructure  
Damage

Water  
contamination

Over 30,000  
evacuated

At least  
63 deaths

Loss of access  
to health  
services

Gastrointestinal  
illness and skin  
rash increased

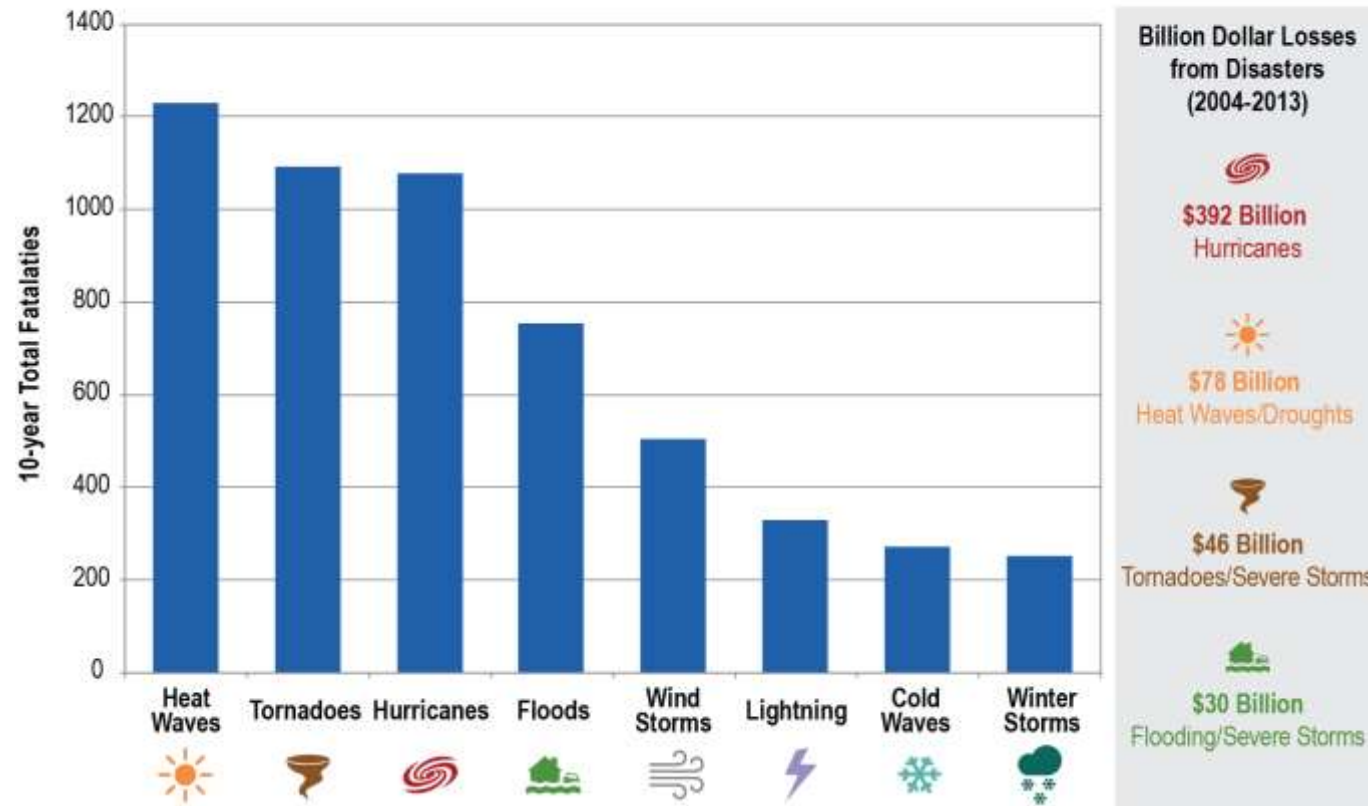
USGCRP, 2018



# Extreme Weather

The impacts of extreme weather are **costly** – in both the **health** and **economic toll**.

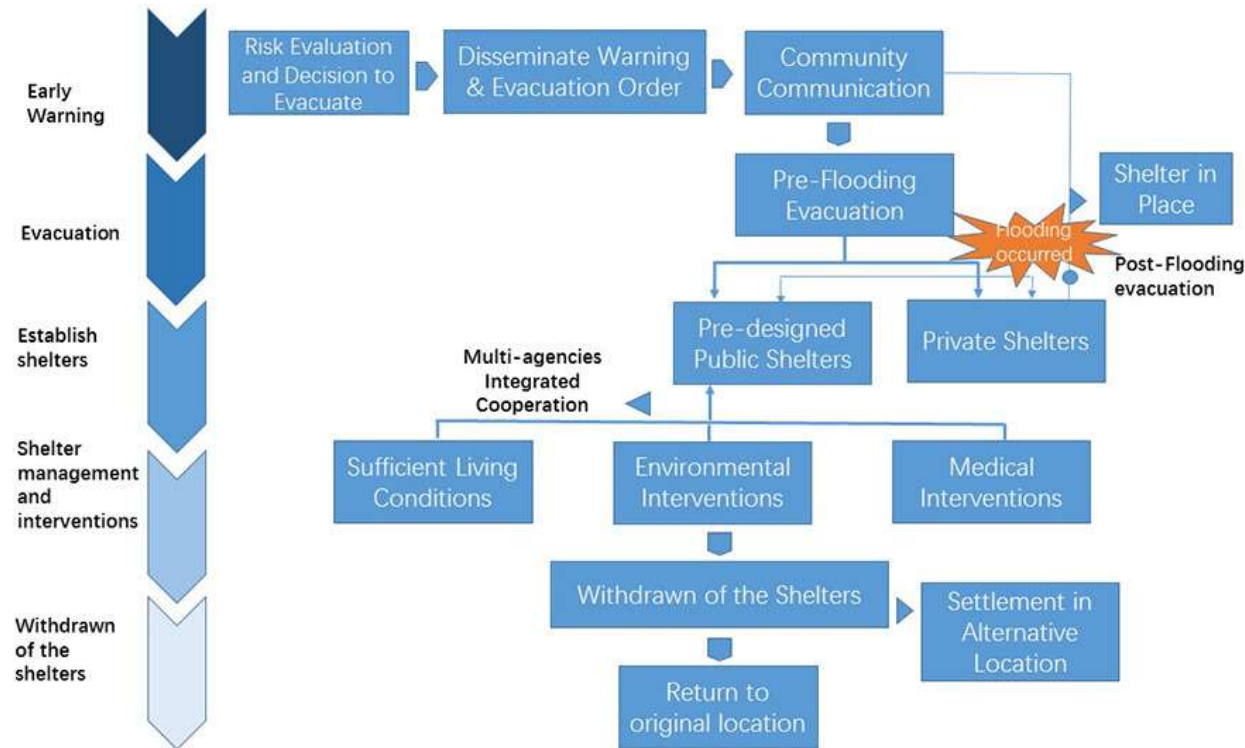
Estimated Deaths and Billion Dollar Losses from Extreme Events in the U.S., 2004–2013



USGCRP, 2016



# Extreme Weather Adaptation



- Disseminate alerts
- Ensure evacuation access

Wu et al., 2019



# Extreme Precipitation



Precipitation extremes harms **physical and mental health**, community infrastructure, and the economy.



# | Extreme Precipitation



Dust storms are linked with **increased respiratory disease.**

Reed and Nugent, 2017



# Extreme Precipitation



Teklewold, Gebrehiwot, Bezabih 2019



Mapfumo, Mtambanengwe, Chikowo, 2019



Lan et al., 2018

**Extreme Precipitation**

- Assess water and soil quality
- Issue water advisories



# Vectorborne Disease

Climate change increases the amount and geographic distribution of disease-carrying mosquitos and ticks.



Vectorborne diseases

Lyme disease



West Nile virus

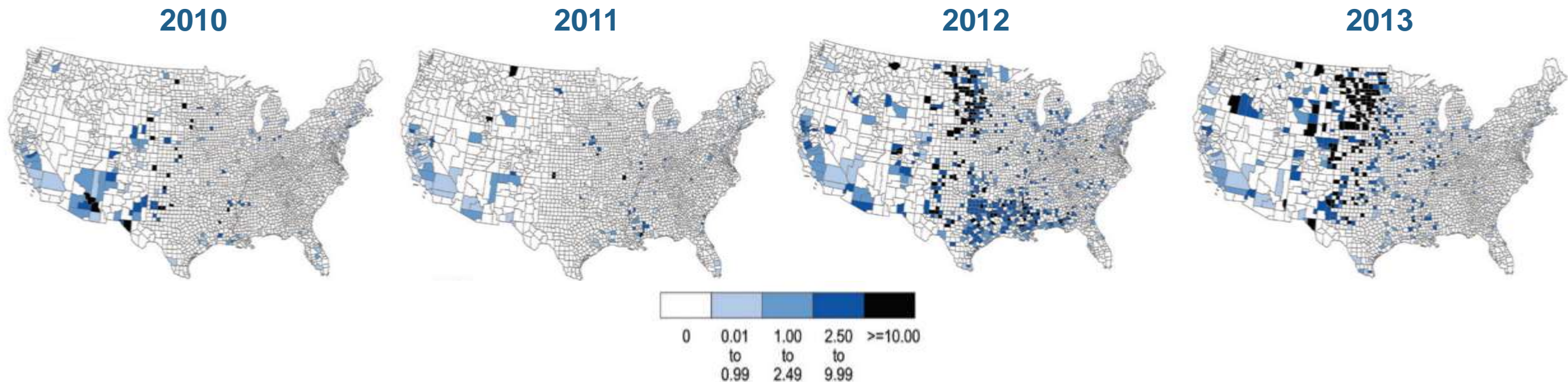


Zika virus



# Vectorborne Disease

New cases of **West Nile virus** are **increasing** in the US



**Figure 5:** Maps show the incidence of West Nile neuroinvasive disease in the United States for 2010 through 2013. Shown as cases per 100,000 people. (Data source: CDC 2014)<sup>73</sup>

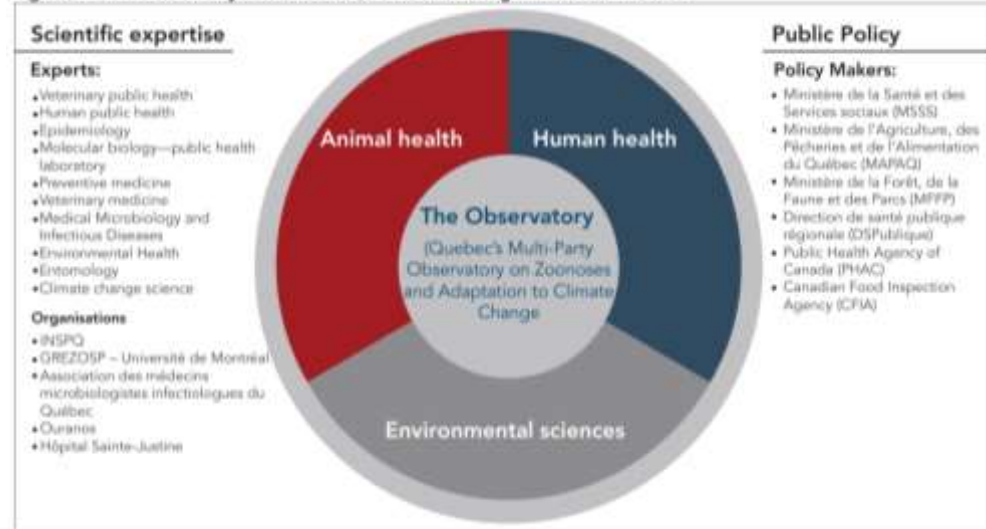
USGCRP, 2016





# Vectorborne Disease Adaptation

Figure 1: The Observatory's "One World, One Health" organizational structure



Abbreviations: INSPQ, Institut national de santé publique du Québec; GREZOSP, Groupe de recherche en épidémiologie des zoonoses et en santé publique  
 Legend: Diagram of the three areas of expertise at the core of Quebec's Multi-Party Observatory on Zoonoses and Adaptation to Climate Change, and the links among scientific experts and public

Table 1: The mandate, activities and actions of the Observatory in Quebec

Mandate	Activities	Actions	Examples
Identify and anticipate possible zoonotic disease and climate change issues	Prioritization exercise	Identifying the most significant zoonotic diseases in terms of effects on health, socio-economic impacts and potential emergence due to climate change  Highlighting the knowledge gaps and related issues in relation to the prioritized zoonotic diseases	Prioritization publications: <a href="http://www.inspq.qc.ca/publications/2432">www.inspq.qc.ca/publications/2432</a> (French only) <a href="http://www.inspq.qc.ca/publications/2293">www.inspq.qc.ca/publications/2293</a> (French only)
Report on the evolution of zoonoses through monitoring	Scientific monitoring	Monitoring and providing summaries of scientific literature, official reports, grey literature and current events	Newsletter: <a href="http://www.inspq.qc.ca/zoonoses/observatoire/bulletin">www.inspq.qc.ca/zoonoses/observatoire/bulletin</a> (French only)
	Tact monitoring	Collecting tact information and recent zoonoses-related issues from members during professional meetings	-
Communicate the identified issues and needs	Issue identification	Sharing meeting reports and highlighting monitoring and identified issues within their organizations	Meeting reports are relayed by the Observatory's members throughout their respective networks
	Circulation of publications	Drafting a communication plan to promote the Observatory's publications	Actions in the communication plan include participation in targeted conferences and promotion through the INSPQ and GREZOSP webpages
Develop knowledge-transfer products	Webinars	Organizing and promoting webinars on zoonotic emerging issues	Ten webinars on topics such as Lyme disease, Enteric zoonoses, Ebola in West Africa, monitoring of <i>Aedes albopictus</i> and modelling studies for mosquito-borne diseases
	Conferences	Organizing conferences for public health professionals	Three conferences as part of the Annual Public Health Days (e.g. 2018 presentation Regional Vulnerabilities to Zoonoses and Adaptation to Climate Change in Municipalities)

Abbreviations: INSPQ, Institut national de santé publique du Québec; GREZOSP, Groupe de recherche en épidémiologie des zoonoses et en santé publique

**Vectorborne Diseases**

- Educate
- Vector control
- Eradicate vector-prone areas

# It's Not *Just* Physical Health



Climate change threatens mental wellness:

Stress

Anxiety

PTSD

Depression

Violence

Suicide

Medication interaction

# Collective Voices in Health

## A Declaration on Climate Change and Health

As leading public health, patient advocacy, nursing and medical organizations, we reiterate our longstanding commitment to addressing climate change as a public health issue. The statement below articulates our consensus on the health impacts of climate change and the need for action to protect the public's health.

- The health impacts of climate change demand **immediate action**.
- The **science is clear**; communities across the nation are **experiencing the health impacts** of climate change, including:
  - Elevated **ozone** and **particulate** air pollution, linked to asthma attacks, cardiovascular disease and premature death;
  - **Extreme weather patterns, such as heat and severe storms that cause droughts, wildfires and flooding** that destabilize communities, especially those least equipped to defend themselves; and
  - Increased **vector-borne diseases** by expanding seasons and geographic ranges for ticks, mosquitoes and other disease-carrying insects to roam.
- The **most vulnerable** – children, seniors, low-income communities, some communities of color, and those with chronic disease – disproportionately bear the health impacts of climate change.
- **Bold action** is needed to address climate change by cleaning up major sources of carbon pollution and other greenhouse gases, including **power plants**, cars, trucks and other mobile sources.
- Communities must have the tools and resources to adapt to and **mitigate the unique impacts** of climate change in their communities.
- **We call on President Trump, EPA Administrator Scott Pruitt, and members of Congress** to heed the clear scientific evidence and take steps now to reduce pollution that drives climate change and harms health.
- The public health, disease advocacy and medical community are **united in our efforts to protect the public from the risks of climate change**.



# | Thank you



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 @DrDeJarnett

