PREPARING FOR THE HEALTH IMPACTS OF CLIMATE CHANGE

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Michigan Climate & Health Adaptation Program
MICHAP

- *Integrating Climate Adaptation into Public Health Practice*

- *Promote Adaptation Strategies to Protect Public Health*

Outline

- Climate Change in Michigan

- How Climate Change Affects Health

- Climate Change Vulnerability in Your Community

- Public Health Response:

  Mitigation & Adaptation

Great Lakes Climate is Changing

Temperatures are rising, especially in winter. Winters have become milder and shorter.

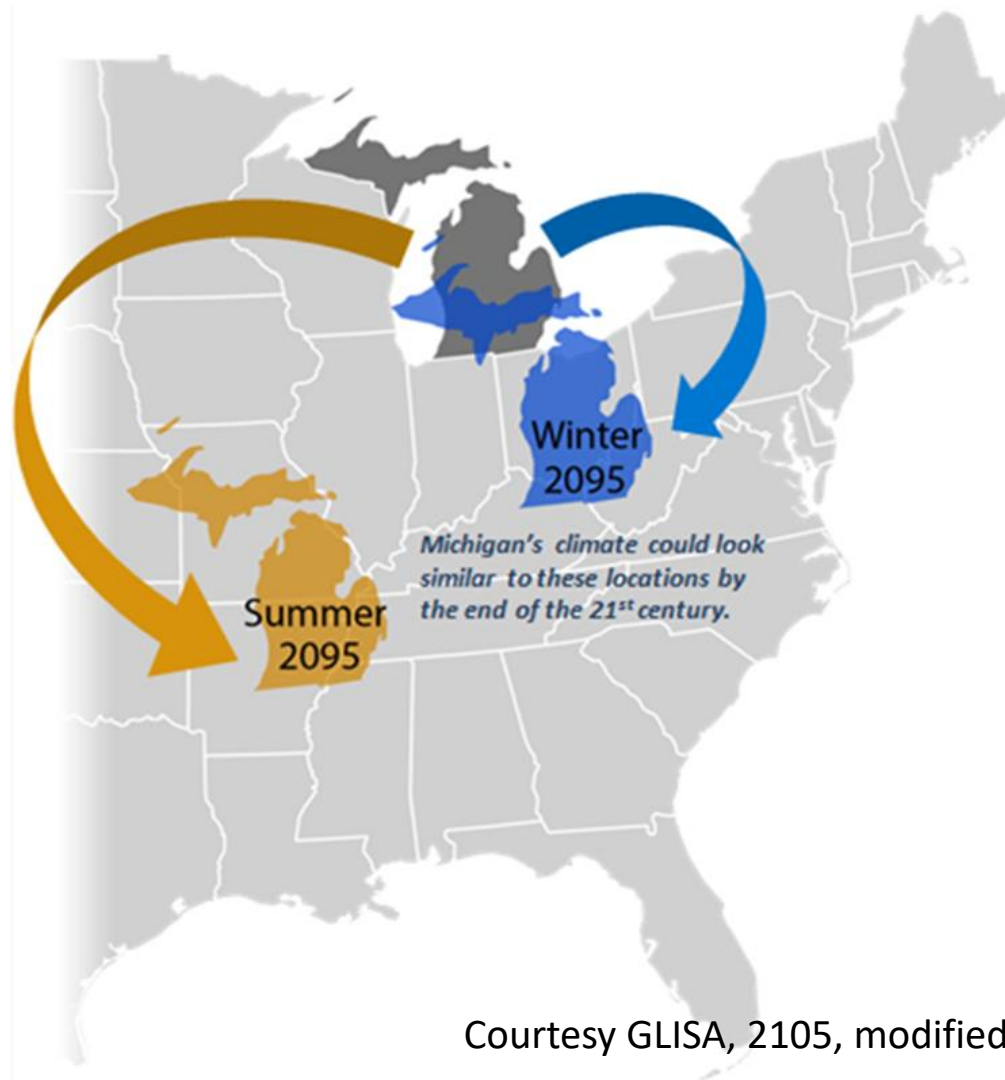<u>Warming</u> winter temperatures increase <u>ice</u> and <u>freezing rain</u>

Spring is arriving earlier.

Frequency, intensity of severe rain and storms are increasing.

Michigan's Changing Climate

Winter 2095

Summer 2095

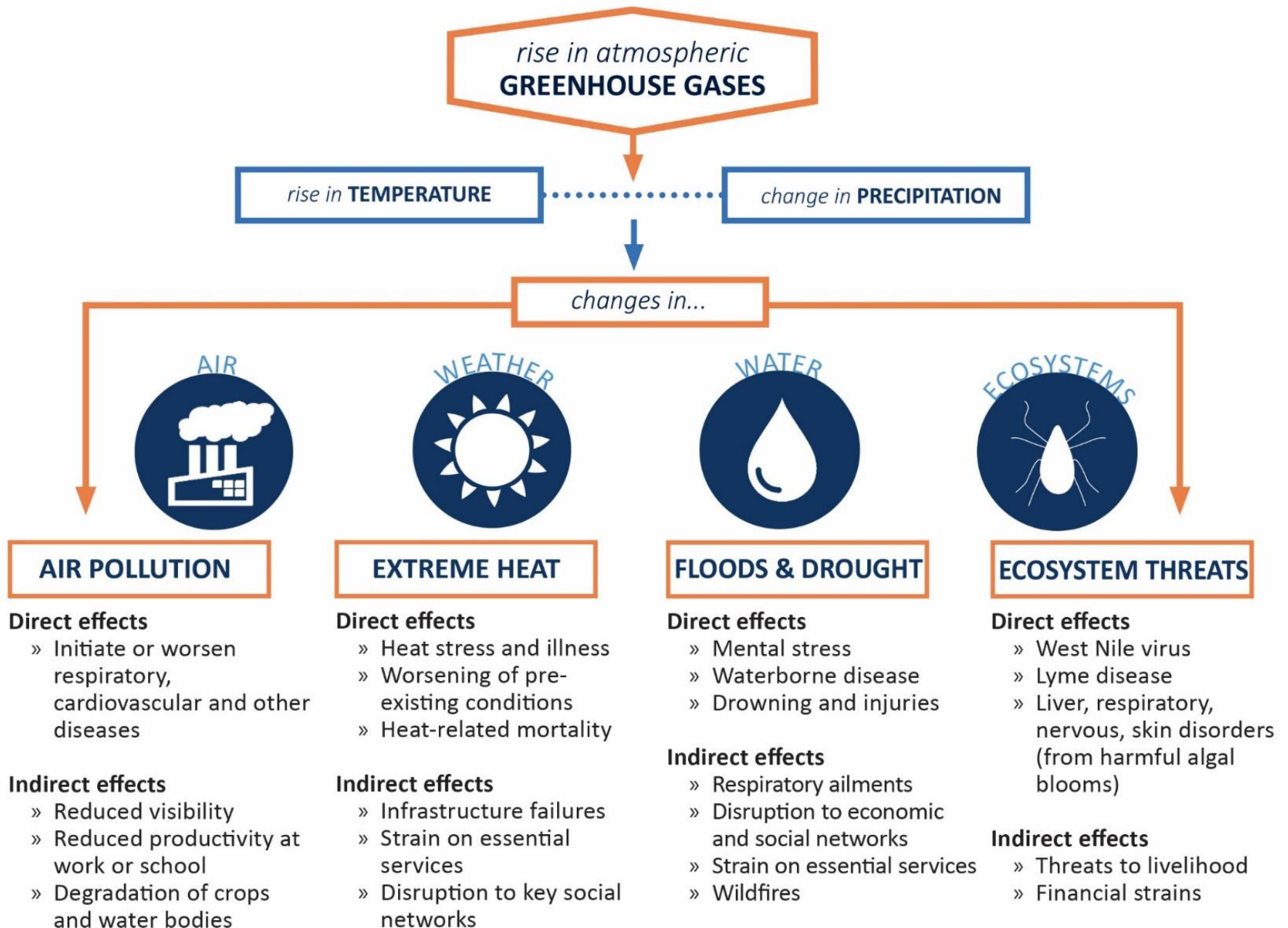Michigan's climate could look similar to these locations by the end of the 21st century.

Courtesy GLISA, 2105, modified from Hayhoe et. al.

How Climate Change Affects Health

CLIMATE CHANGES LEAD TO HEALTH EFFECTS

rise in atmospheric
GREENHOUSE GASES

rise in **TEMPERATURE** .... change in **PRECIPITATION**

changes in...

AIR

WEATHER

WATER

ECOSYSTEMS

AIR POLLUTION

Direct effects
» Initiate or worsen respiratory, cardiovascular and other diseases

Indirect effects
» Reduced visibility
» Reduced productivity at work or school
» Degradation of crops and water bodies

EXTREME HEAT

Direct effects
» Heat stress and illness
» Worsening of pre-existing conditions
» Heat-related mortality

Indirect effects
» Infrastructure failures
» Strain on essential services
» Disruption to key social networks

FLOODS & DROUGHT

Direct effects
» Mental stress
» Waterborne disease
» Drowning and injuries

Indirect effects
» Respiratory ailments
» Disruption to economic and social networks
» Strain on essential services
» Wildfires

ECOSYSTEM THREATS

Direct effects
» West Nile virus
» Lyme disease
» Liver, respiratory, nervous, skin disorders (from harmful algal blooms)

Indirect effects
» Threats to livelihood
» Financial strains

Priority Climate-Related Health Impacts

| Key Health Outcome	Biophysical Parameter Changes	Predicted Change
Heat Morbidity, Mortality	More frequent, longer Heat Events; Warmer minimum temperatures	⬆
Respiratory Diseases	Air Pollutants increase with high temps; Pollen, Mold levels increase with longer growing season & more moisture	⬆
Injury, CO Poisonings	More frequent Ice Storms, Extreme Rain leading to more Power Outages & Cleanup; changes in other storm types unclear	⬆ ?
Waterborne Diseases, Toxins	Algal blooms, other Flood-related contaminations more frequent	⬆
Vector borne Diseases	Impact on Mosquito & Tick lifecycle unclear	???
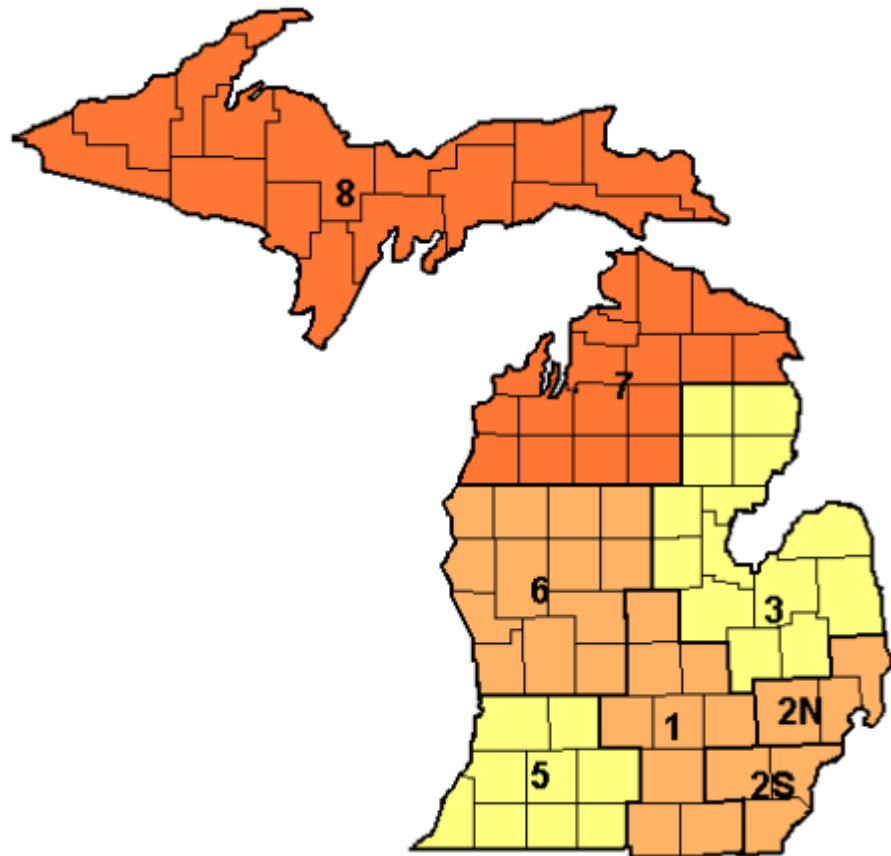
Extreme Heat Events Impacts on Health

Summary of Heat-Related ED Visits by Region
(April 1 – August 31, 2016)

Region	Heat-Related ED Visits	All ED Visit	Proportion of Heat-Related ED Visits	Distribution of Heat-Related ED Visits Across Regions
1	524	248,482	0.211%	11.54%
2N	832	319,918	0.260%	18.32%
2S	1124	503,790	0.047%	24.75%
3	438	221,386	0.198%	9.65%
5	384	205,490	0.187%	8.46%
6	847	299,551	0.283%	18.65%
7	271	84,011	0.323%	5.97%
8	121	39,798	0.304%	2.66%
Michigan Total	4541	1,922,426	0.236%	100.0%

Severe Storms:
# Floods, Snow/Ice
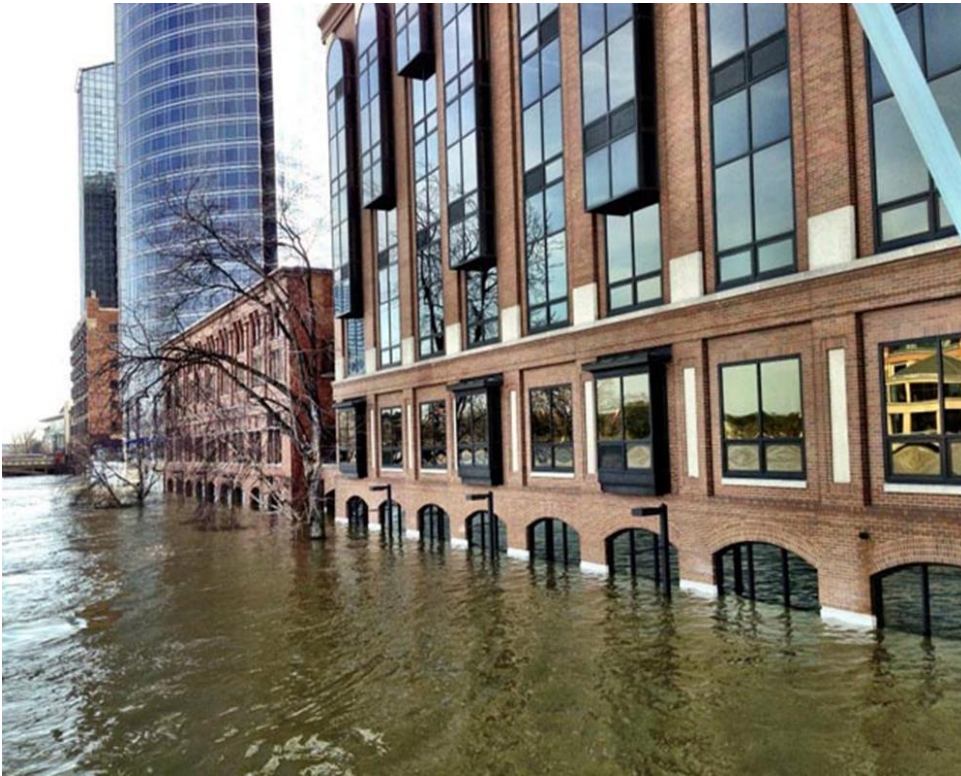
Downtown Grand Rapids, April 2013

- Physical Injuries (drowning, accidents)
- Allergies (mold)
- Food and Water-borne Illnesses
- Displacement
- Mental Health Issues
- Interruption of Emergency Services
- Carbon Monoxide poisoning

Severe Storms May 1999-Ap 2019 in Emmet County, MI

Storm Type	Number of Storms	% Total Storms	Average per Year
Winter Storm (ice, snow)	95	60.1	4.75
Thunderstorm w/ Excess Wind	27	17.1	1.35
High/Strong Winds	14	8.9	0.70
Hail	10	6.4	0.50
Extreme Heat/Drought	4	2.5	0.20
Extreme Cold/Freeze	4	2.5	0.20
Other	4	2.5	0.20
Total	158	100	7.90

Data from the NOAA Storm Events Database: www.ncdc.noaa.gov/stormevents/
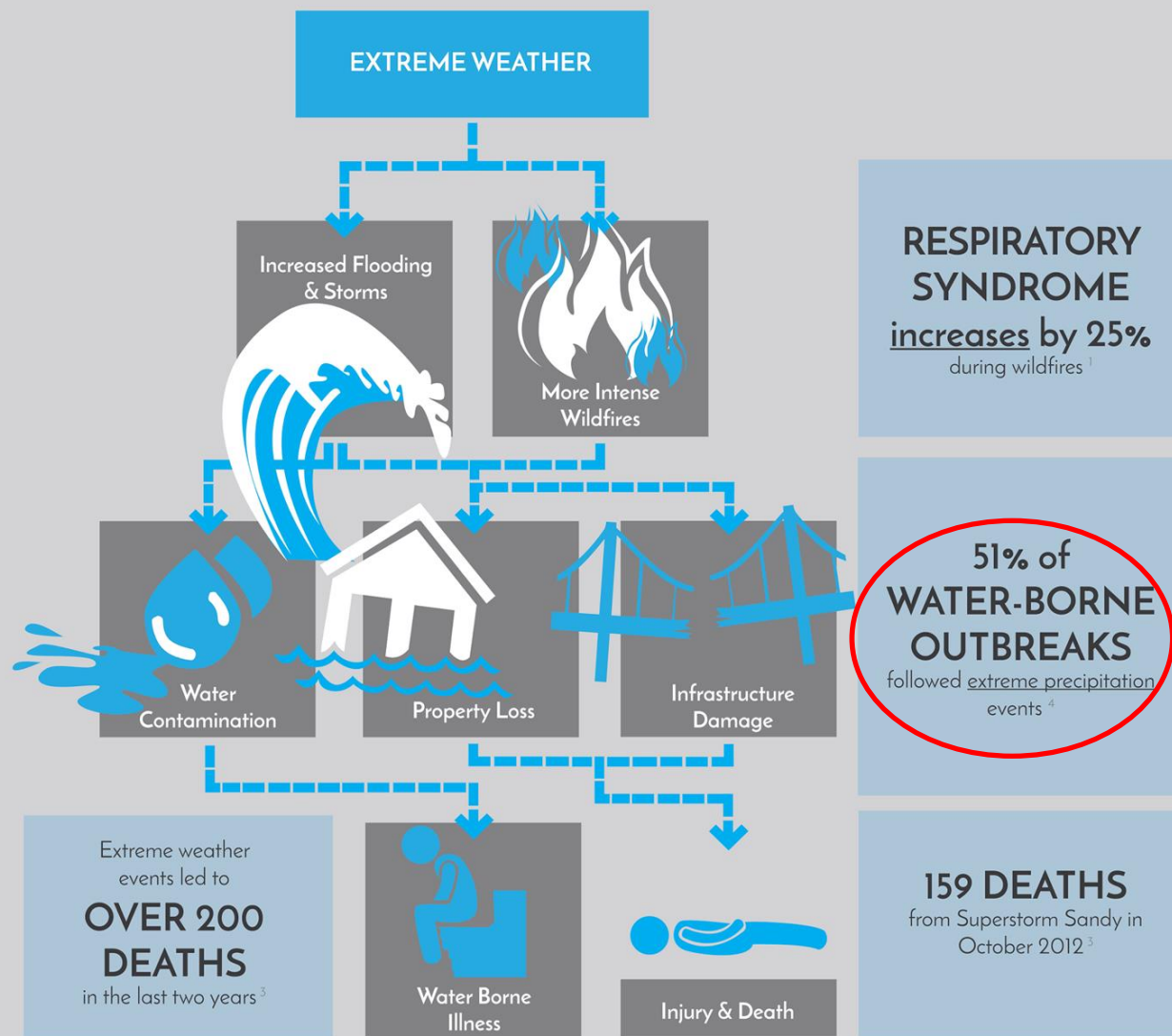
Potential Sources of Waterborne Disease Exposure

Local Risk Factors for Waterborne Disease Exposure

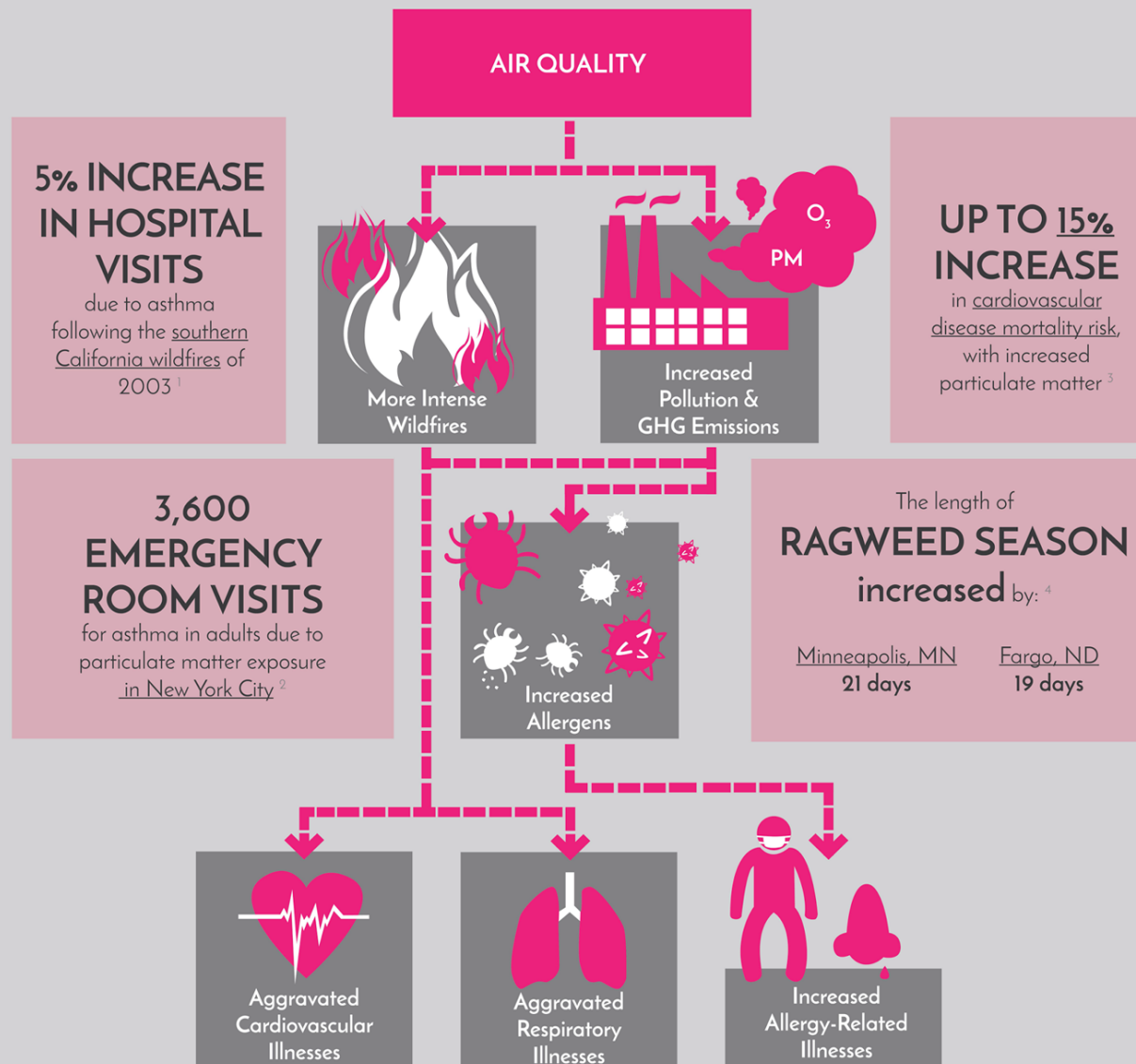| Exposure Source	Estimated no. housing units (2018)[b]	Emmet percent (1990)[a]	Michigan percent (1990)[a]
Private well	13,324	61.2	57.6
Septic system	12,628	58.0	57.3
Estimated Failed Septics[c]			10-25%
'Too Old' Septic systems[d]		33.0%	
Watersheds w. human fecal contamination[e]			100.0%

a. Percent calculated using data from the 1990 Census of Housing;
b. Number calculated using (a) times number of 2018 Emmet Co. housing units from Census Quick Facts;
c. From *21st Century infrastructure Commission Report to Gov. Snyder*, Nov. 30, 2016.
d. From *2016 Septic Question Project Report*, NW Michigan Health Dept. and Tip of the Mitt Watershed Council.
e. *PNAS* Aug 18, 2015 vol. 112 (33):10419-10424.

Climate Change → Disrupted Ecosystems
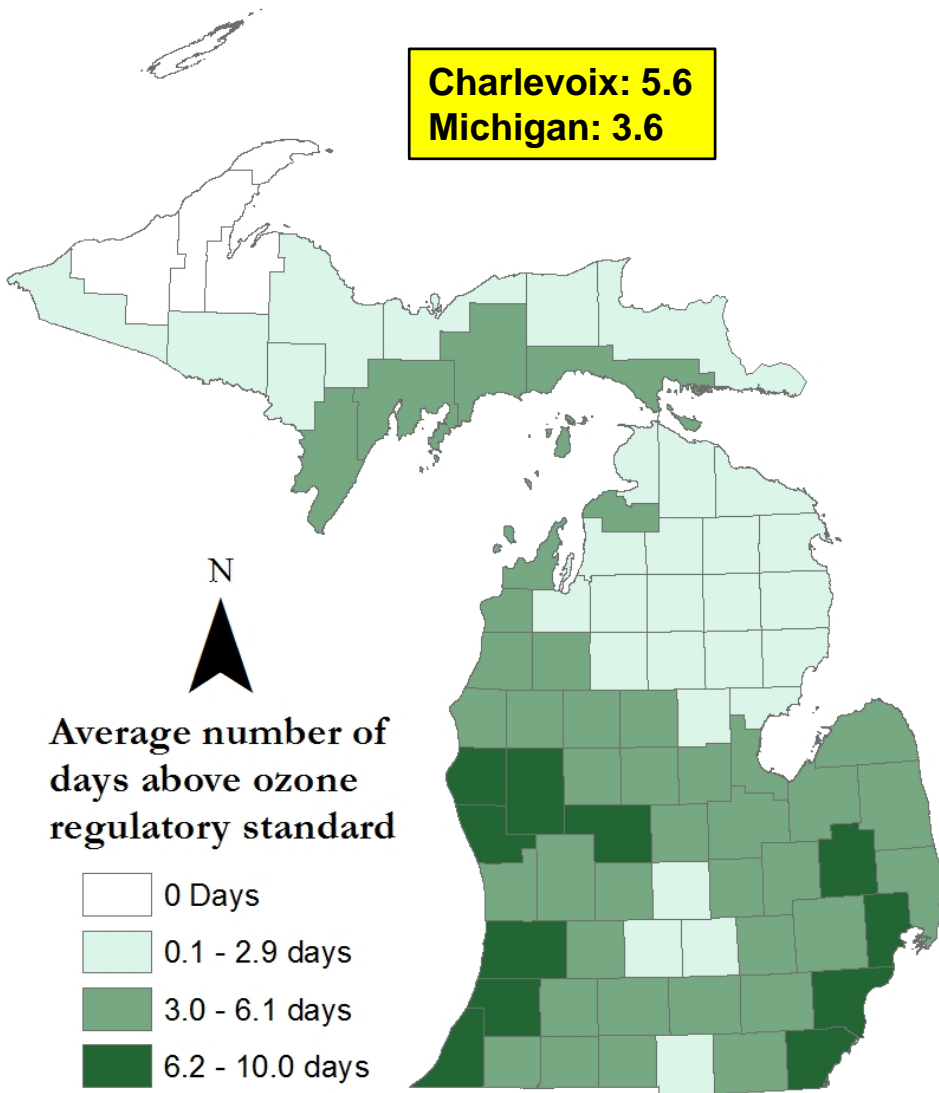
Disruptions ➜ New Opportunities for Diseases To Thrive

Climate Change Affects Air Pollutants

Distribution of Poor Air Quality by County

Charlevoix: 5.6
Michigan: 3.6

Charlevoix: 8.2
Michigan: 9.7

N

Average number of days above ozone regulatory standard

- 0 Days
- 0.1 - 2.9 days
- 3.0 - 6.1 days
- 6.2 - 10.0 days

N

Average ambient concentration of PM2.5 (micrograms per cubic meter)

- Average above NAAQS
- 6.79 - 8.87
- 8.88 - 10.67
- 10.68 - 13.59

Source: Environmental Health Tracking Network (2005-2011)
*Includes both counties with monitors and counties which values were mathematically modelled
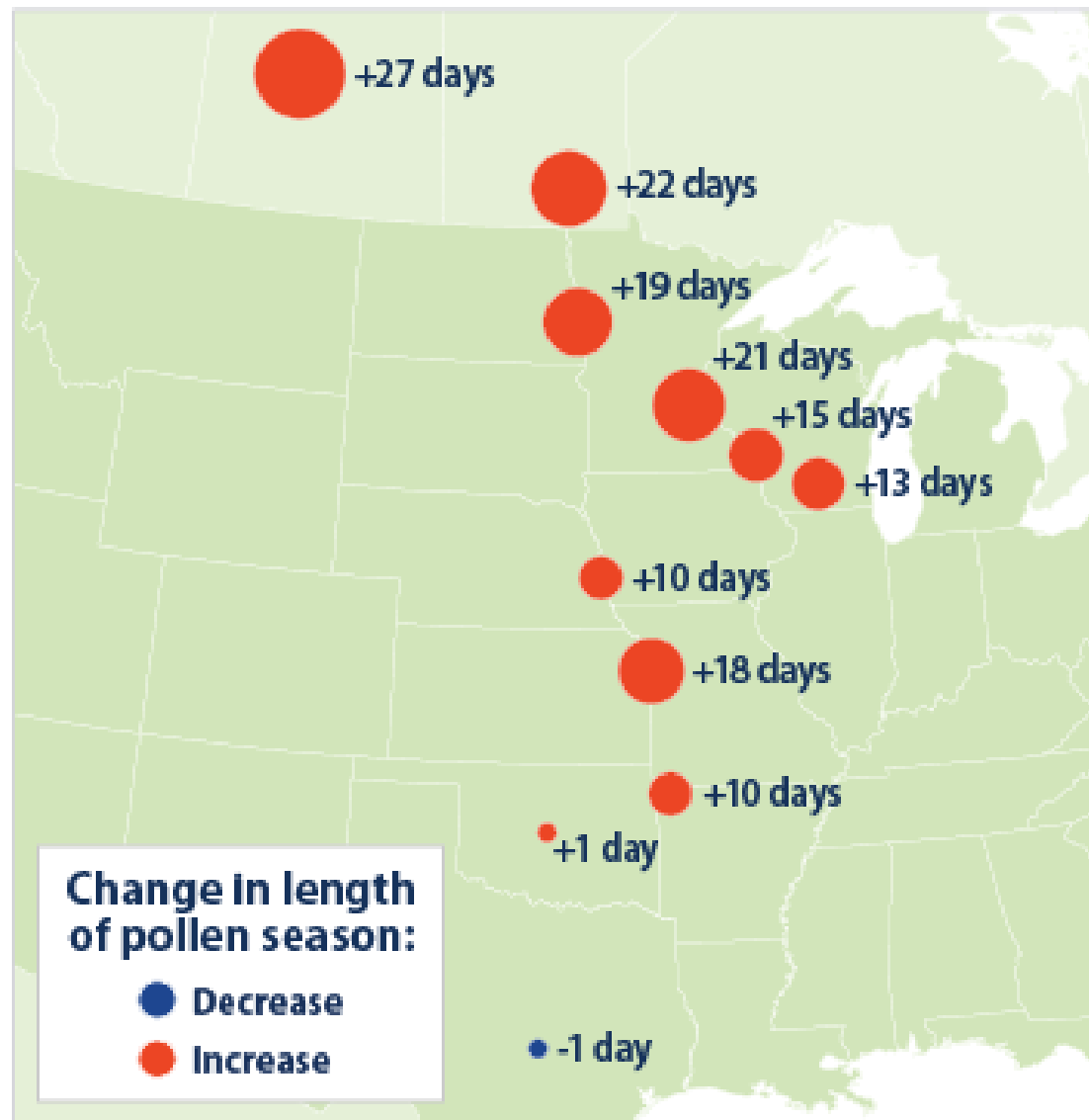*Ozone regulatory standard changed from 80 ppb to 75 ppb in 2008
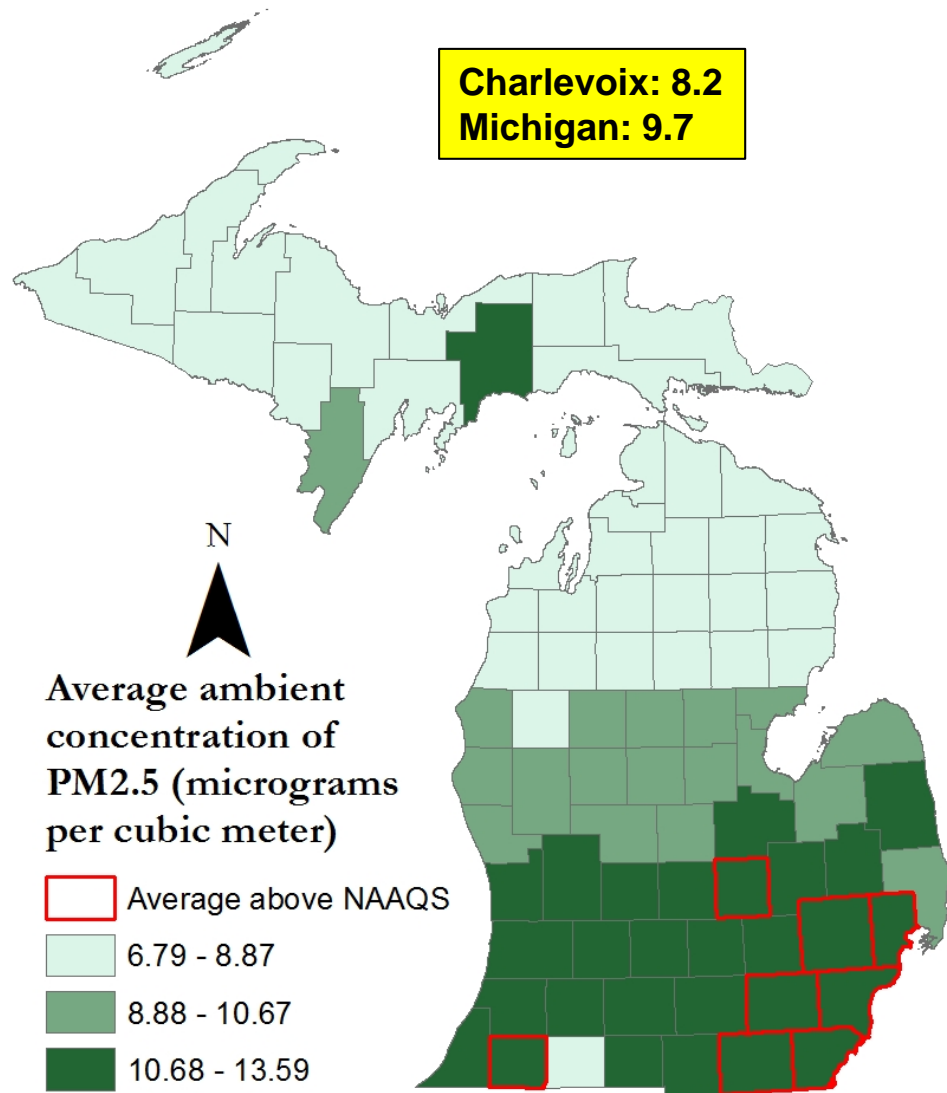
Source: Environmental Health Tracking Network (2005-2011)
*Includes both counties with monitors and counties which values were mathematically modelled
National Ambient Air Quality Standard = 12 micrograms PM2.5 per cubic meter

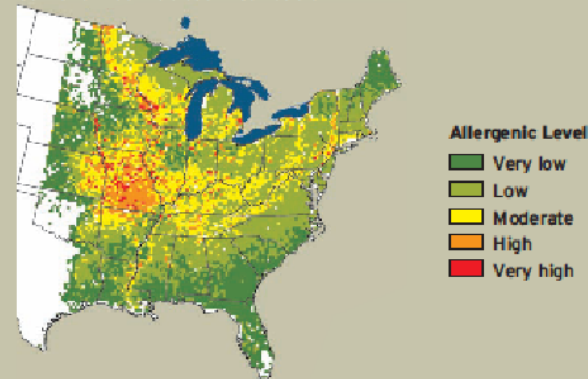# Change in Length of Ragweed Pollen Season, 1995–2013

+27 days

+22 days

+19 days

+21 days

+15 days

+13 days

+10 days

+18 days

+10 days

+1 day

Change in length of pollen season:

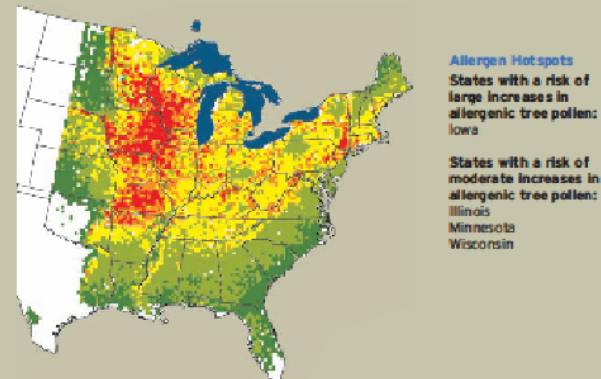● Decrease

● Increase

-1 day

Data source: Ziska et al., 2014

Example: Increased amounts of Tree Pollen in the air

ANNUAL ALLERGENIC TREE POLLEN POTENTIAL

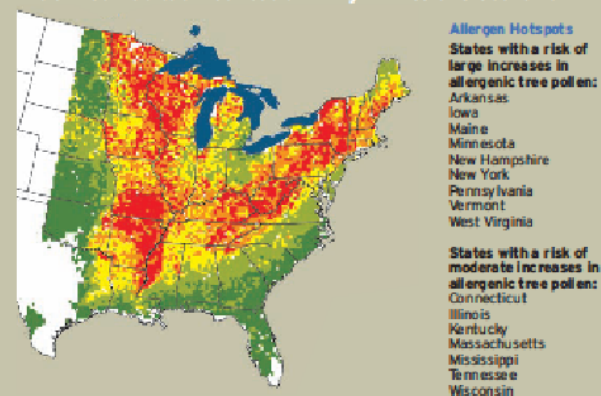### Current Tree Habitat Distribution

Allergenic Level
- Very low
- Low
- Moderate
- High
- Very high

2100 Tree Habitat Distribution—Low Emissions Scenario

Allergen Hotspots

States with a risk of large increases in allergenic tree pollen:
Iowa

States with a risk of moderate increases in allergenic tree pollen:
Illinois
Minnesota
Wisconsin

2100 Tree Habitat Distribution—High Emissions Scenario

Allergen Hotspots

States with a risk of large increases in allergenic tree pollen:
Arkansas
Iowa
Maine
Minnesota
New Hampshire
New York
Pennsylvania
Vermont
West Virginia

States with a risk of moderate increases in allergenic tree pollen:
Connecticut
Illinois
Kentucky
Massachusetts
Mississippi
Tennessee
Wisconsin

Choices we make now about global warming pollution can make a big difference in the future potential for allergenic tree pollen. These maps show the annual allergenic potential from tree pollen for the current distribution of tree species habitat and for projected distributions of tree species habitat under two future climate scenarios—one in which greenhouse gas emissions are higher and one with lower emissions. Following the lower emissions pathway will help curb the possibility of expanding the range of trees, like oaks and hickories, that are known to produce highly allergenic pollen.

How the Maps Were Made:
The potential tree habitat distributions for 134 species are from the USDA Forest Service's Climate Change Tree Atlas, available at http://www.nrs.fs.fed.us/atlas/tree. Future distributions based on the average of three global climate models, each run for two emissions scenarios (low: carbon dioxide increases to 550 ppm by 2100; high: carbon dioxide increases to 970 ppm by 2100). The Tree Atlas calculates Importance Values (IV) for each species for each 20 km by 20 km gridbox in the Eastern half of the United States. We scaled these Importance Values by how allergenic the pollen from each species is, as indicated in the Researchers Allergy and Botany Library available at http://www.pollenlibrary.com (highly allergenic= IV*3, moderately allergenic = IV*2, low allergenic = IV*1, not allergenic = IV*0). Then, we summed the contributions from all 134 species to calculate the total annual allergenic potential for each grid box. Note that the actual future distribution of trees and annual allergenic potential will also depend on many factors that this model does not consider, such as fragmentation of landscapes and competition with other species.

Climate Change Vulnerability

Who is affected by Climate Change?

Everyone is impacted; Some are more likely to be harmed than others.

Vulnerable People include:

- Elderly, and very young children

- Persons with pre-existing conditions

- Persons taking certain medications

- Socially isolated, homeless

- Lower income

- Outdoor workers

Vulnerable People (Emmet County)

| Health Risk Factor | Emmet County | | Michigan |
	Number	Percent	Percent
Age under 5 yrs	1,233	4.8	5.7
Age 65 + yrs	5,799	22.5	17.2
Non-white	1,181	7.6	20.7
In poverty	3,306	8.5	14.2
Adult smokers*		18	20
Adult excessive drinking*		21	21
Adult Obesity*		30	30

Data from Census Quick Facts 2018 estimates, and
* *2015 Community Health Assessment*, NW Michigan Health Dept. www.nwmich.org

Vulnerable People NW MI Health District (Antrim, Charlevoix, Emmet & Otsego Cos.)

Chronic Health Conditions

Self-Reported from the Behavioral Risk Factor Survey

	NW MI Health District		Michigan	
	rate %	95% CI	rate %	95% CI
Disability	24.7	19.9-30.1	25.6	25.0-26.2
Asthma(Still)	8.9	6.2-12.6	10.7	10.2-11.2
Asthma(Ever)	12.8	9.3-17.2	15.8	15.2-16.3
Diabetes	12.3	8.5-17.4	10.8	10.4-11.2
Any Cardiovascular Disease	11.3	8.0-15.8	9.7	9.3-10.1
Obesity	29.3	23.9-35.3	31.4	30.7-32.1
Arthritis	34.8	29.2-40.7	31.1	30.7-31.9

All data from the 2014-2016 Combined Michigan BRFS Regional and Local Health Department Estimates

Characteristics of Vulnerable Places

Exposure = Place

Geographic

Urban/Rural/Farm

Topography/Flood Plain

Storm Frequency/Projections

Infrastructural

Septic Systems

Combined Sewers

Housing Quality

Private Wells

Green space/Trees

Heavy traffic exhaust

How Do We Respond to Protect Human Health?

Public Health Strategies

Mitigation: Reduce, Prevent Carbon Emissions

- Reduce energy consumption
- Use fossil fuel alternatives
- Reduce necessary fossil fuel combustion
- Control emissions

Adaptation: Actions that Moderate Harm

- Monitor conditions, inform the public
- Community, infrastructure planning
- Emergency preparedness

AIR QUALITY ALERT

Climate Change Response also has several Co-Benefits

***Co-Benefits*:** actions that benefit the community regardless of future climate changes.

Examples:

    - Increase energy efficiency / **saving money**

    - Promote walking, biking / **improved fitness**

    - Improve greenspaces / **more desirable communities**

    - Build rain gardens / **fewer mosquitoes**

These are the Characteristics of:

                    Resilient Communities!

For further information:

APHA Climate Change

   www.apha.org/topics-and-issues/climate-change

CDC Climate and Health Program

   www.cdc.gov/climateandhealth/

National Climate & Health Assessment

   https://health2016.globalchange.gov/

Contact Us at MDHHS: CameronL@michigan.gov

                  www.Michigan.gov\climateandhealth