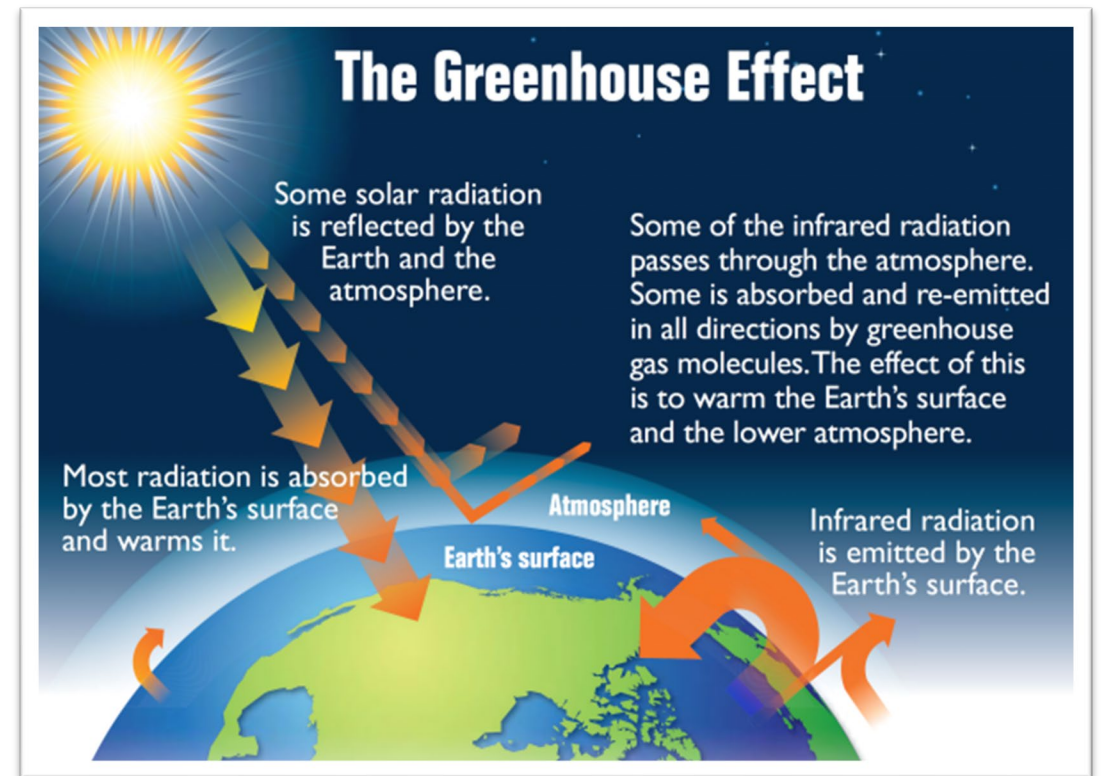

MICHIGAN CLIMATE & HEALTH ADAPTATION PROGRAM

Learning Objectives

1. How is Michigan's climate changing?
2. What are the impacts to health?
3. What are impacts to asthma and what can be done?

CLIMATE CHANGE 101

- **Weather:** day to day temperature, humidity, rainfall, wind, etc.
- **Climate:** describes weather of a place averaged over a period of time
- **Climate change:** significant change in average temperature, precipitation, wind patterns, or other aspects of climate over time
- Human and natural factors influence the earth's climate, but the long-term trend observed over the past century **can only be explained by the effect of human activities on climate**



Source: <https://www.epa.gov/climatechange-science>

Climate Change in the Great Lakes Region



Average
Temperature



2.3°F

1951-2017

Frost-free
Season



16 Days

1951-2017

Total
Precipitation



14%

1951-2017

Heavy Precipitation
Events



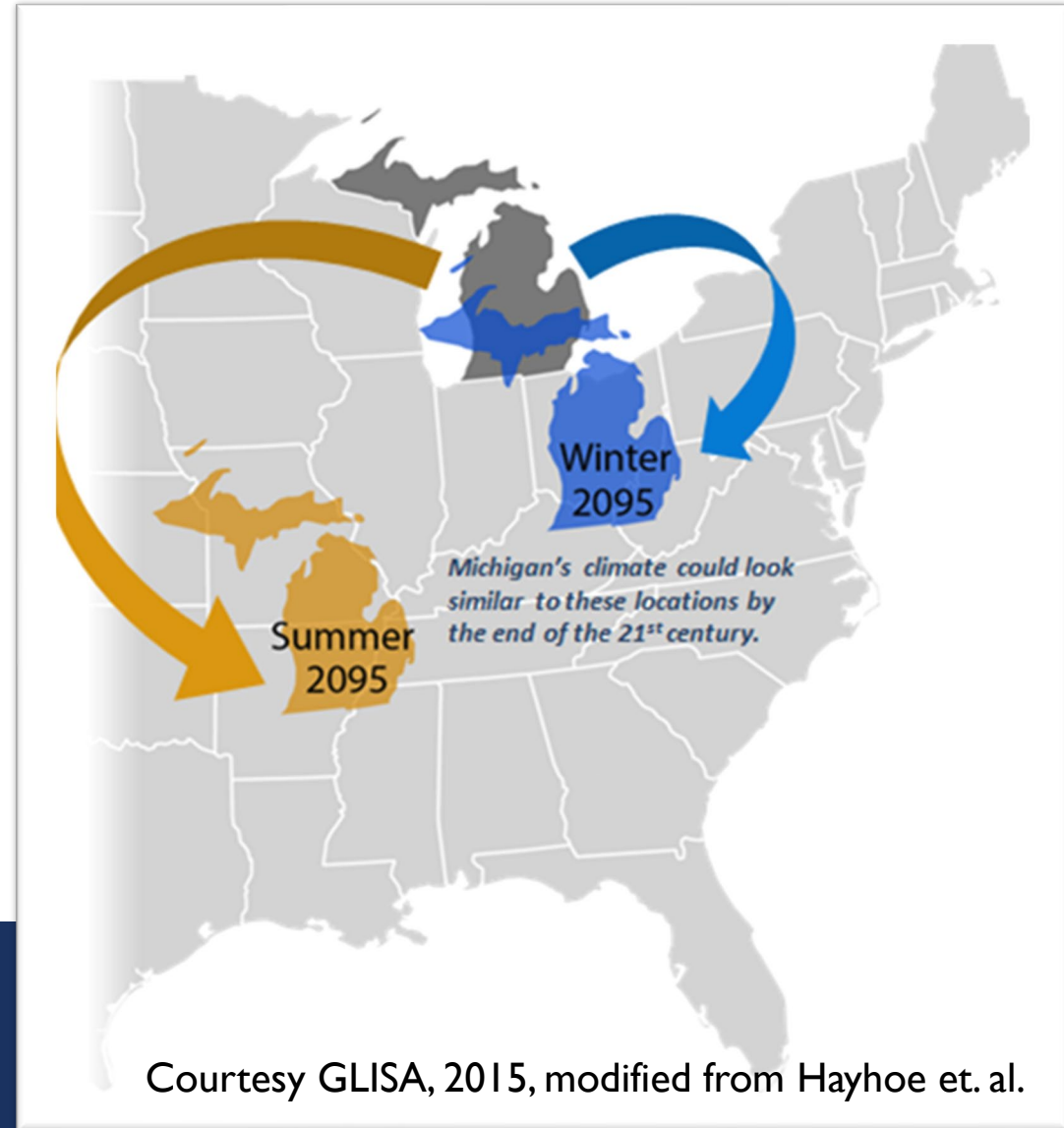
35%

1951-2017

Michigan 1960 -2012
2.9°F

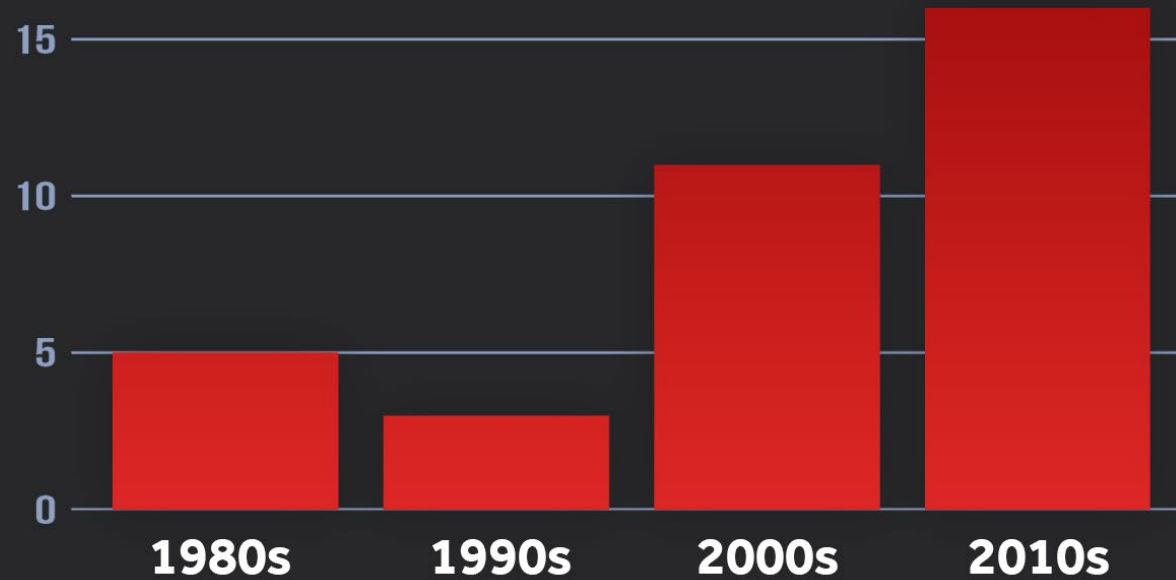
Michigan 1960-2012
4.5%

WHAT DO THOSE CHANGES REALLY MEAN?



SIGNIFICANT IMPACTS

MICHIGAN BILLION-DOLLAR DISASTERS WEATHER & CLIMATE EVENTS



1980-2019 billion-dollar weather and climate disasters (CPI-adjusted).
Source: NOAA/NCEI. Produced 2/12/2020



“The [Midland] flood in 2020 had great impact on those with diabetes in this area. We had patients that lost homes or were living outside of their home for a long time after the flood. This led to issues with refrigeration for their insulin and obtaining supplies for their insulin pump because they had no address for their durable medical equipment company to ship their diabetes supplies to.”

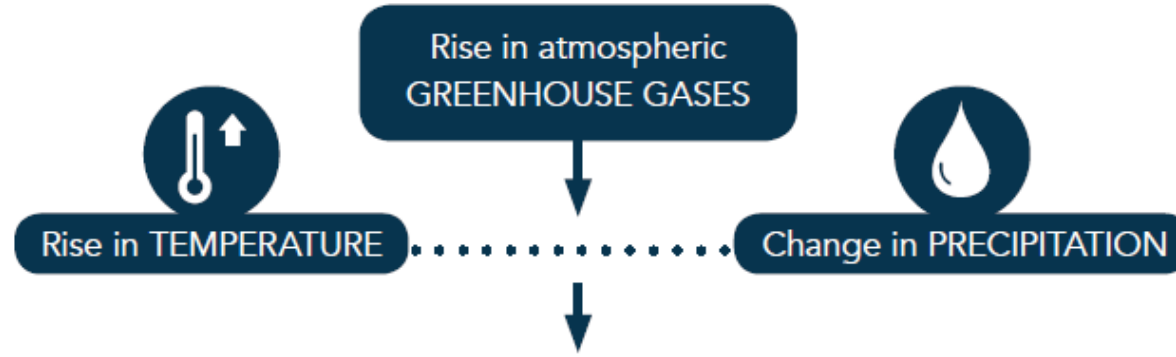
– Erin, RN, CDCES, Diabetes Center Manager, MyMichigan Medical Center, Midland



CONNECTING HEALTH TO CLIMATE

HOW DOES THAT IMPACT US?

CHANGES IN OUR ATMOSPHERE LEAD TO HEALTH EFFECTS

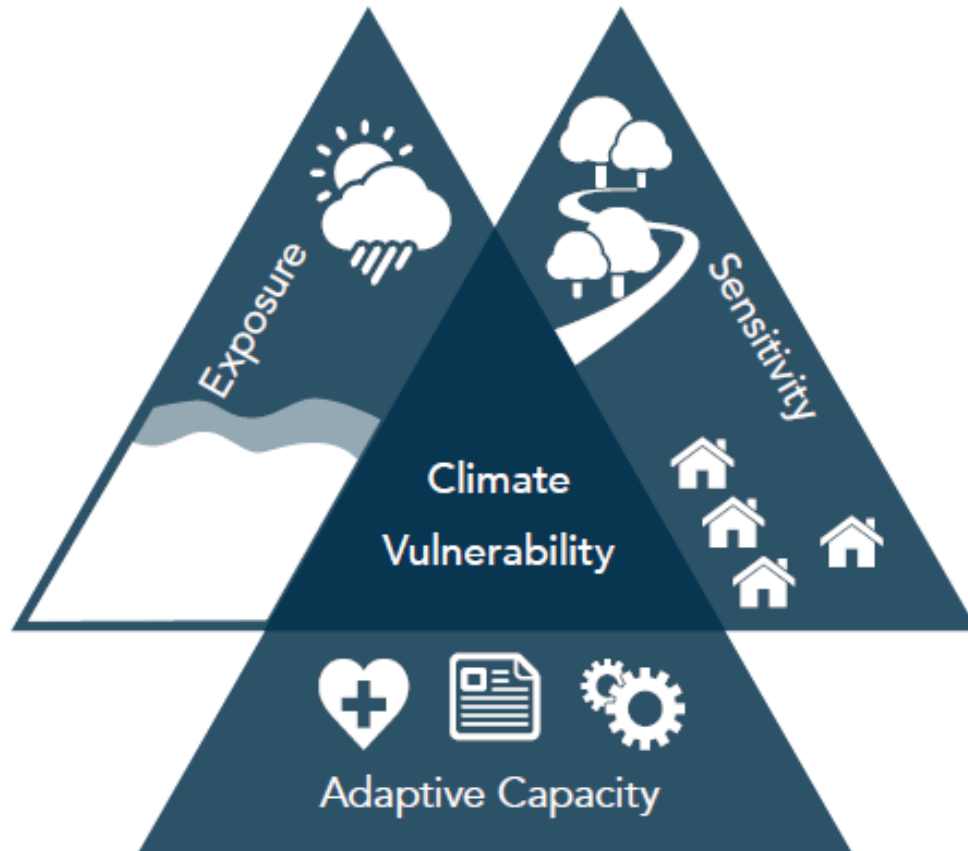


Changes in...



AIR QUALITY	EXTREME WEATHER EVENTS	WATER QUALITY AND QUANTITY	ECOSYSTEM CHANGES
Exposure Pathway <ul style="list-style-type: none">• Wildfire smoke• Particulates• Longer pollen season• Ozone and smog	Exposure Pathway <ul style="list-style-type: none">• Heat waves• Extreme cold• Storms	Exposure Pathway <ul style="list-style-type: none">• Drought• Flood• Harmful algal blooms	Exposure Pathway <ul style="list-style-type: none">• More animal hosts• More ticks & mosquitoes• Longer vector season
Health Outcomes <ul style="list-style-type: none">• New and worsening existing respiratory illness• Allergic diseases• Mental stress	Health Outcomes <ul style="list-style-type: none">• Heat illness and death• Cold-related injuries• Worsening existing cardio-respiratory illnesses• Mental stress	Health Outcomes <ul style="list-style-type: none">• Waterborne diseases• Worsening existing respiratory illness• Mental stress	Health Outcomes <ul style="list-style-type: none">• Lyme disease• West Nile Virus• Other tick- and mosquito-borne diseases

Intersection of Social Determinants of Health and Climate Vulnerability



EXPOSURE

Area impacted by climate hazard(s)
Severity of climate hazard(s)
Frequency of climate hazards

ADAPTIVE CAPACITY

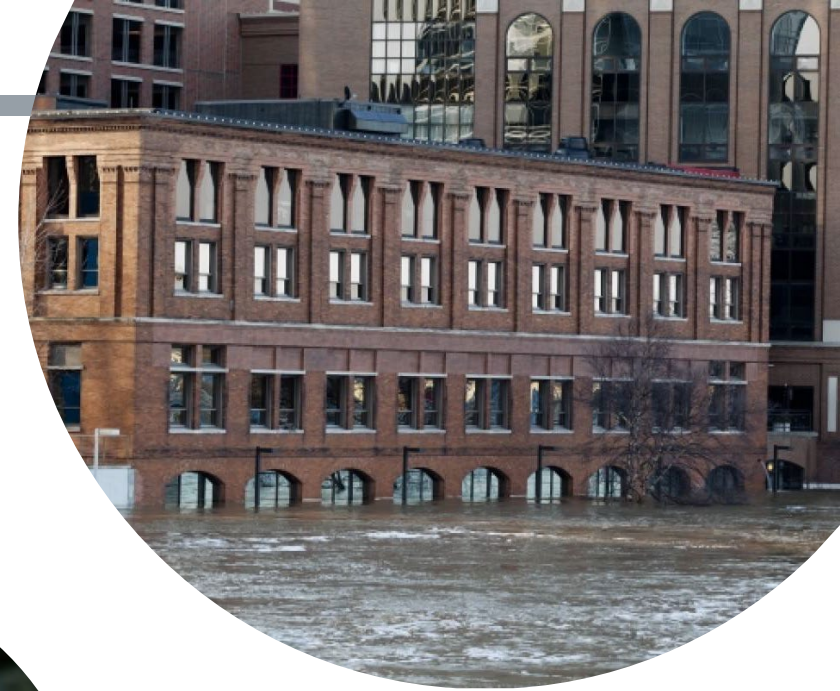
- Mobilizable response resources
- Information, skills & communication
- Institutional and social capital

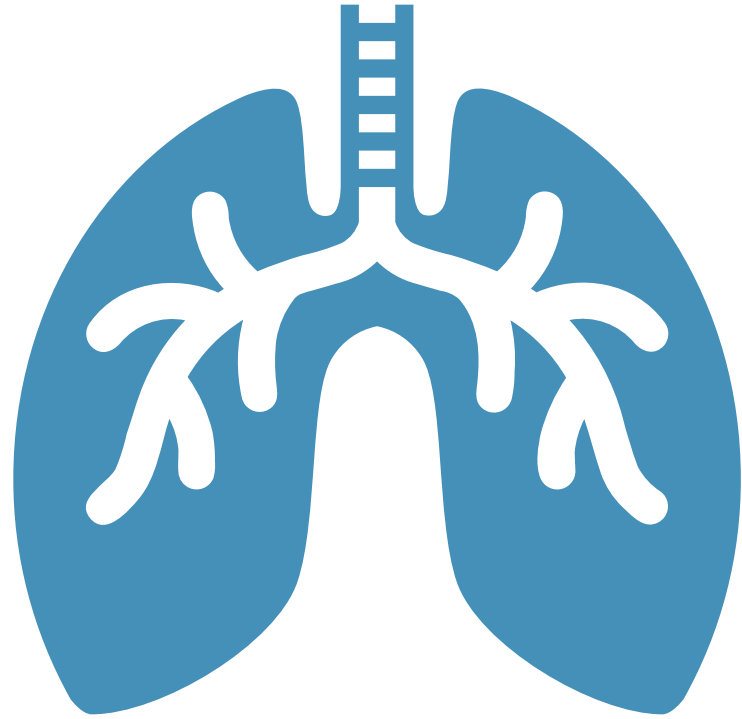
SENSITIVITY

- Household & community characteristics
- Quality of housing & other physical systems
- Functionality of, access to services & utilities

PRIORITY CLIMATE-RELATED HEALTH IMPACTS

1. Respiratory conditions
2. Heat illness
3. Waterborne diseases
4. Vector-borne diseases
5. Physical and mental health impacts



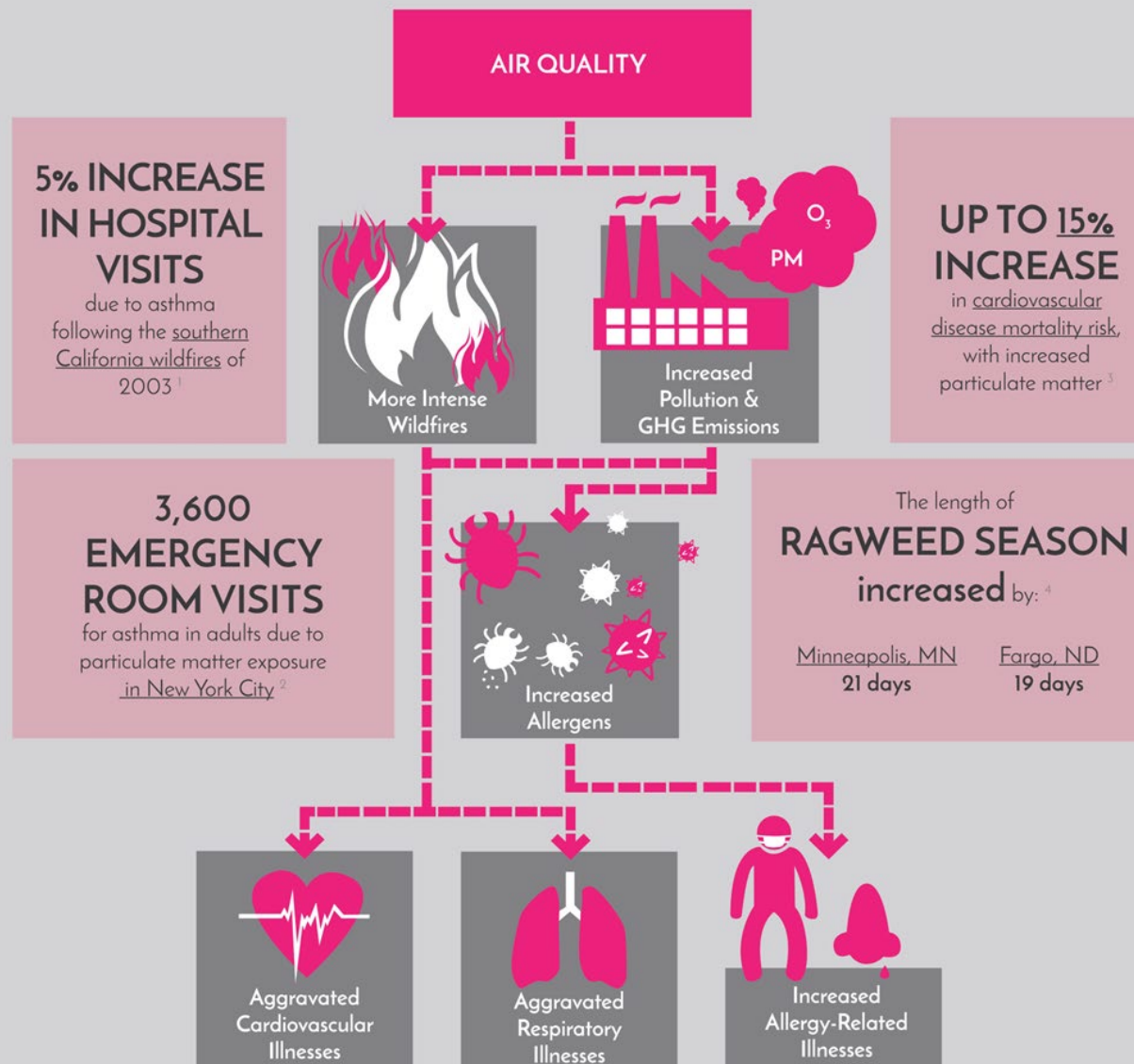


ASTHMA & CLIMATE CHANGE

HOW CLIMATE CHANGE AFFECTS YOUR HEALTH

Environmental changes increase:

- Average annual temperatures
- Precipitation
- Frost-free days
- Extreme weather events (flood, wildfires in Western US)



Health Impacts:

- Changes in air pollution, increase in ground-level ozone
- Longer pollen season & increased potency
- Increase in mold

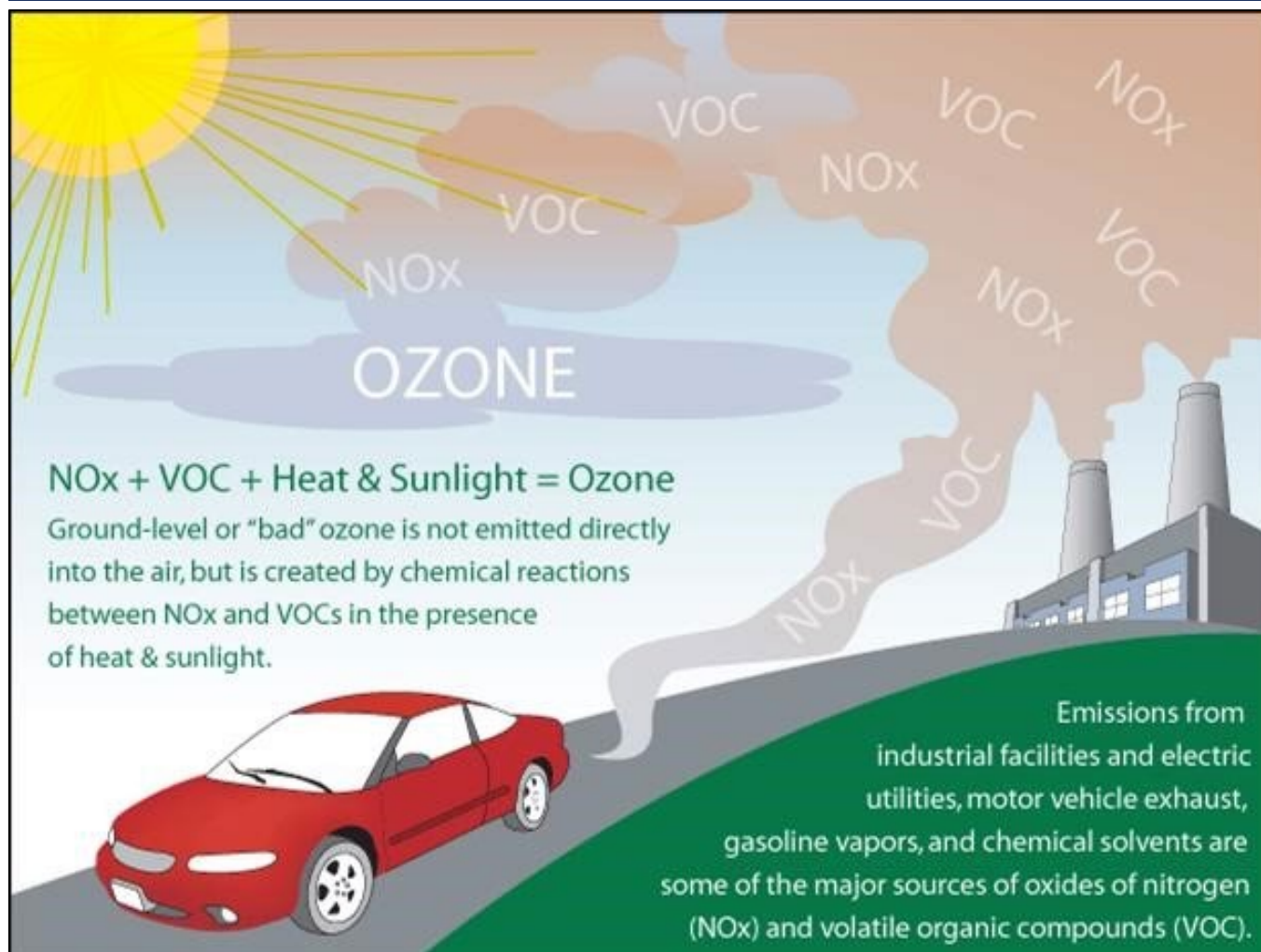
1. <http://www.ncbi.nlm.nih.gov/pubmed/19017694>
2. <http://www.nyc.gov/html/doh/downloads/pdf/eade/eade-air-quality-impact.pdf>
3. <http://www.aphis.usda.gov/comment/721212331/full>
4. https://www.whitehouse.gov/sites/default/files/docs/the_health_impacts_of_climate_change_on_american_food.pdf

CLIMATE CHANGE & ASTHMA IN CHILDREN

Table 1. The impact of climate change (CC)-related meteorological conditions on allergic rhinitis (AR) and asthma in children.

CC-Related Meteorological Conditions	AR	Asthma
Temperature	Prevalence of AR symptoms is positively associated with temperature [25,26].	Cold and hot temperatures influence the risk of access to emergency care [27,28].
Humidity	Inconsistent association with AR prevalence [29,30].	Inconsistent association with asthma prevalence and outcomes [6,31–34].
Drought	Prevalence of AR is lower in areas with a higher drought index (wetter conditions) [30].	Drought variations are positively correlated with asthma death rates [35].
Rainfall	Minimum and maximum precipitation are positively associated with AR symptom prevalence [25].	Exposures to extreme precipitation are associated with an increased risk of asthma hospitalisation [36] and epidemics of thunderstorm asthma [38].

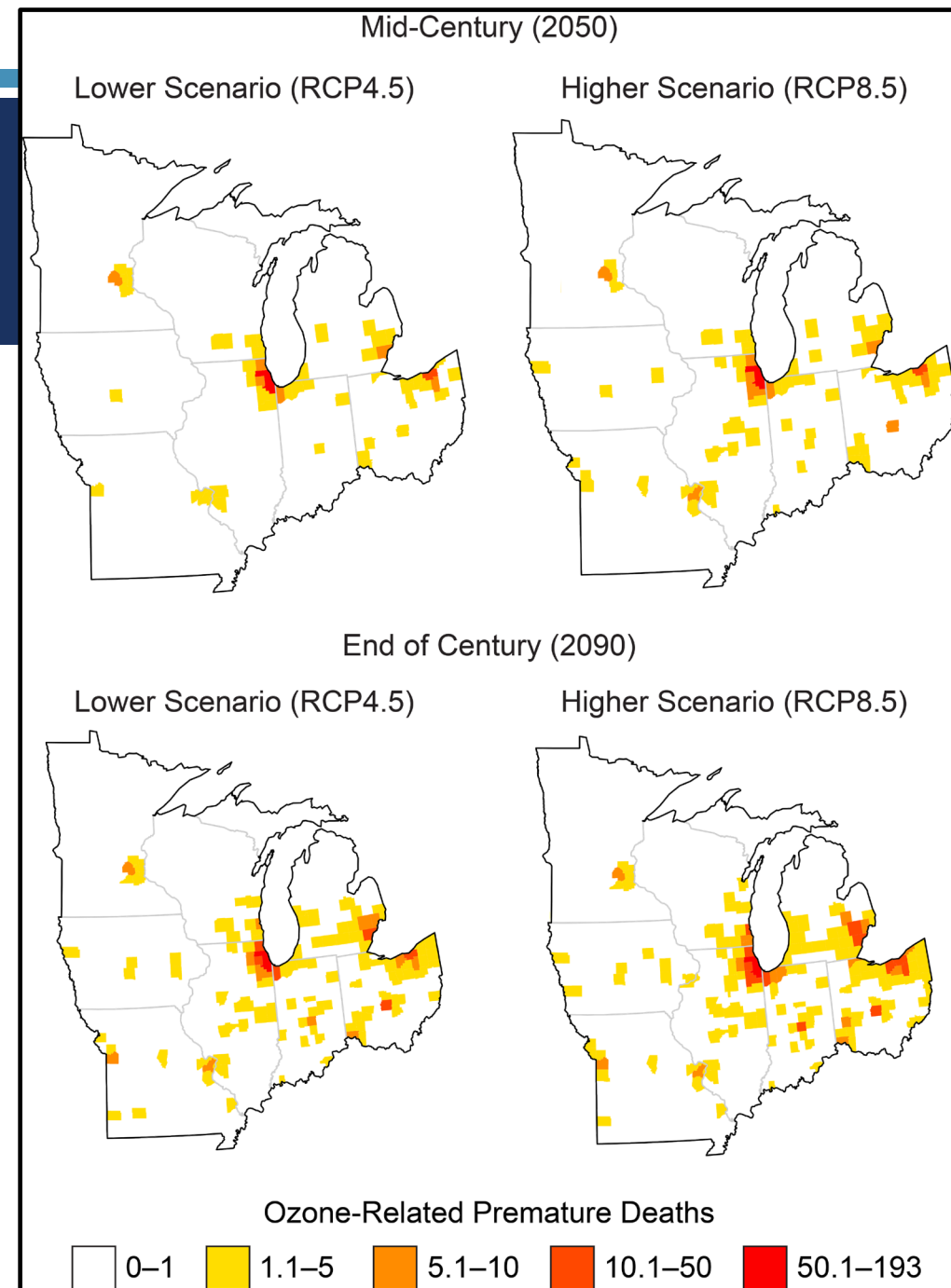
CLIMATE CHANGE & GROUND-LEVEL OZONE



- "Business as usual" 2050 projections: ozone levels contribute to **84,000 est. asthma ED visits** annually, **\$45 million to \$156 million** in costs
- 2050 projections if emissions are lowered: fewer asthma ED visits and annual costs associated with ground-level ozone than BAU, largest benefits in Midwest and Southwest ([Nassikas et al 2020](#))

CLIMATE CHANGE & GROUND-LEVEL OZONE

- No mitigation (RCP8.5, right column in maps), projected **200 to 550 additional premature deaths annually** due to ground-level ozone (all related deaths, not just asthma)

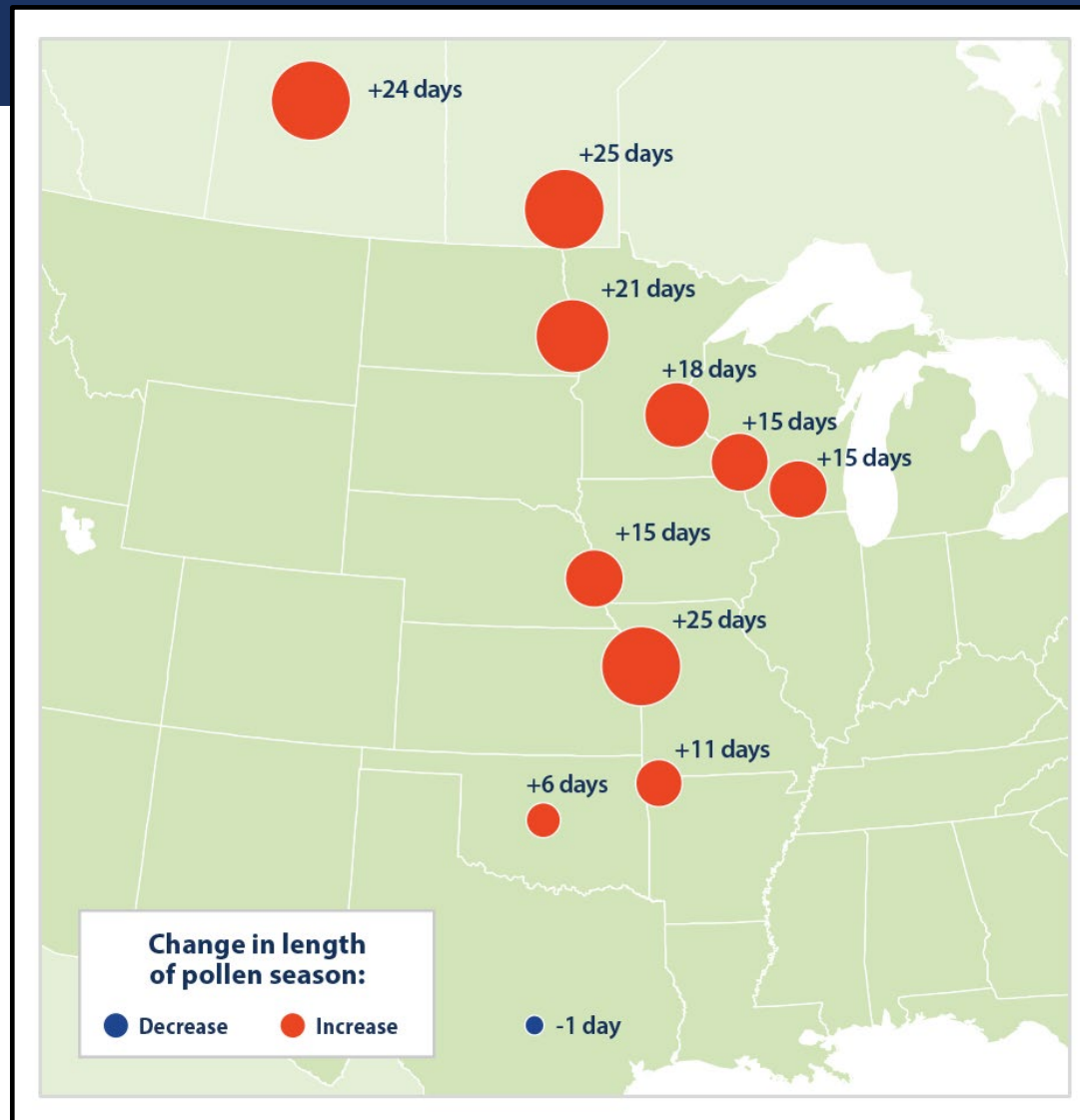


CLIMATE CHANGE & POLLEN

- Frost-free season is getting longer, extends growing period for many plants (like Ragweed)
- Warmer temperatures and increased CO₂ enable ragweed/other plants to produce more allergenic pollen, in larger quantities
- Ragweed is one of the most common allergens and can cause hay fever & trigger asthma attacks, especially in children and elderly

Source: <https://www.epa.gov/climate-indicators/climate-change-indicators-ragweed-pollen-season#ref1>

Change in Ragweed Pollen Season, 1995–2015



CLIMATE CHANGE, PRECIPITATION & MOLD

- Systemic lit review suggests that extreme weather events (flooding) may worsen pre-existing respiratory conditions and increase risk of developing asthma ([Peirce et al 2022](#))
- UMICH study in Detroit found flooding is associated with asthma risk in adults and children ([Larson et al 2021](#))



WHO IS VULNERABLE?

COMMUNITIES OF COLOR

Some communities of color living in risk-prone areas face cumulative exposure to multiple pollutants.

Adaptation plans that consider these communities and improve access to healthcare help address social inequities.



OLDER ADULTS

Older adults are vulnerable to extreme events that cause power outages or require evacuation.



Checking on elderly neighbors and proper emergency communication can save lives.

CHILDREN

Children have higher risk of heat stroke and illness than adults.



Adults can lessen risk by monitoring exertion and hydration.



LOW INCOME COMMUNITIES

Low income families are at risk of physical and mental illnesses during flooding and in crowded shelter conditions.



Comprehensive disaster management can improve resiliency for people with limited resources.



WHAT IS EQUITY? THREE RELATED CONCEPTS

Equality



The assumption is that **everyone benefits from the same supports**. This is equal treatment.

Equity



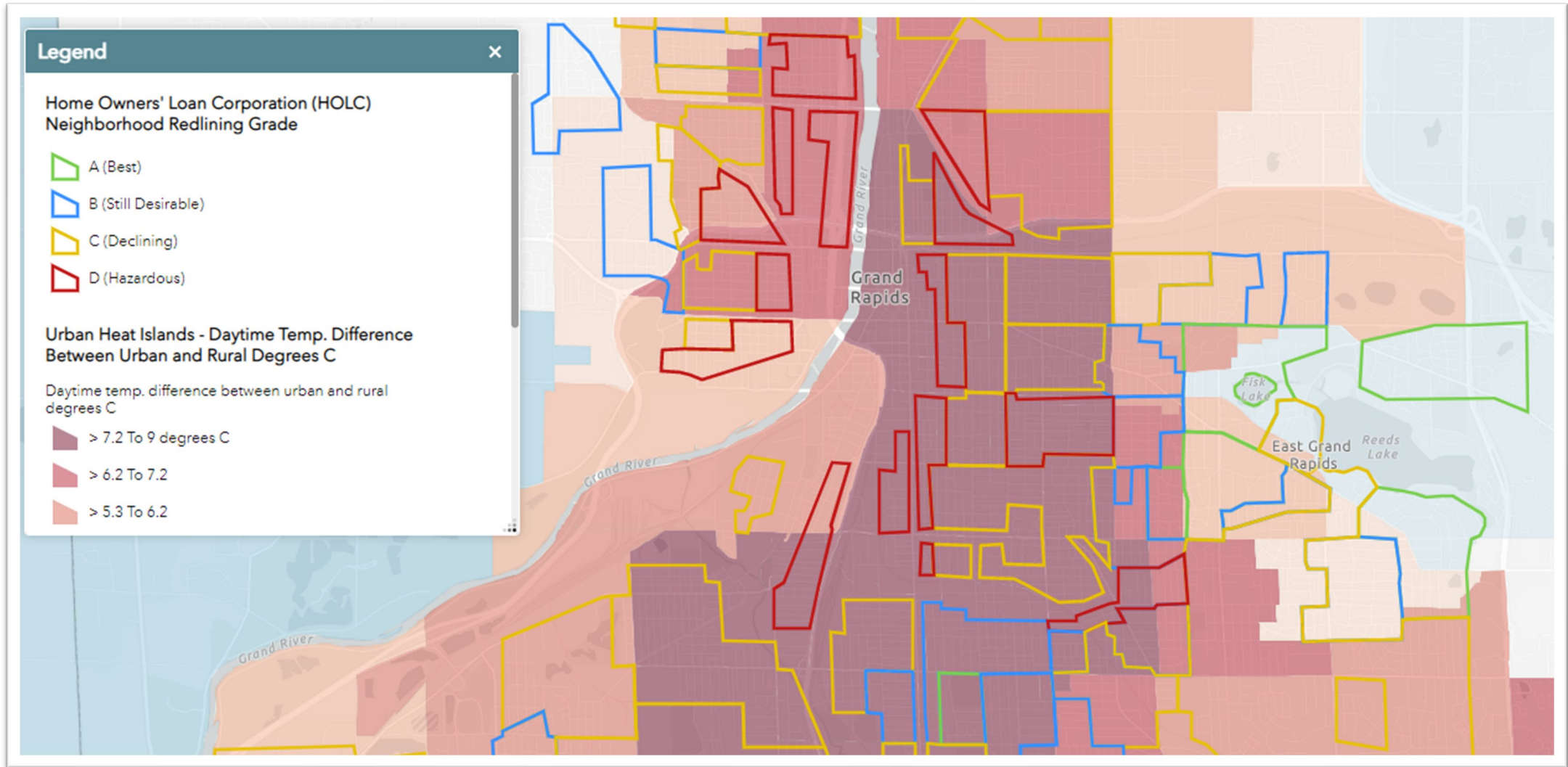
Everyone gets the supports they need (this is the concept of "affirmative action"), thus producing equity.

Justice

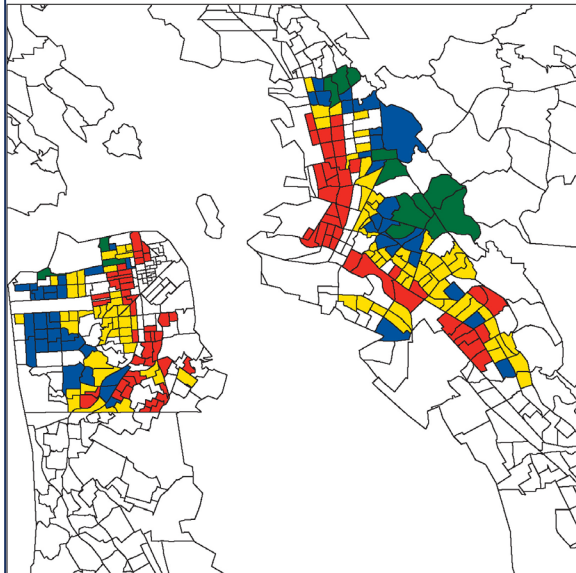


All 3 can see the game without supports or accommodations because **the cause(s) of the inequity was addressed**. The systemic barrier has been removed.

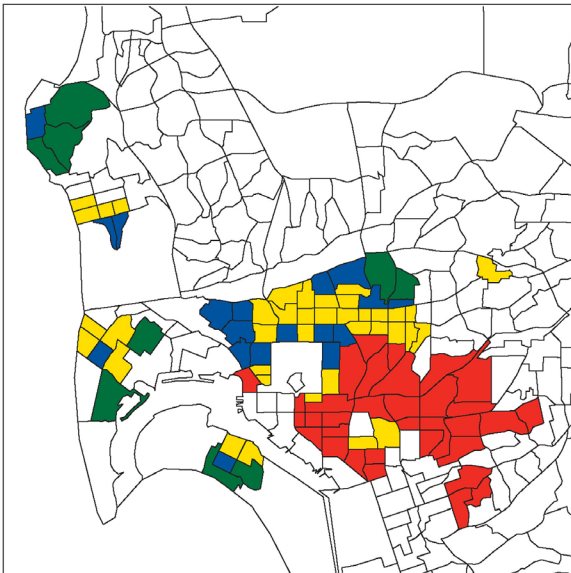
HISTORIC INEQUITY INFLUENCES CURRENT RESILIENCE



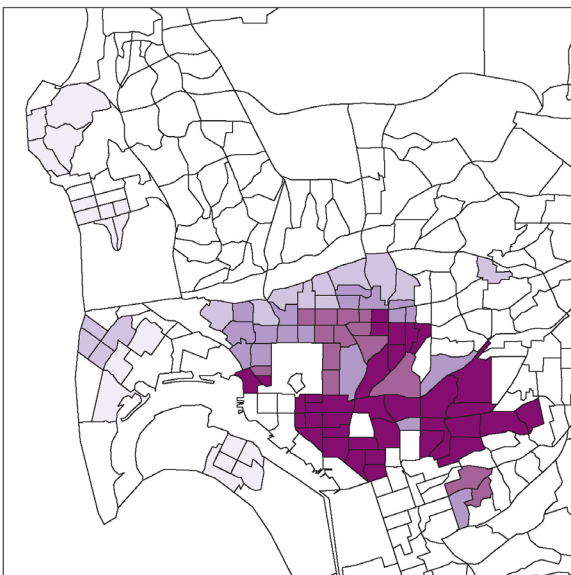
San Francisco and Oakland



San Diego



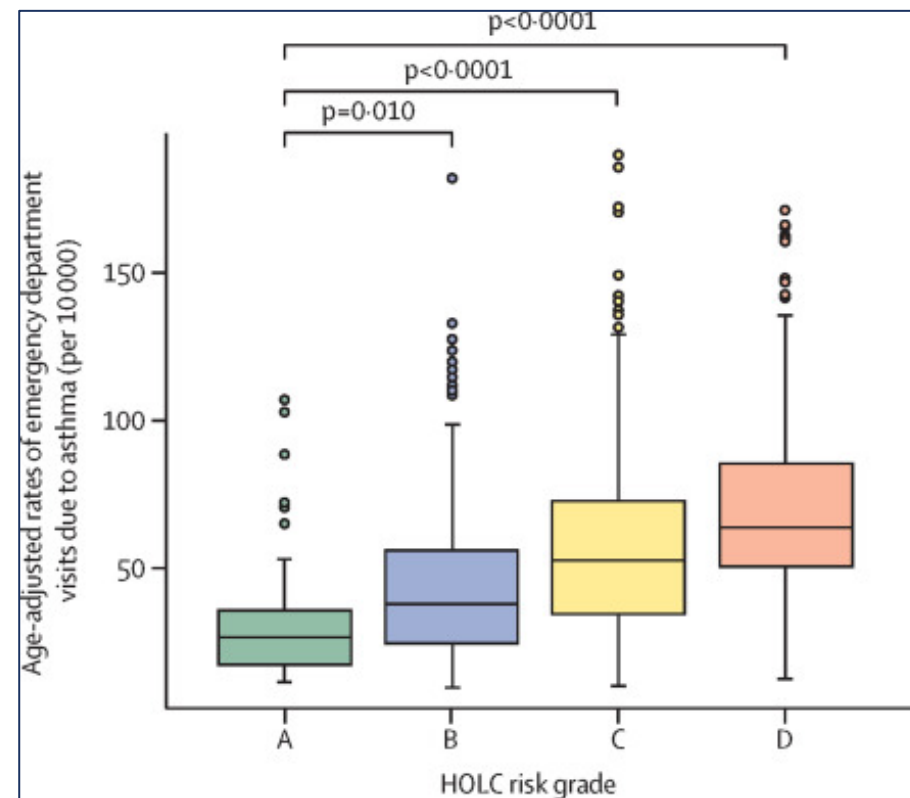
HOLC risk grade
A B C D



Emergency department visit rate (per 10000)
<29 29-42 42-58 58-77 >77

CA study found historically redlined census tracts have **significantly higher rates of emergency department visits due to asthma**

Source: The Lancet Planetary Health, January 2020, [https://doi.org/10.1016/S2542-5196\(19\)30241-4](https://doi.org/10.1016/S2542-5196(19)30241-4)





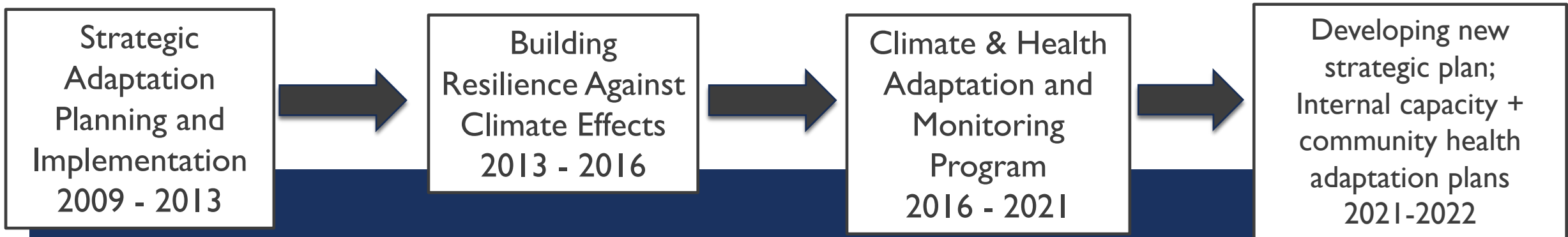
BUILDING RESILIENCE

HOW IS PUBLIC HEALTH RESPONDING?

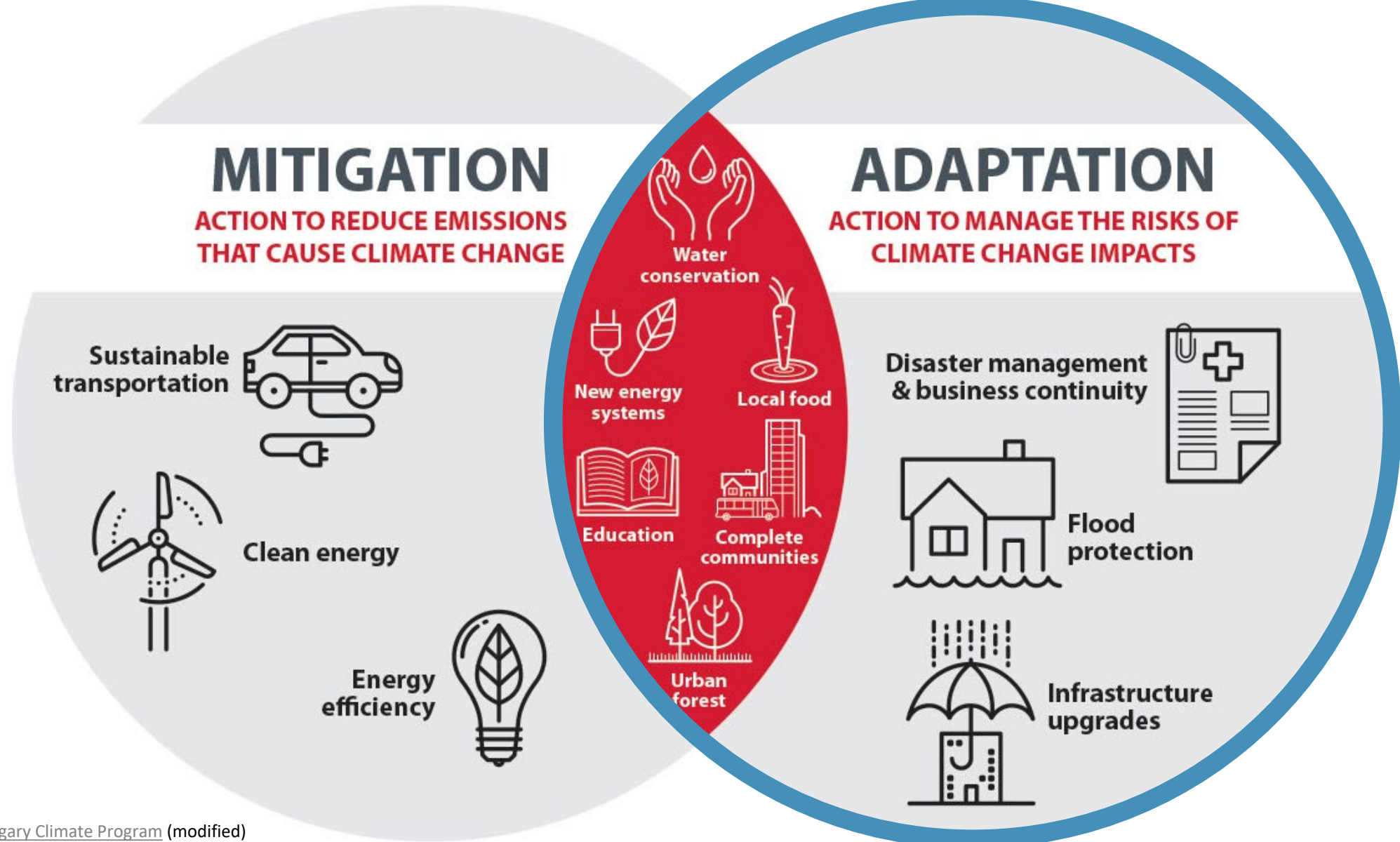
MICHIGAN CLIMATE AND HEALTH ADAPTATION PROGRAM (MICHAP)

Mission

MICHAP supports a climate resilient public health system by **investigating** climate-driven health risks, **identifying** needs for decision-making across sectors, and collaboratively **implementing** climate adaptation strategies.



Climate Mitigation, Adaptation & Resilience



**Climate &
Health
Adaptation
Strategies**

Technical Assistance to State and Local Partners

Surveillance & Assessments - focus on vulnerability and inequity

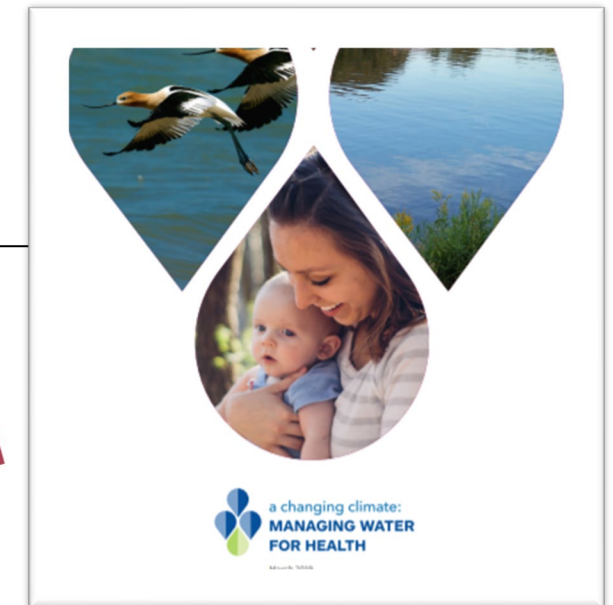
Emergency Response & Preparedness

Climate & Health in All Policies

Evaluate to Improve Interventions

MICHAP Products

- Climate and Health Adaptation Planning Guide for Michigan Communities
- Fact sheets (general audience)
 - Cold Health and Safety
 - Heat Health and Safety
- Climate & health reports (more technical)
 - Extreme Heat and Heat-related Illness
 - Burden of Disease study, Gronlund 2019
- Michigan Climate and Health Profile Report (GLISA)
- Managing Water For Health In a Changing Climate



School of Planning, Design
and Construction
MICHIGAN STATE UNIVERSITY

MICHIGAN STATE UNIVERSITY | Extension

MDHHS
Michigan Department of Health and Human Services

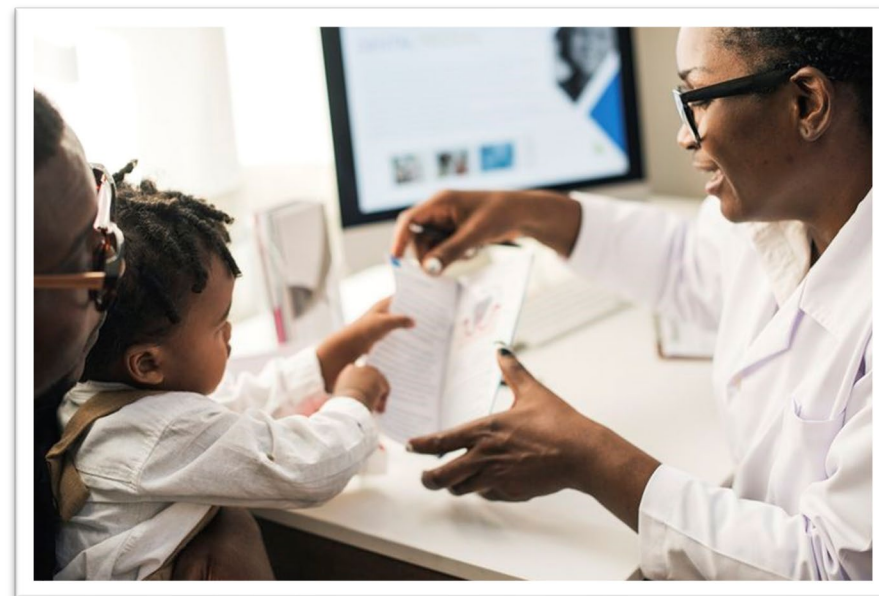
WHAT PUBLIC HEALTH CAN DO

- Advocate to reduce use of fossil fuels
- Support environmental and climate justice
- Become involved in local city planning efforts to:
 - Reduce traffic, improve public transit & walkability
 - Increase green space, plant nonallergenic trees
- Encourage home weatherization
- Work with media on extreme heat, air quality alerts
- Develop plans for response to severe storms, flooding, heat events, algal blooms, power loss, etc.
- Promote installing pollen monitoring stations



WHAT HEALTHCARE PROVIDERS CAN DO

- Teach patients to monitor weather, heat waves, air quality and pollen forecasts
 - *Example:* on high-risk days patients should carry rescue inhaler, limit time & avoid intense exercise outdoors
- Modify the guidance for climate change-related impacts
 - *Example:* adequate hydration and cooling on hot days, advise vulnerable individuals to stay indoors or wear protective masks when the air quality is harmful
- Teach patients to recognize respiratory symptoms related to extreme weather events



KEY POINTS

Climate Change in Michigan Increases:

- Average annual temperatures
- Precipitation
- Frost-free days
- Extreme weather events (flood, wildfires in Western US)

Health Impacts Include:

- Changes in air pollution, increase in ground-level ozone
- Longer pollen season & increased potency
- Increase in mold growth

What Can You Do?:

- Public health can participate in city planning and emergency response planning
- Healthcare providers can educate patients on climate change and its health risks
- Individuals can become involved in climate action in their community

RESOURCES

- **Receive** air quality alerts from www.airnow.gov
- **Subscribe** to MI-HAN (Michigan Health Alert Network at michiganhan.org)
- Michigan Clinicians for Climate Action: <https://www.michigancca.com/>
- General climate & health resources:
 - APHA Climate Change: www.apha.org/topics-and-issues/climate-change
 - CDC Climate and Health Program: www.cdc.gov/climateandhealth/
 - National Climate & Health Assessment: www.health2016.globalchange.gov/
 - Asthma & Allergy Foundation of America: <https://www.aafa.org/climate-and-health/>
 - American Lung Association: <https://www.lung.org/blog/asthma-and-climate-change>
 - Climate & Health Planning Guide for Michigan Communities: <https://www.michigan.gov/mdhhs/safety-injury-prev/environmental-health/topics/climate/resources>

SOURCES FROM PRESENTATION:

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- Nassikas et al. Ozone-related asthma emergency department visits in the US in a warming climate. *Environ Res*. 2020. doi: 10.1016/j.envres.2020.109206.
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- EPA & Pollen: <https://www.epa.gov/climate-indicators/climate-change-indicators-ragweed-pollen-season#ref1>
- Peirce et al. Climate Change Related Catastrophic Rainfall Events and Non-Communicable Respiratory Disease: A Systematic Review of the Literature. *Climate*. 2022; <https://doi.org/10.3390/cli10070101>
- Larson et al. Recurrent Home Flooding in Detroit: Results of a Household Survey. *Int J Environ Res Public Health*. 2021. doi: 10.3390/ijerph18147659.
- Thunderstorm Asthma: <https://www.health.harvard.edu/blog/thunderstorm-asthma-bad-weather-allergies-and-asthma-attacks-202206222766>
- Nardone et al. Associations between historical residential redlining and current age-adjusted rates of emergency department visits due to asthma across eight cities in California: an ecological study. *The Lancet Planetary Health*, January 2020, [https://doi.org/10.1016/S2542-5196\(19\)30241-4](https://doi.org/10.1016/S2542-5196(19)30241-4)

QUESTIONS?

Contact Information:

Julia Field
Program Manager
fieldj@michigan.gov

Aaron Ferguson
Climate & Tracking Unit Manager
fergusona1@michigan.gov