



Climate Change

Populations of Concern

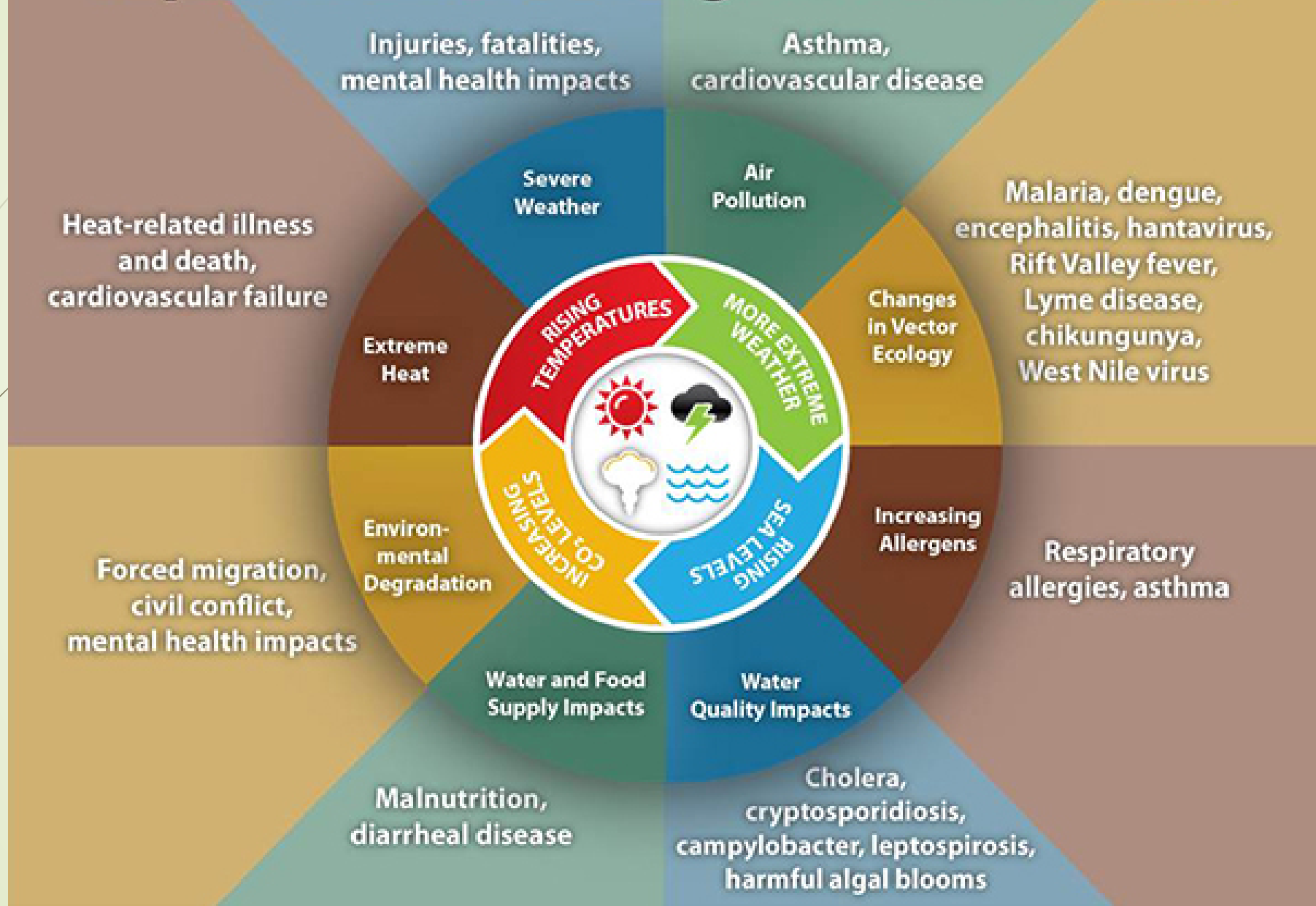


Framing the Issues of Climate Change

“Climate change is a public health emergency: The health and well-being (and possibly the very survival) of the communities we serve is in danger, as witnessed by the increased occurrence of disastrous wildfires and extreme weather events. Our actions now (or lack thereof) will affect the magnitude of climate impacts and the extent to which our communities thrive in the face of climate change and recover in the aftermath of climate-related disasters.”

Georges C. Benjamin, MD Executive Director American Public Health Association

Impact of Climate Change on Human Health



CLIMATE DRIVERS

- Increased temperatures
- Precipitation extremes
- Extreme weather events
- Sea level rise

ENVIRONMENTAL & INSTITUTIONAL CONTEXT

- Land-use change
- Ecosystem change
- Infrastructure condition
- Geography
- Agricultural production & livestock use

EXPOSURE PATHWAYS

- Extreme heat
- Poor air quality
- Reduced food & water quality
- Changes in infectious agents
- Population displacement

SOCIAL & BEHAVIORAL CONTEXT

- Age & gender
- Race & ethnicity
- Poverty
- Housing & infrastructure
- Education
- Discrimination
- Access to care & community health infrastructure
- Preexisting health conditions

HEALTH OUTCOMES

- Heat-related illness
- Cardiopulmonary illness
- Food-, water-, & vector-borne disease
- Mental health consequences & stress



Climate Drivers

- 
1. Extreme Heat
 2. Outdoor Air Quality
 3. Food-Related Infections
 4. Water-Related Infections
 5. Vector-Borne Infections
 6. Extreme Weather Events
 7. Mental Health & Well-Being

Source: The Impacts of Climate Change on Human Health in the United States



Climate Change is a Risk Multiplier

Risk for adverse effects of climate change may be increased by:

1. Living in areas particularly vulnerable to climate change;
2. Already having existing health risks compared to other groups;
3. Being uninsured or living with limited access to health care services;
4. Having limited availability and accessibility to public health information and resources; and
5. Having a low ability to relocate or rebuild after a disaster.

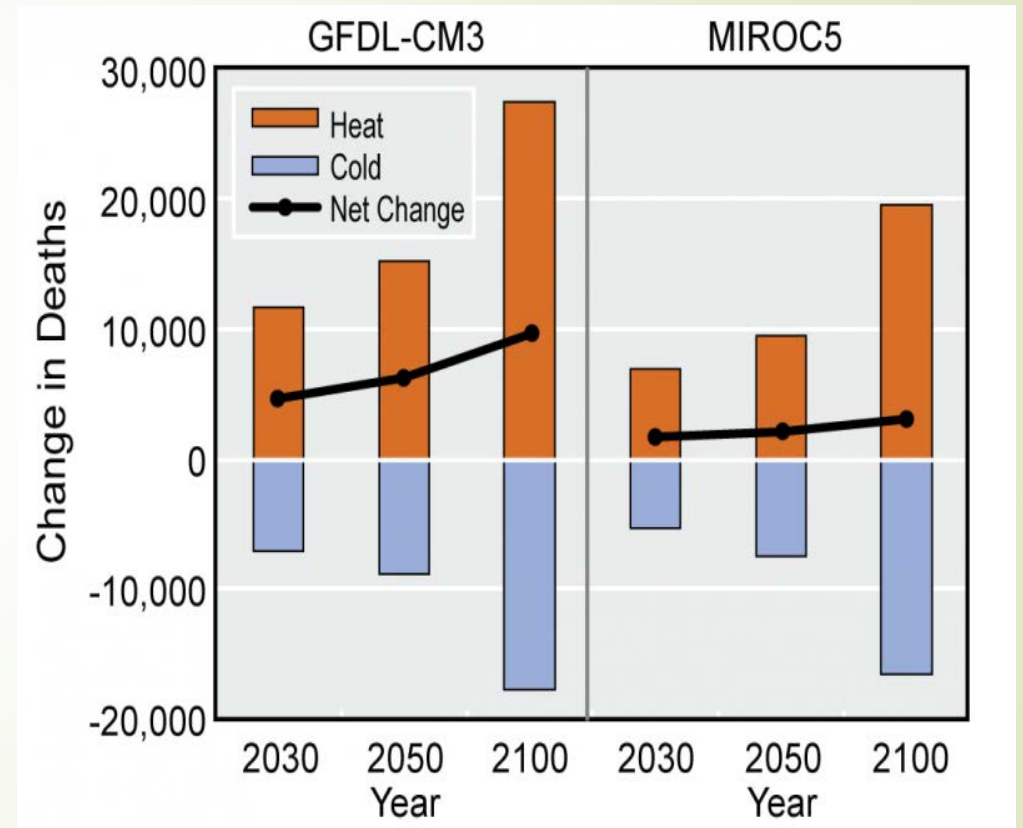


EXTREME HEAT

Climate Driver	Exposure	Health Outcome	Impact
More frequent, severe, prolonged events	Elevated temperatures	Heat-related death and illness	Rising temperatures will lead to an increase in heat-related deaths and illnesses.

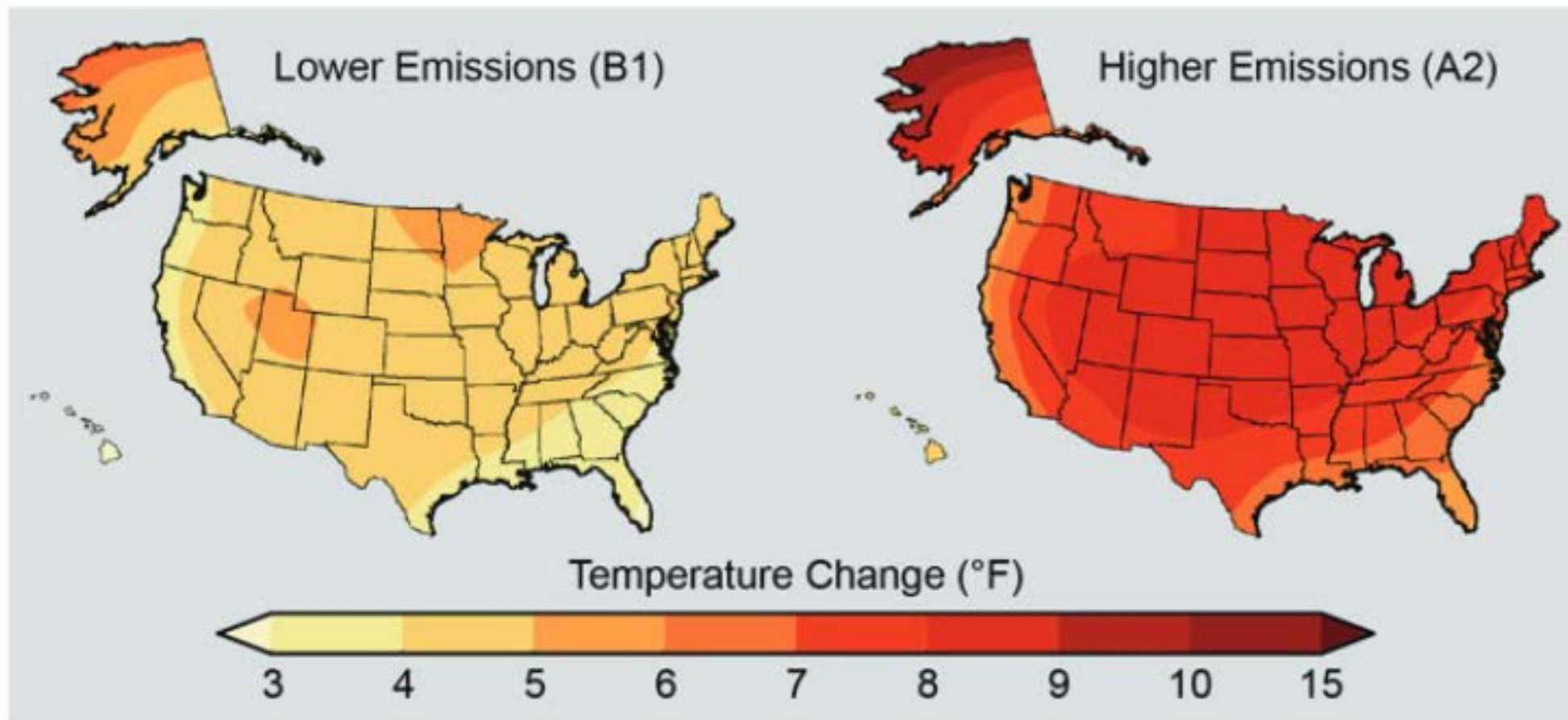
Temperature-Related Death and Illness

Increasing concentrations of greenhouse gases lead to an increase of both average and extreme temperatures. This is expected to lead to an increase in deaths and illness from heat and a potential decrease in deaths from cold, particularly for a number of communities especially vulnerable to these changes, such as children, the elderly, and economically disadvantaged groups.



- GFDL-cm3: Geophysical Fluid Dynamics Laboratory Climate Model Intercomparison Project
- MIROC5: Model for Interdisciplinary Research on Climate

Projected Temperature Change



Source: CLIMATE CHANGE, HEALTH, AND EQUITY: A GUIDE FOR LOCAL HEALTH DEPARTMENTS



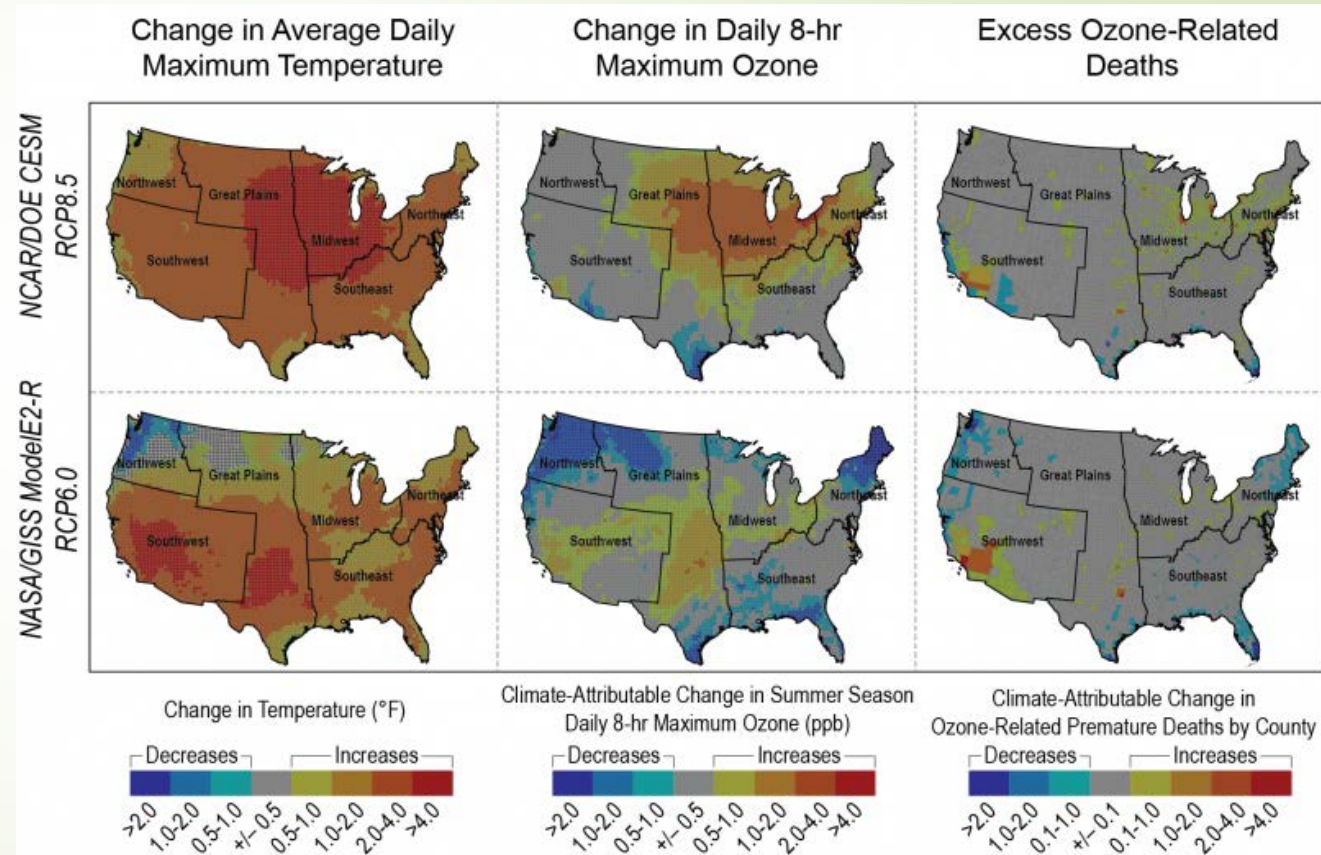
Outdoor Air Quality

Climate Driver	Exposure	Health Outcome	Impact
Increasing temperatures and changing precipitation patterns	Worsened air quality (ozone, PM, higher pollen counts)	Premature death, acute and chronic cardiovascular and respiratory illnesses	Rising temperatures and wildfires and decreasing precipitation will lead to increases in ozone and PM, elevating the risks of cardiovascular and respiratory illnesses and death.

Air Quality Impacts

Changes in the climate affect the air we breathe, both indoors and outdoors. The changing climate has modified weather patterns, which in turn have influenced the levels and location of outdoor air pollutants such as ground-level ozone (O_3) and fine particulate matter.

Increasing carbon dioxide (CO_2) levels also promote the growth of plants that release airborne allergens. Finally, these changes to outdoor air quality and aeroallergens also affect indoor air quality as both pollutants and aeroallergens infiltrate homes, schools, and other buildings.





HEALTH EFFECTS OF AIR POLLUTION

Exposure to air pollution is linked to mortality and shortening of life expectancy. In the short-term (i.e., a few days to weeks), exposure to air pollution can impact an individual's health. During certain high-pollution days, the effects can be more severe.

However, the biggest impact comes from long-term exposure (i.e., weeks to months) to air pollutants, which increases a person's chances of dying from heart disease, chronic respiratory diseases, lung infections, lung cancer, diabetes, and other health problems.



Particulate Matter

Not surprisingly, exposure to air pollution also reduces the numbers of years that a person is expected to live. Among the air pollutants, fine particulate matter (PM_{2.5}) is the most consistent and robust predictor of mortality in studies of long-term exposure.

Particulate matter is a complex mixture of particles of various sizes and chemical composition originating from combustion and other sources. Over the past decades, research has focused on the question which particles may be more toxic than others, but it remains difficult to disentangle the effects of different types of particles from each other or from other pollutants.

Some groups of people, including children, pregnant women, the elderly, and people with heart and lung diseases, are more affected by exposure to air pollution.



Health Impacts of PM_{2.5}

- Studies have shown that long-term exposure to PM_{2.5} can contribute to ischemic heart disease, cerebrovascular disease (ischemic stroke and hemorrhagic stroke), lung cancer, chronic obstructive pulmonary disease (COPD), lower-respiratory infections (in particular, pneumonia), and more recently, diabetes.
- PM_{2.5} pollution contributed to nearly 3 million deaths, or 5.2% of all global deaths in 2017.
- More than half of these deaths (52%) occurred in China and India.
- The number of deaths attributable to PM_{2.5} grew by 68% between 1990–2017.

<https://www.stateofglobalair.org/health#PMH>



Ozone and Oxidants

Ozone (O₃) is a reactive gas that has been associated with adverse health effects in children and adults. Effects on the respiratory system are well established and include exacerbation of asthma (acute effects) and effects on lung growth (chronic effects). More recently, long-term exposure to ozone has been associated with adverse cardiovascular outcomes, including increased mortality. It is unclear, however, at what ozone concentrations effects start occurring. HEI's research program on ozone focuses on effects at low concentrations and on mechanisms of effects.

- ❖ Ozone is created by atmospheric reactions on sunny days
- ❖ Building blocks are nitrogen oxides and volatile organic compounds
- ❖ Ground level ozone affects lung and heart health and also affects crops



Health Impacts of Ozone

- Short-term exposure to ozone is linked to asthma exacerbation and other respiratory problems. Long-term exposure to ozone is associated with increased risk of death from chronic obstructive pulmonary disease (COPD).
- Long-term exposure to ozone accounted for nearly half a million deaths from COPD worldwide in 2017.
- That number jumped 20% between 1990 and 2017, with most of the growth seen in the past decade.



Short-Term Health Effects

Exposures over a few hours to a few days can contribute to ear, nose, and throat irritation. The irritation usually disappears with the removal of the pollutant(s).

Short-term exposure may also cause and aggravate lower-respiratory and chronic conditions such as allergies, asthma, and bronchitis. In people with heart disease, short-term exposure to PM_{2.5} can lead to heart attacks, arrhythmias, and even death.



Long-Term Health Effects

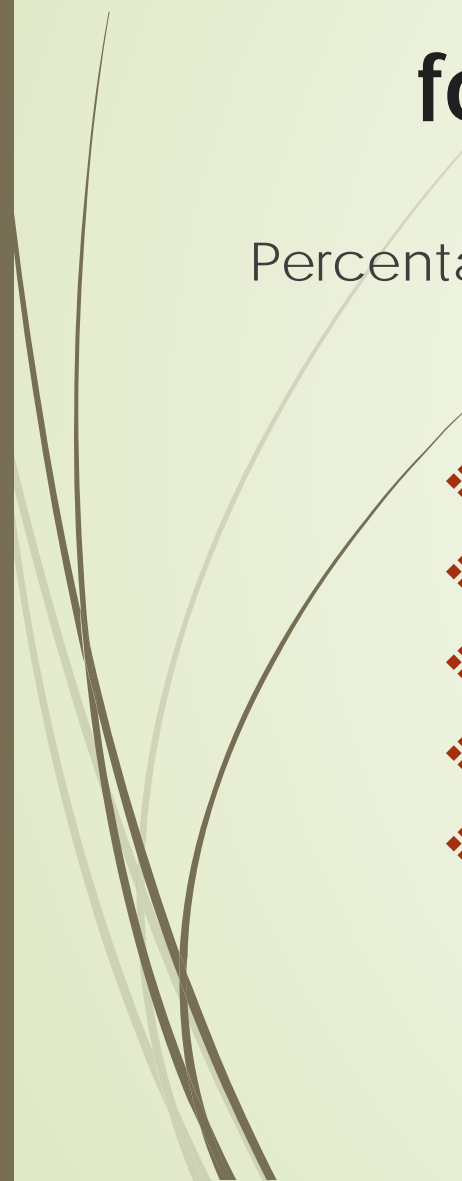
The Global Burden of Disease analysis estimates the impacts on health from long-term exposure to air pollution, which includes five noncommunicable diseases — diabetes, stroke, COPD, lung cancer, and ischemic heart disease — and one communicable disease — lower-respiratory infection.

There is broad scientific agreement that exposure to PM_{2.5} increases the risk of dying from these diseases. Exposure to air pollution is also associated with other conditions and diseases including metabolic dysfunction, disorders of the central nervous system (including neurological and psychiatric diseases), and adverse pregnancy and developmental outcomes (e.g., preterm birth, low birth weight, or growth restriction).



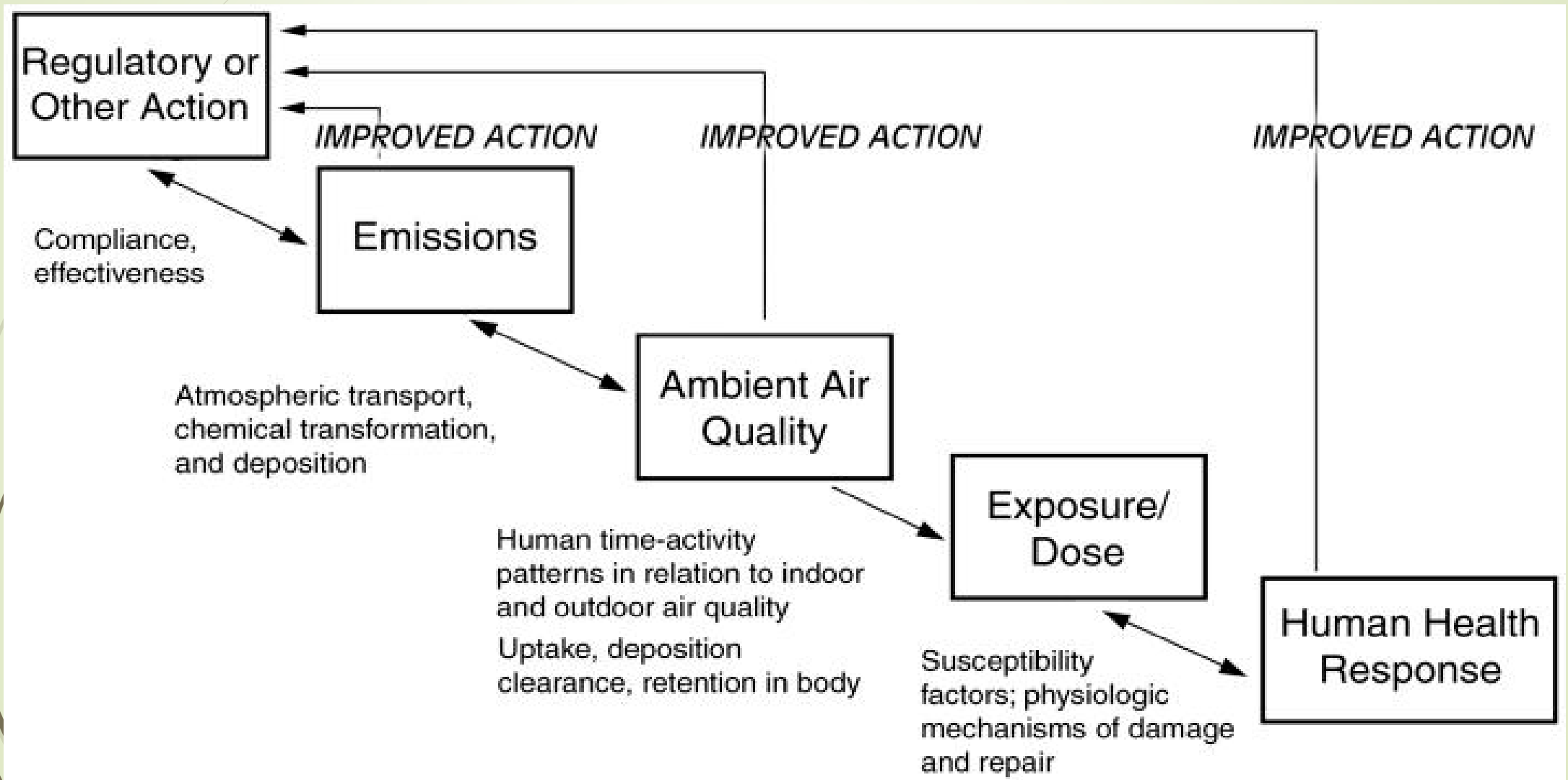
Globally, air pollution is linked to the following noncommunicable diseases:

Percentage of deaths by cause attributed to air pollution in 2017.



❖ COPD Deaths	41%
❖ Diabetes Deaths	20 %
❖ Ischemic heart Disease Deaths	16%
❖ Lung Cancer Deaths	11%
❖ Stroke Deaths	11%

Chain of Accountability

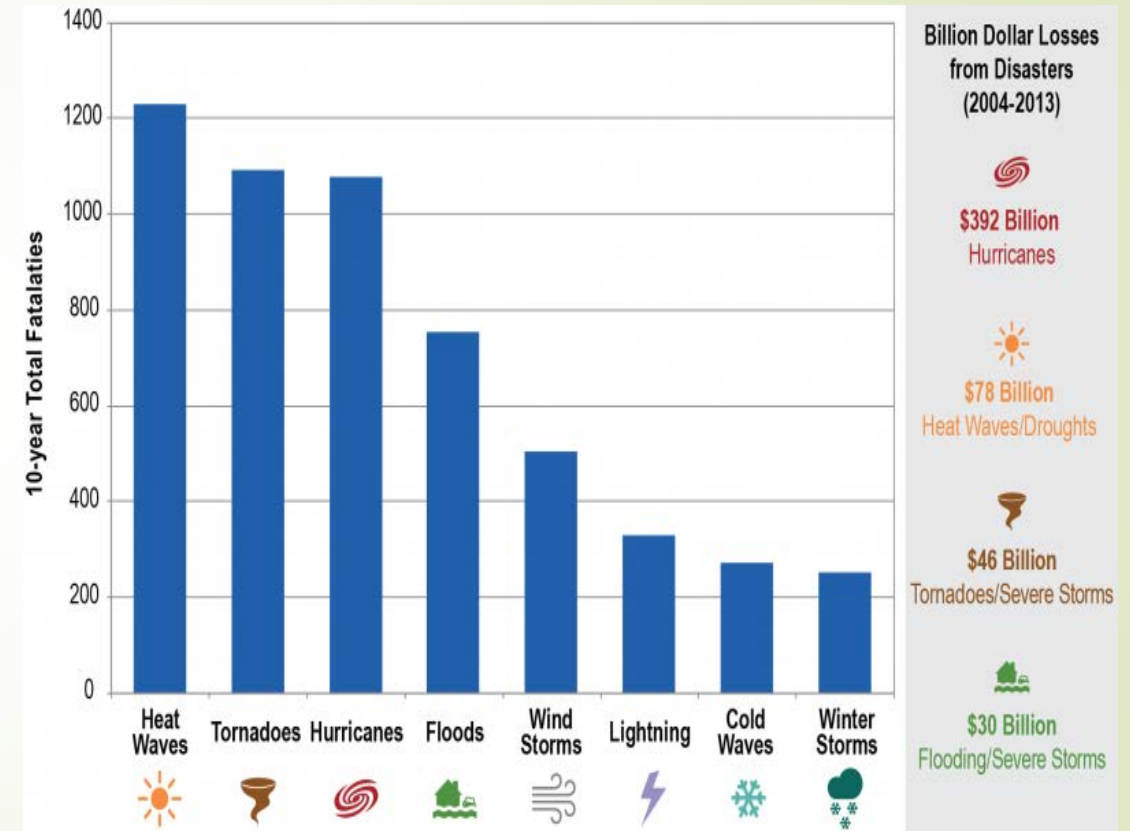


Extreme Events

Climate change projections show that there will be continuing increases in the occurrence and severity of some extreme events by the end of the century, while for other extremes the links to climate change are more uncertain.

While it is intuitive that extremes can have health impacts such as death or injury during an event (for example, drowning during floods), health impacts can also occur before or after an extreme event, as individuals may be involved in activities that put their health at risk, such as disaster preparation and post-event cleanup.

Health risks may also arise long after the event, or in places outside the area where the event took place, as a result of damage to property, destruction of assets, loss of infrastructure and public services, social and economic impacts, environmental degradation, and other factors.

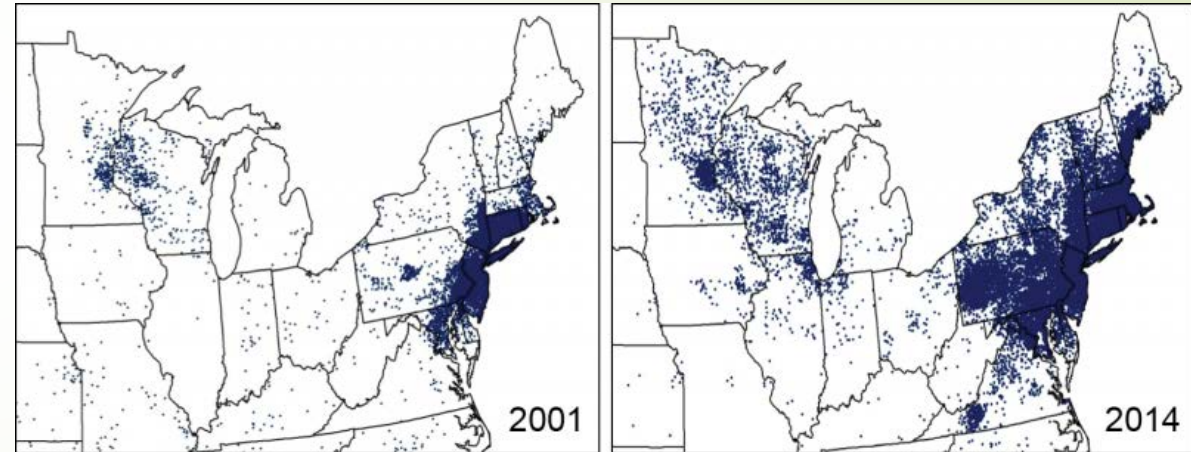


Vector-Borne Diseases

Vector-borne diseases are illnesses that are transmitted by *vectors*, which include mosquitoes, ticks, and fleas. These vectors can carry infective pathogens such as viruses, bacteria, and protozoa, which can be transferred from one host to another.

The seasonality, distribution, and prevalence of vector-borne diseases are influenced significantly by climate factors, primarily high and low temperature extremes and precipitation patterns.

Climate change is likely to have both short- and long-term effects on vector-borne disease transmission and infection patterns.



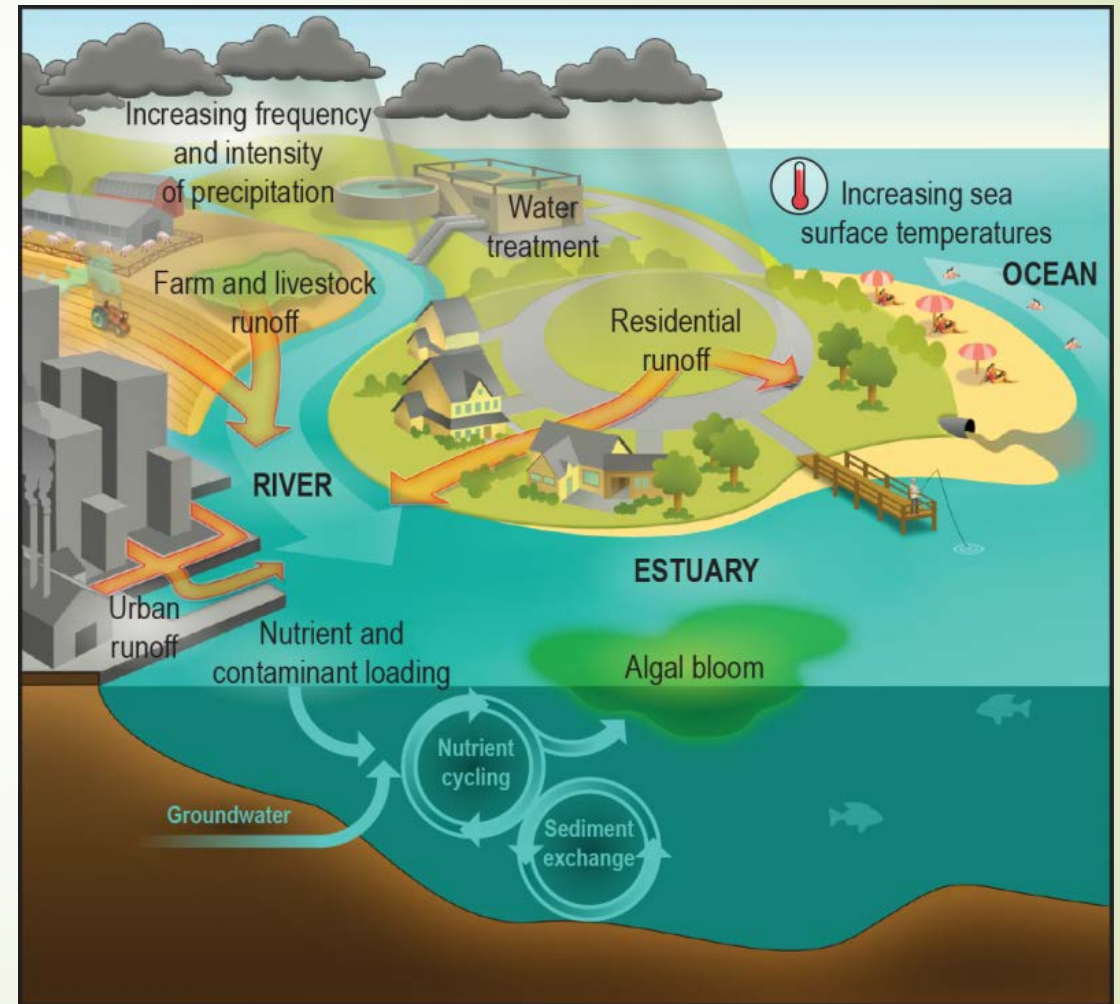
Water-Related Illness

Across most of the United States, climate change is expected to affect fresh and marine water resources in ways that will increase people's exposure to water-related contaminants that cause illness.

Water-related illnesses include waterborne diseases caused by pathogens, such as bacteria, viruses, and protozoa.

Water-related illnesses are also caused by toxins produced by certain harmful algae and cyanobacteria and by chemicals introduced into the environment by human activities.

Exposure occurs through ingestion, inhalation, or direct contact with contaminated drinking or recreational water and through consumption of contaminated fish and shellfish.



Food Safety, Nutrition, and Distribution

A safe and nutritious food supply is a vital component of food security.

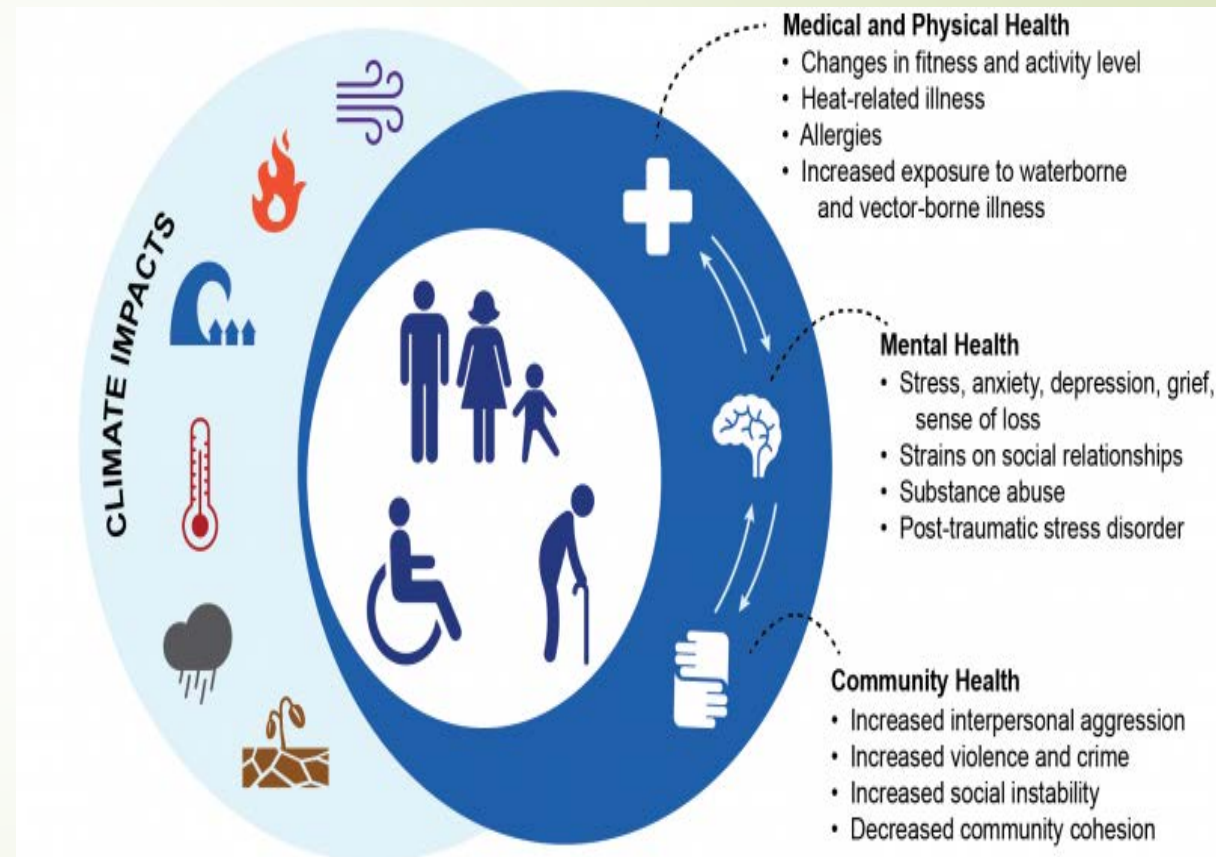
The impacts of climate change on food production, prices, and trade for the United States and globally have been identified in the recent report "Climate Change, Global Food Security, and the U.S. Food System."

An overall finding of that report was that "climate change is very likely to affect global, regional, and local food security by disrupting food availability, decreasing access to food, and making utilization more difficult.



Mental Health and Well-Being

The effects of global climate change on mental health and well-being are integral parts of the overall climate-related human health impacts. Mental health consequences of climate change range from minimal stress and distress symptoms to clinical disorders, such as anxiety, depression, post-traumatic stress, and suicidality. Other consequences include effects on the everyday life, perceptions, and experiences of individuals and communities attempting to understand and respond appropriately to climate change and its implications.

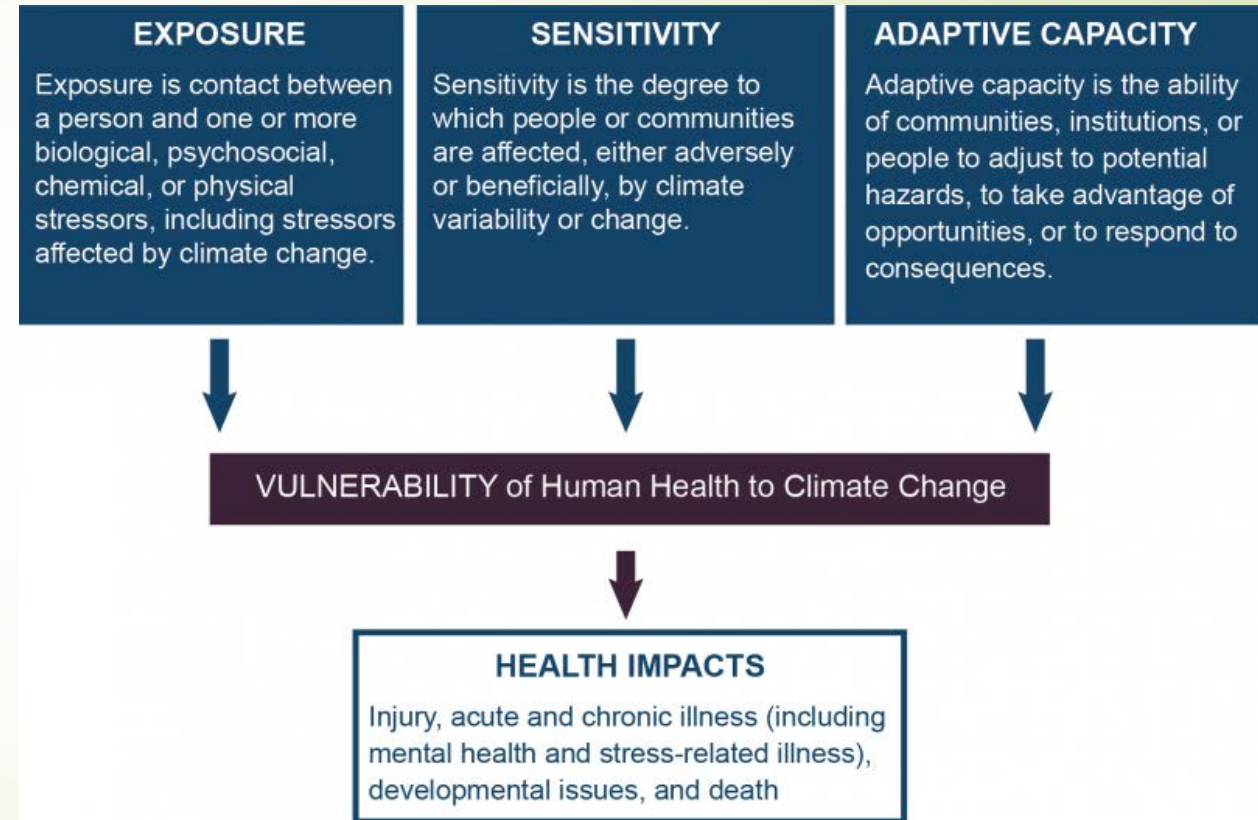


Populations of Concern

Climate change is already causing, and is expected to continue to cause, a range of health impacts that vary across different population groups in the United States.

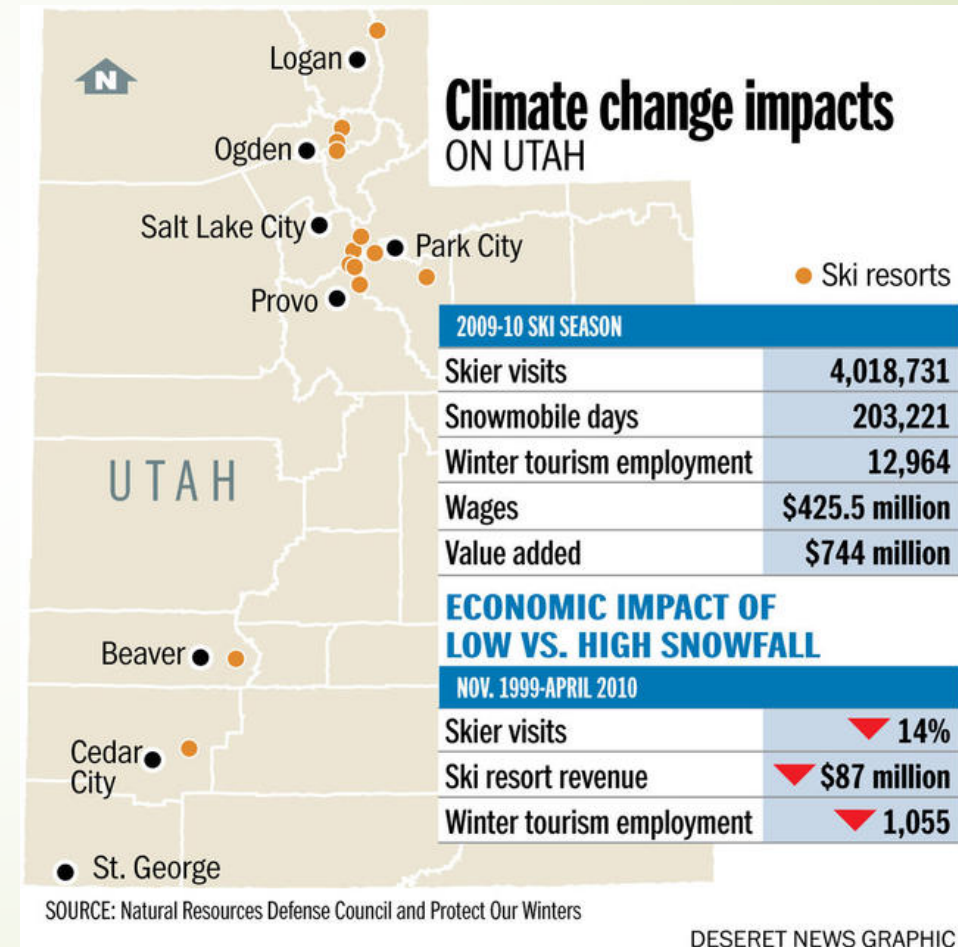
The vulnerability of any given group is a function of its sensitivity to climate change related health risks, its exposure to those risks, and its capacity for responding to or coping with climate variability and change.

Vulnerable groups of people (*populations of concern*) include those with low income, some communities of color, immigrant groups (including those with limited English proficiency), Indigenous peoples, children and pregnant women, older adults, vulnerable occupational groups, persons with disabilities, and persons with preexisting or chronic medical conditions.

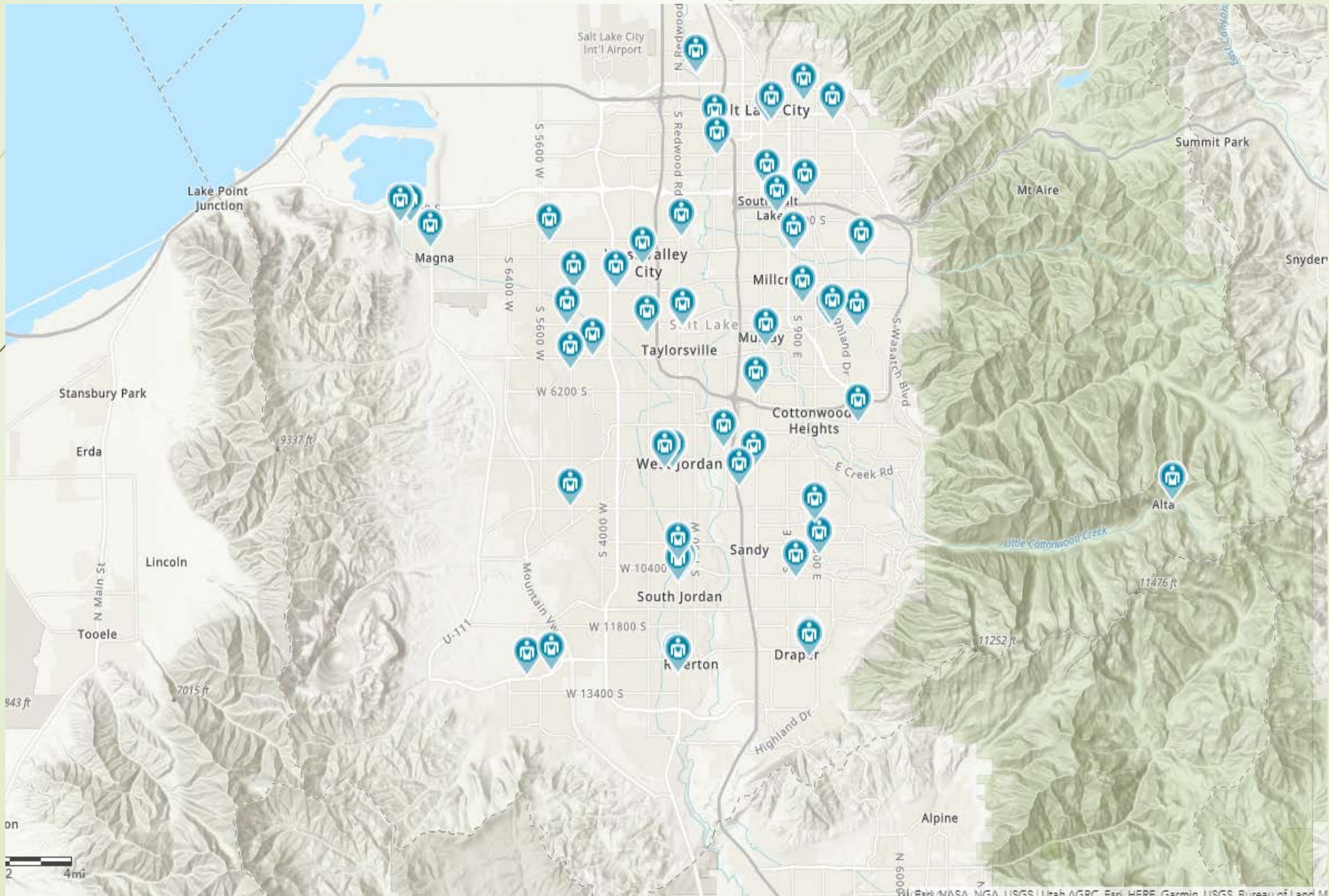


Regional Impacts

Heat Stress Events
Increasing Ozone Events
PM_{2.5} Events (Wildfires)
Harmful Algal Blooms
Drought
Water Quality/Quantity Issues



Salt Lake County Cool Zones






Salt Lake County Cool Zones

<https://slco.maps.arcgis.com/apps/LocalPerspective/index.html?appid=96d6561cb47c41ea82bff5209e2b2c89>





Royal P. DeLegge, Ph.D., LEHS, RS
Environmental Health Director
Salt Lake County Health Department
385-468-3874

rdelegge@slco.org



Information & Data Sources

- <https://www.cdc.gov/climateandhealth/default.htm>
- <https://health2016.globalchange.gov>
- <https://www.healtheffects.org/>