Climate Change & Public Health in Minnesota

2010 Clean Water & Climate Adaptation Summit

September 17, 2010

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Climate Change and public health

Learning objectives

- What is the MN Dept. of Health (MDH) doing to prepare for climate change?
- What are the public health consequences of climate change? (6 areas covered)
- What strategies provide co-benefits to adapting/mitigating to climate change and improving public health?

Taking the Pulse Of A Changing Nation: *Findings from a Survey on Climate Change and State/Territorial Health Agencies*

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MDH Climate Change Activities: Past Year

1. Developed training for public health professionals
2. Developed draft MDH Strategic Plan for Adapting to Climate Change
3. Assessed MDH staff regarding their knowledge of climate change as it relates to public health
4. Developed website: http://www.health.state.mn.us/divs/climatechange/

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Training

- Information on the following topics

1. Vector-borne diseases
2. Extreme heat and extreme weather events
3. Vulnerable populations

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MDH Strategic Plan for Adapting to Climate Change

- **Vision**

  People and communities in Minnesota are resilient and are committed to reducing climate change and adapting to changing climatic conditions in ways that promote and protect public health, safety, and wellbeing

- **Mission**

  Protecting, maintaining and improving the health of all Minnesotans through preparation and adaptation to climate change.

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MDH Climate Change Workgroup

- A coalition of agency-wide senior management and subject matter experts from:
  - Environmental Health Division
  - Office of Emergency Preparedness
  - MDH Environmental Public Health Tracking Program
  - Public Health Laboratory Division
  - Community and Family Health Division
  - Health Promotion and Chronic Disease Division
  - Infectious Disease Epidemiology, Prevention and Control Division
  - Office of Minority and Multicultural Health
  - County Commissioner
  - County Public Health Director

Strategic Plan to Adapt to Climate Change - Goals

- **Goal 1: Understand, research, monitor, track, and report on the public health impacts of climate change.**
- **Goal 2: Identify and develop potential mitigation and adaptation strategies and tools to address climate change and public health.**
- **Goal 3: Identify populations that are at risk of poor health outcomes and sources.**
- **Goal 4: Enhance planning and preparedness for emergency and disaster response and recovery to effectively protect the public's health against negative impacts associated with climate change-related disasters.**
- **Goal 5: Increase the public health system's capacity to respond to and adapt to the public health impacts of climate change.**
- **Goal 6: Communicate and educate public health professionals, healthcare providers, state agency personnel, policy-makers, vulnerable populations and the general public on climate change's effects on human health.**

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MDH's Public Health Plan Focus Areas

- Extreme heat events;
- Extreme weather events;
- Vector-borne diseases;
- Air pollution and allergens;
- Water quality and quantity; and
- Waterborne and foodborne diseases

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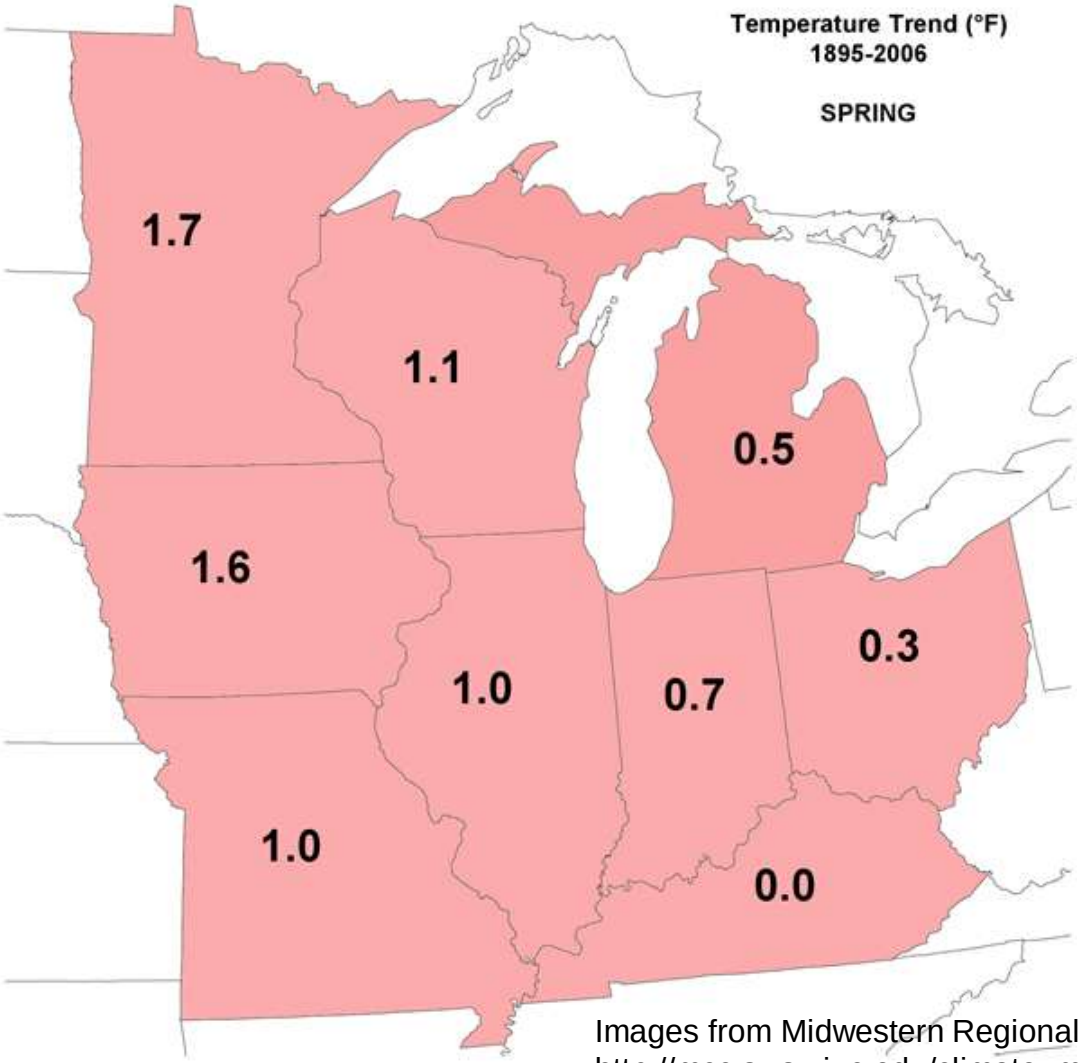
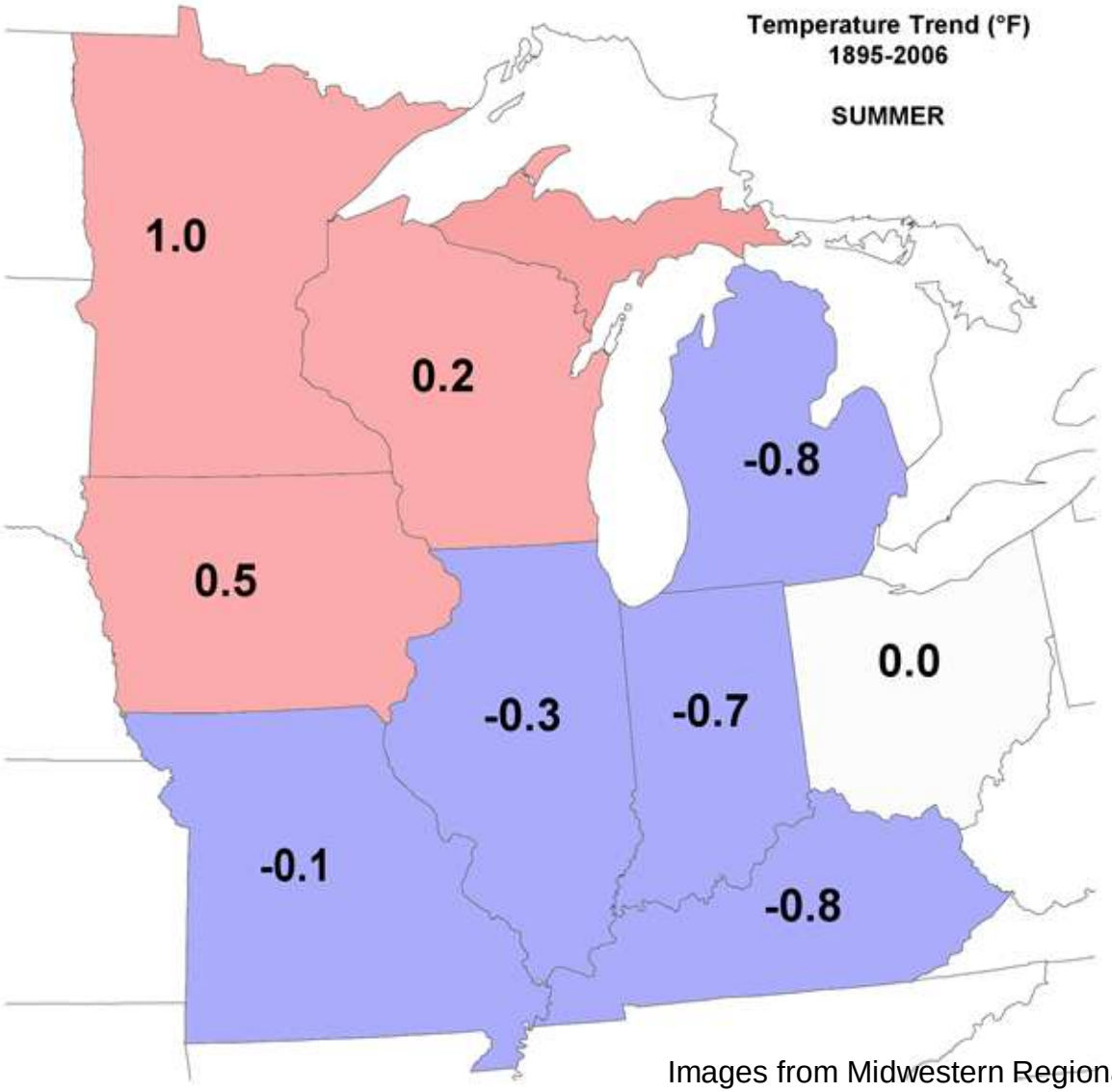
Temperature trends: It's getting warmer Spring



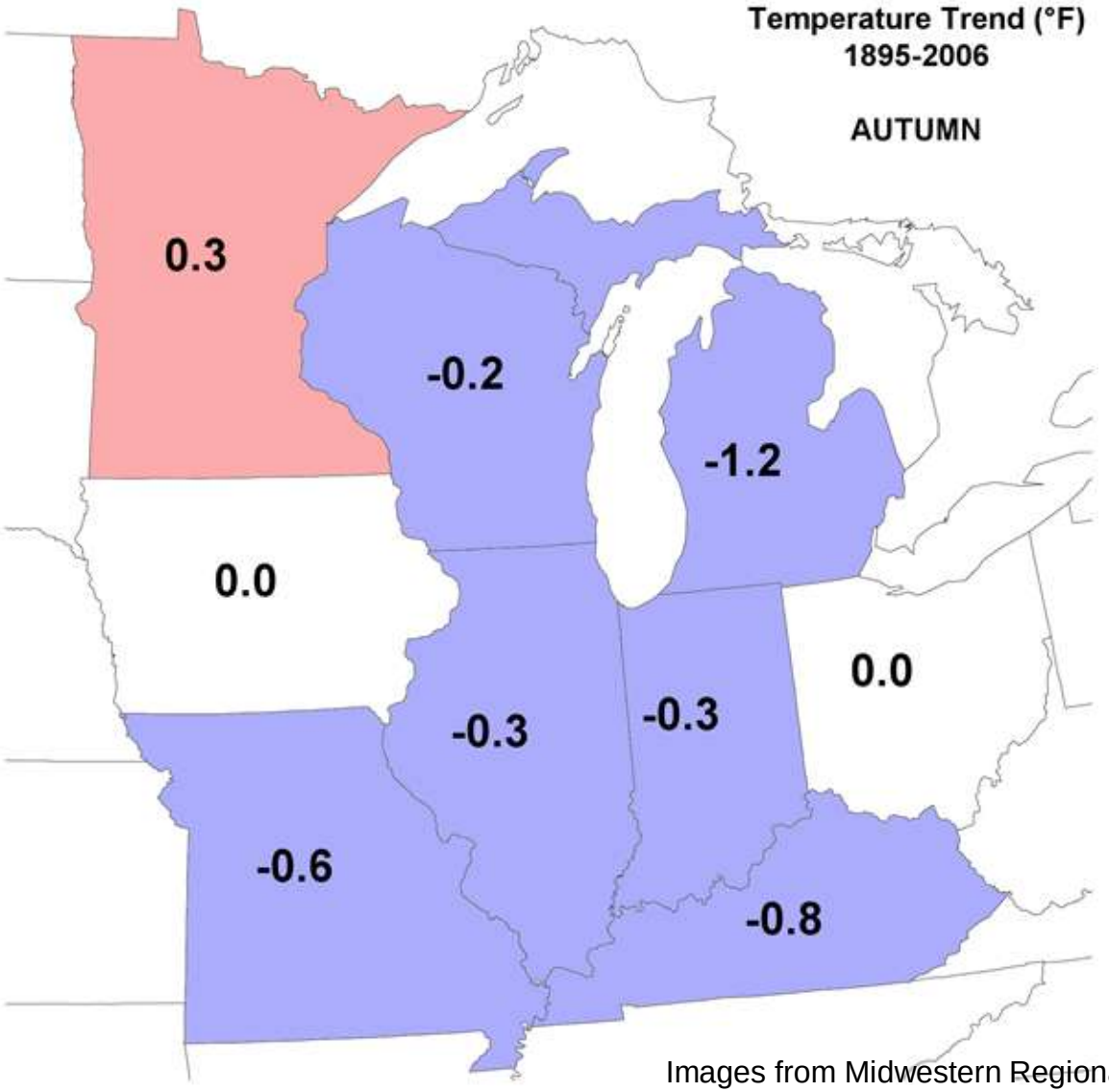
Images from Midwestern Regional Climate Center
http://mcc.sws.uiuc.edu/climate_midwest/mwclimate_chang

Summer



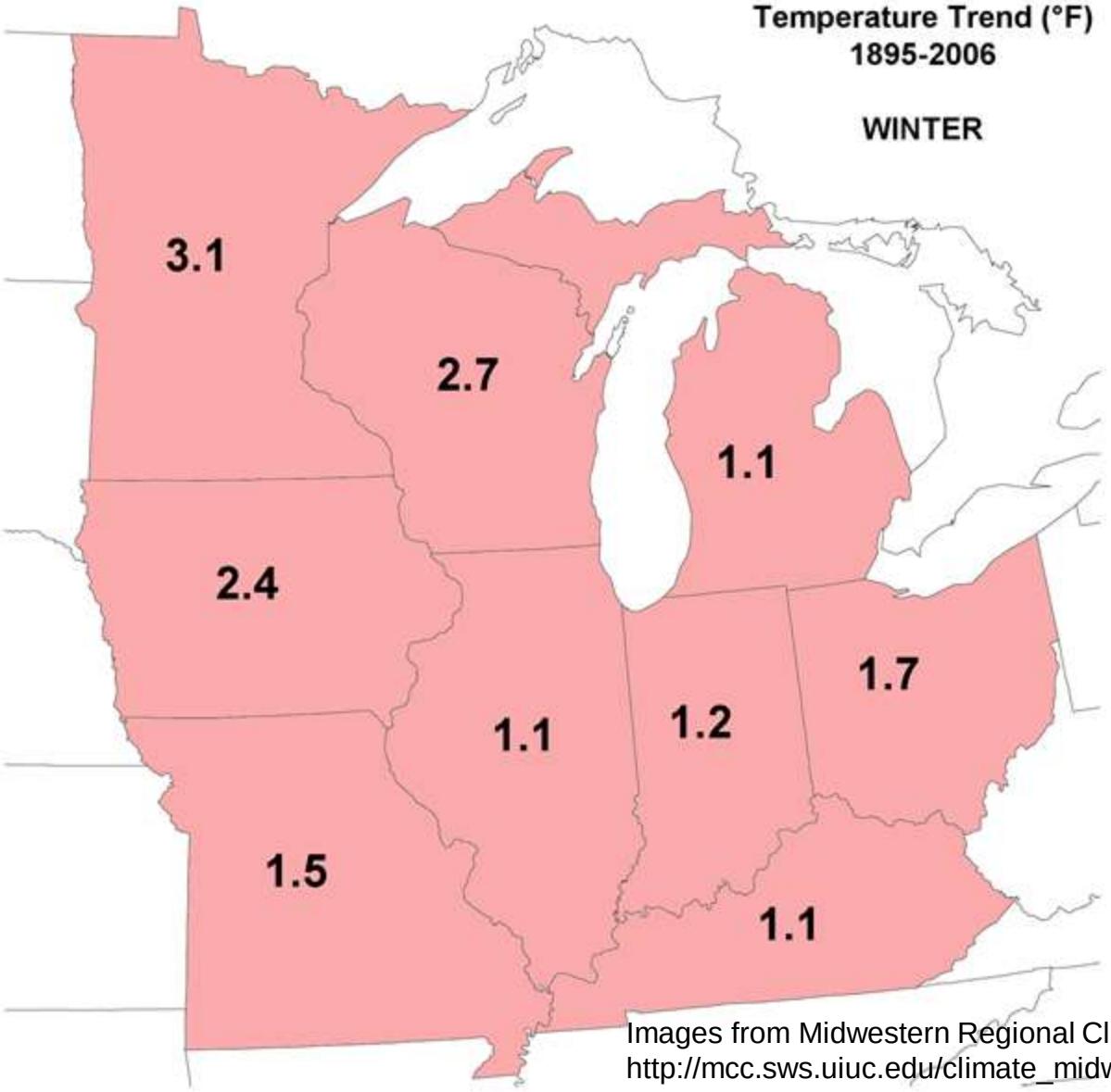
Images from Midwestern Regional Climate Center
http://mcc.sws.uiuc.edu/climate_midwest/mwclimate_chang

Autumn



Images from Midwestern Regional Climate Center
http://mcc.sws.uiuc.edu/climate_midwest/mwclimate_chang

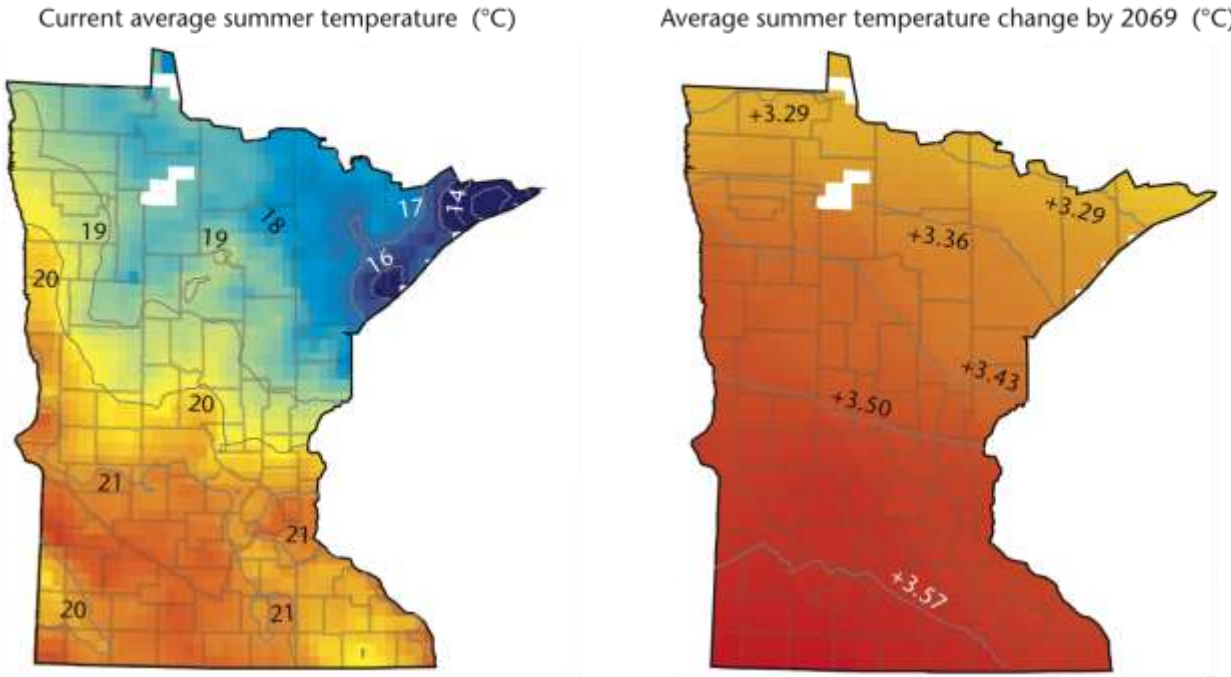
Winter



Images from Midwestern Regional Climate Center
http://mcc.sws.uiuc.edu/climate_midwest/mwclimate_chang

Predicted temperature changes in summer by 2069

Figure 1. Projected Changes in Summer (June–August) Temperatures (°C) and Precipitation (millimeters/day) from Recent Conditions (1970 to 1999) to 2060 to 2069 Based on an Ensemble of 16 Models



Source: S. Galatowitsch, L. Frelich, and L. Phillips-Mao, "Regional Climate Change Adaptation Strategies for Biodiversity Conservation in a Midcontinental Region of North America," *Biological Conservation* 142 (2009): 2012–2022.

Atlanta: It really **is** hotter in the city!

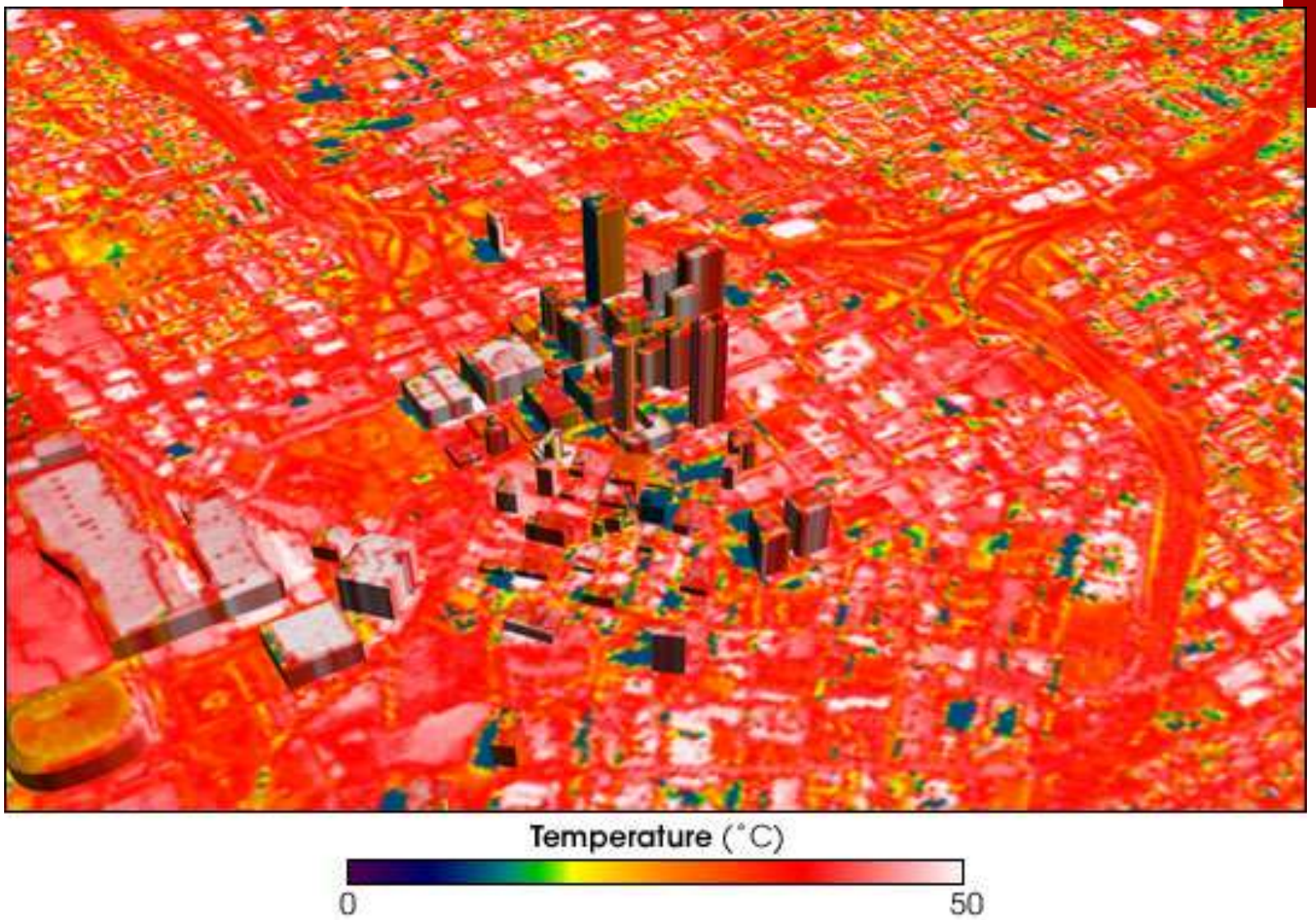


Image from NASA http://earthobservatory.nasa.gov/Features/GreenRoof/Images/atlanta_thermal.jpg

Urban Heat Island Effect

- Hard surfaces, e.g., buildings with dark roofs and dark paving materials absorb heat in the day.
- Urban areas lack significant amount of vegetation that provides shade.
- Less trees, vegetation and exposed soil, limits evaporation of water from leaves and soil so cooling is lost.
- Urban heat islands have higher daytime maximum temperatures and less nighttime cooling than rural areas.

US population living in urbanized areas in 2000

68.6%

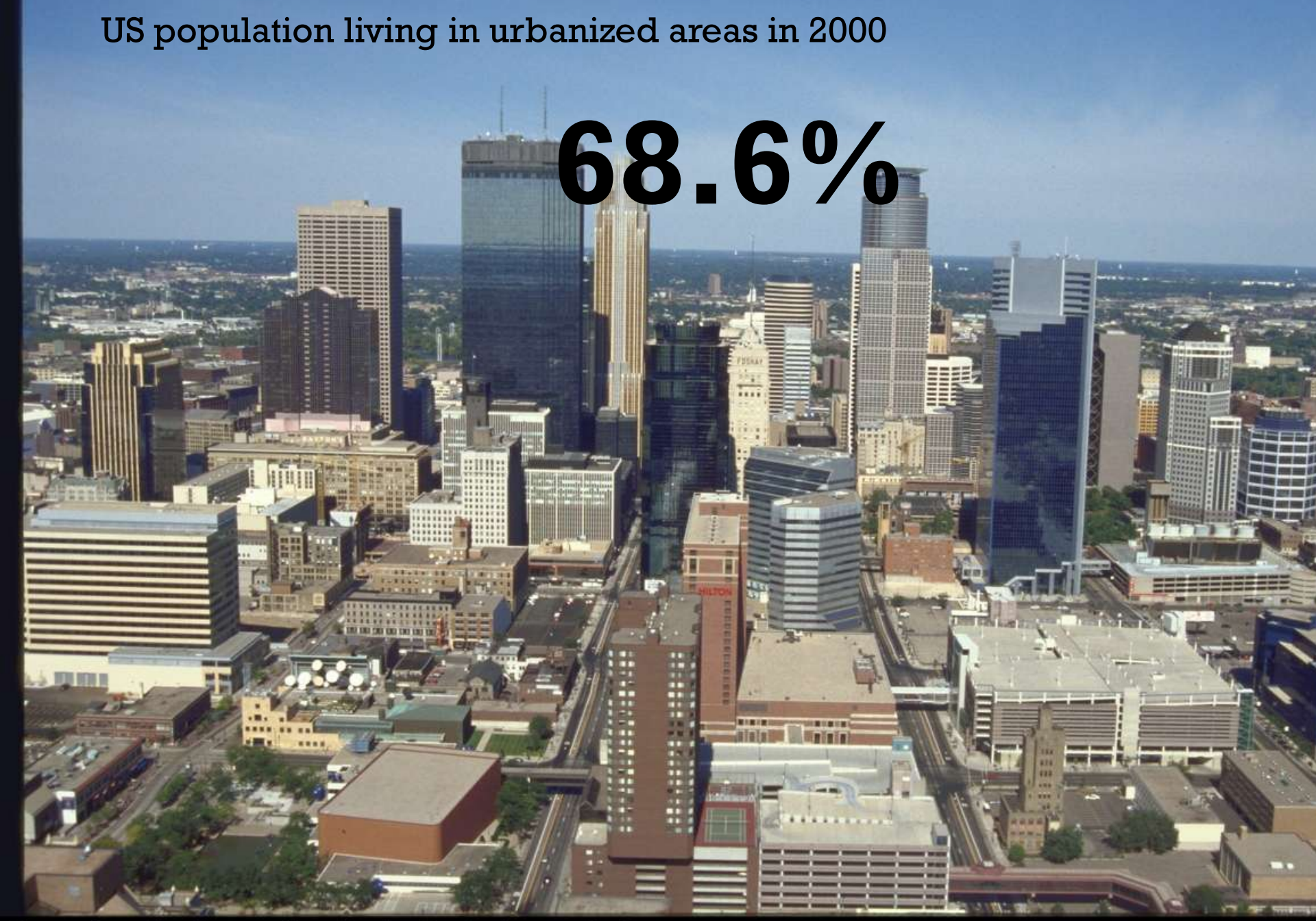
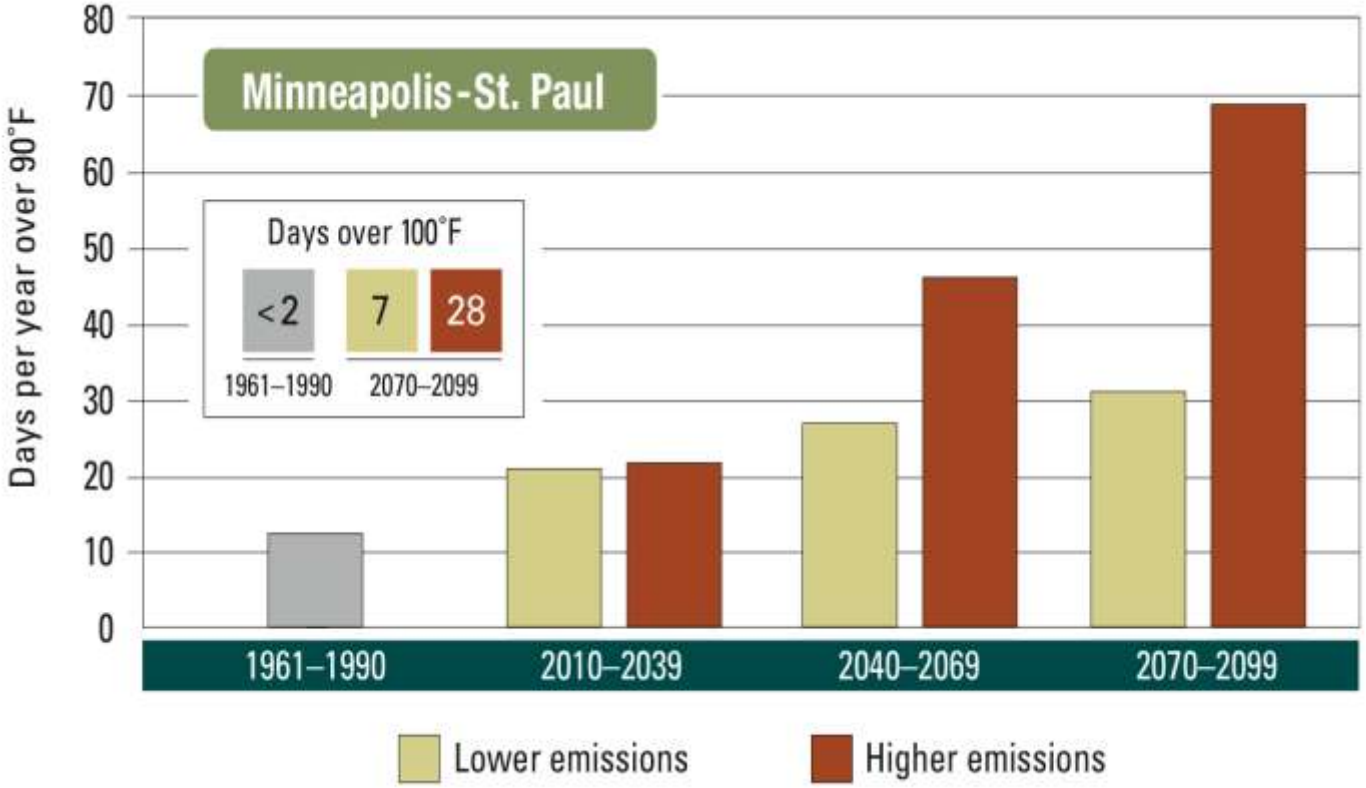


Image from the Metropolitan Design Center Image Bank

Census 2000 Population Statistics
http://www.fhwa.dot.gov/planning/cps2k.htm

Extreme heat events are predicted to increase



Source: Confronting Climate Change in the US Midwest. Union of Concerned Scientists, July 2009.

Public Health Impacts

- **Extreme heat events**
  - **Most common cause of weather-related human mortality in the United States**
  - **Include heat cramps, dehydration, heat exhaustion, heat syncope (fainting), heat stroke and death**
  - **Highest impact in the Northeast and Midwest**
  - **Some populations disproportionately affected**

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Extreme heat events and human health

- From 1999-2003, 3,442 deaths resulted from exposure to extreme heat (likely more because deaths due to extreme heat are generally underreported)
  - MMWR Weekly. *Heat-Related Deaths---United States, 1999-2003.* July 28, 2006
- From 1979 to 2003, more people in America died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes **combined.** *CDC*

‘Heat Waves’

- The 1995 Chicago heat wave caused more than 600 heat-related deaths over 5 days.
- France, summer of 2003: 14,802 excess deaths
  - Hurricane Katrina: 1,836 confirmed deaths
  - World Trade Center: 2,752 deaths

France and public health

- Life expectancy
  - France: 81.9 years
  - United States: 78.24
- Infant mortality
  - France: 3.31 deaths/1,000 live births
  - United States: 6.14 deaths/1,000 live births
- HIV prevalence rate
  - France: 0.4
  - United States: 0.6

https://www.cia.gov/library/publications/the-world-factbook/

France Summer 2003

- Seven days of temperatures >104 degrees F
- Nights were hot
- Most houses and apartments not air conditioned
- Many elderly left unmonitored during traditional August holiday
- Little experience with hot weather

European Journal of Public Health, Vol. 16, No. 6, 592–599

doi:10.1093/eurpub/ckl049 Advance Access published on 27 April, 2006
Heatwaves and public health in Europe
R Sari Kovats1, Kristie L Ebi2

Minnesota is at risk

- *Populations in regions where extremely hot weather is relatively infrequent are most vulnerable to heatwaves owing to a lack of behavioral adaptations and inappropriate housing (for example, the Midwestern US and Northern France).*
  - R Sari Kovats, Kristie L Ebi. *Heatwaves and public health in Europe.* European Journal of Public Health, April 2006. Vol 16, No. 6 592-599.

Extreme Heat Events and Air Pollution

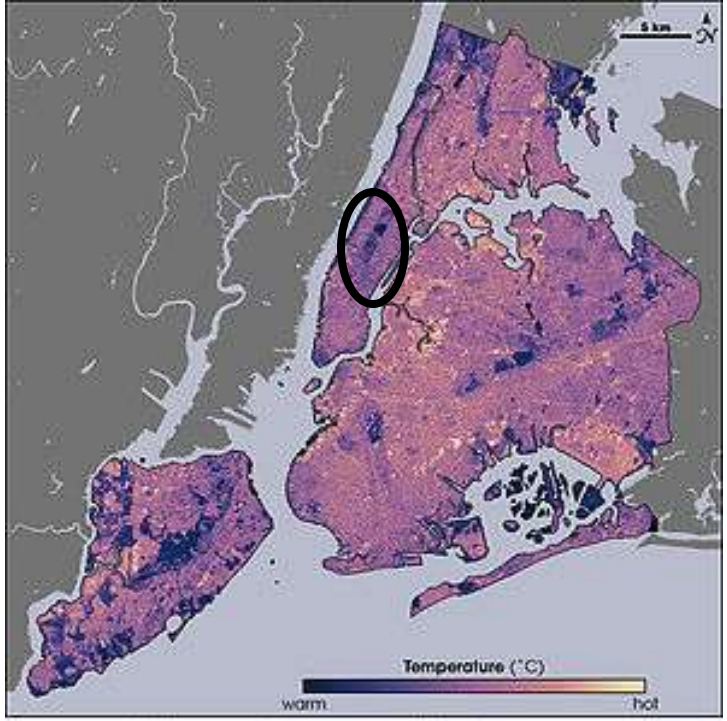
- Extreme heat events increases air pollution by increasing ground-level ozone production. Ozone and high temperature work together to increase mortality.
- Mortality is greatest during a heat wave on days with high particulate matter in the air.

George Luber and Michael McGeehin. *Climate Change and Extreme Heat Events.* American Journal of Preventative Medicine 2008;35(5)

Mitigating Urban Heat Islands

- Plant trees "urban forestry" and vegetation
- Green roofs
- Cool roofs
- Cool pavements

Green roof installed on Chicago City Hall. *Photo Credit: The Green Institute*



- Thermal image of New York City

- Vegetation in New York City

http://www.nyserda.org/programs/environment/emep/climate_change_newyork_heat.asp New York City Regional Heat Initiative. Images from NASA.

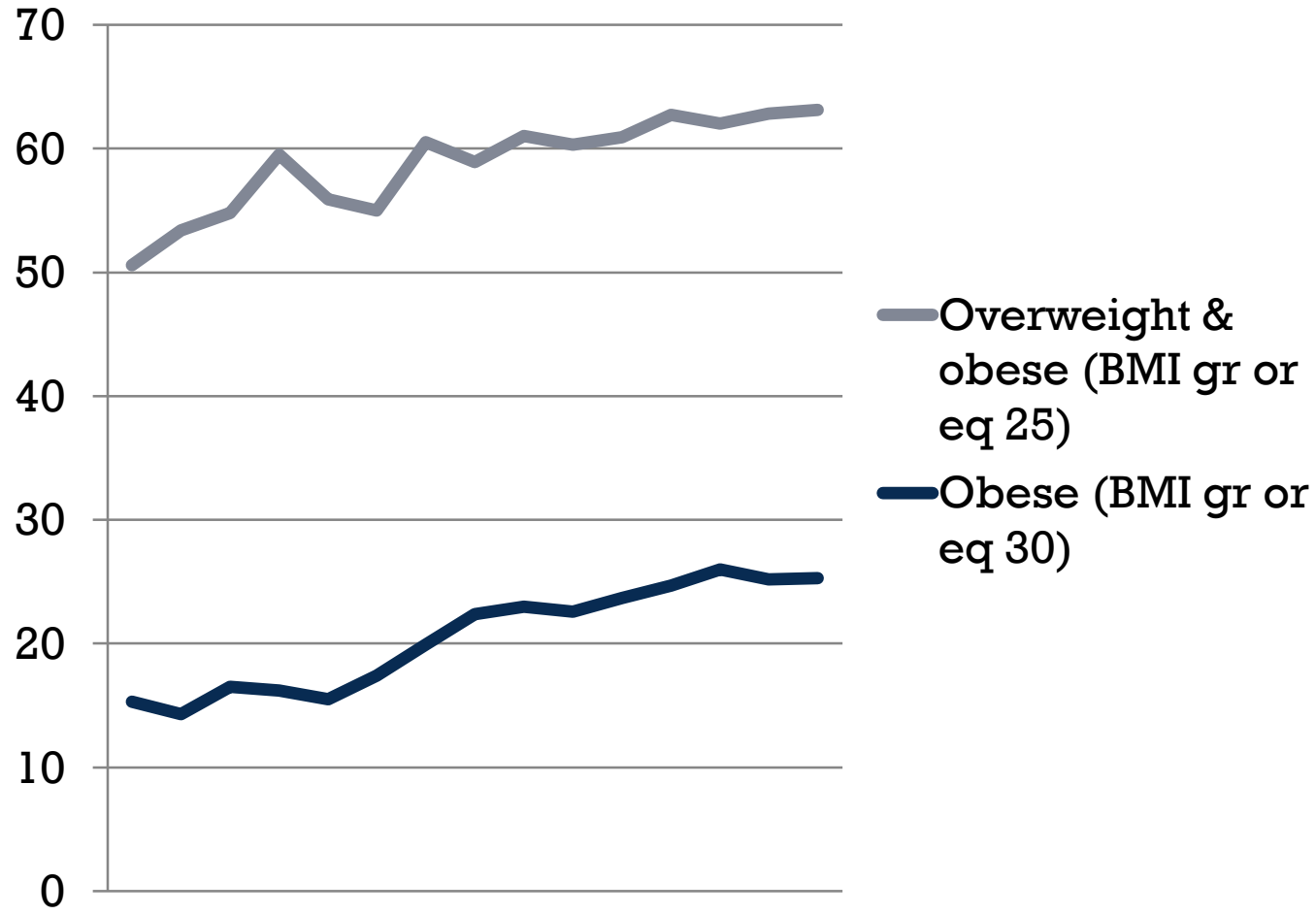
Co-benefits: Parks & physical activity research

- People who have access to walking/jogging trails are 55% more likely to be physically active (Humpel, N, et al., 2002)
- Park proximity is associated with higher levels of park use and physical activity
- Having more parks and more park area (e.g., acreage) within a community is associated with higher physical activity levels

http://www.activelivingresearch.org/files/Synthesis_Mowen_Feb2010.pdf

Overweight & Obesity Trends Among Minnesota Adults

BRFSS 1995-2009



Without trails, parks and green spaces

http://www.k9ring.com/blog/post/Walking-His-Dog-While-Driving.aspx

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With…

MN Afton State Park

Increases in precipitation and severe weather events

- **Recent headlines: 6 reported dead in floods in southeastern Minnesota;** Star Tribune 2010
- In Montevideo, the Minnesota River has reached three of its five highest recorded crests in the past 13 years.

Source: Mark Seeley, University of Minnesota

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Public Health Impacts

- **Extreme weather events**
  - **Storms – injuries, displacement, power loss**
  - **Flooding –drowning, injuries, displacement, impaired water quality**
  - **Drought – wildfires, drinking water quality, water shortages, food shortages**
  - **Mental health impacts**
  - **Disruption in healthcare services**
  - **Vulnerable populations disproportionately affected**

Moorhead, MN, March 30, 2009 -- Resident wades through water to check on his flooded home on the Red River in Moorhead. Photo by Andrea Booher/FEMA

Oslo, MN, May 14, 2009 -- 35 days after the Red River flooded, the damage is still dramatic. Photo by Ed Edahl/FEMA

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Public Health Impacts

- **Vectorborne diseases**
  - **Change in the distribution and incidence of endemic vector-borne diseases**
  - **Tick-borne diseases include Lyme disease, human anaplasmosis, and babesiosis**
  - **Mosquito-borne diseases includ West Nile virus, La Crosse encephalitis virus, and western equine encephalitis virus**

Ixodes scapularis (blacklegged tick or deer tick)

CDC/ Michael L. Levin, Ph. D. (Public Health Image Library)

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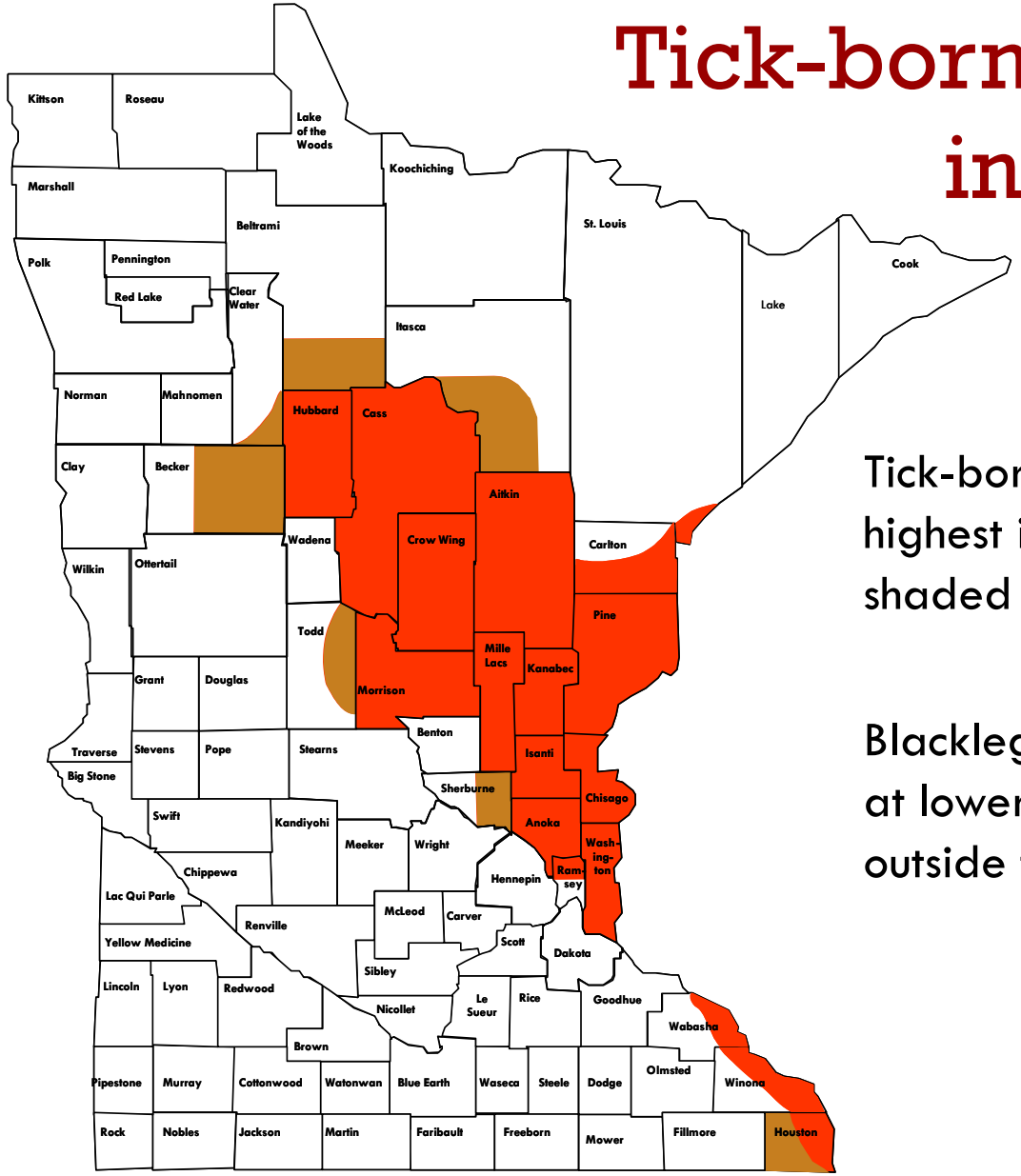
High Risk Areas for Tick-borne Diseases in Minnesota



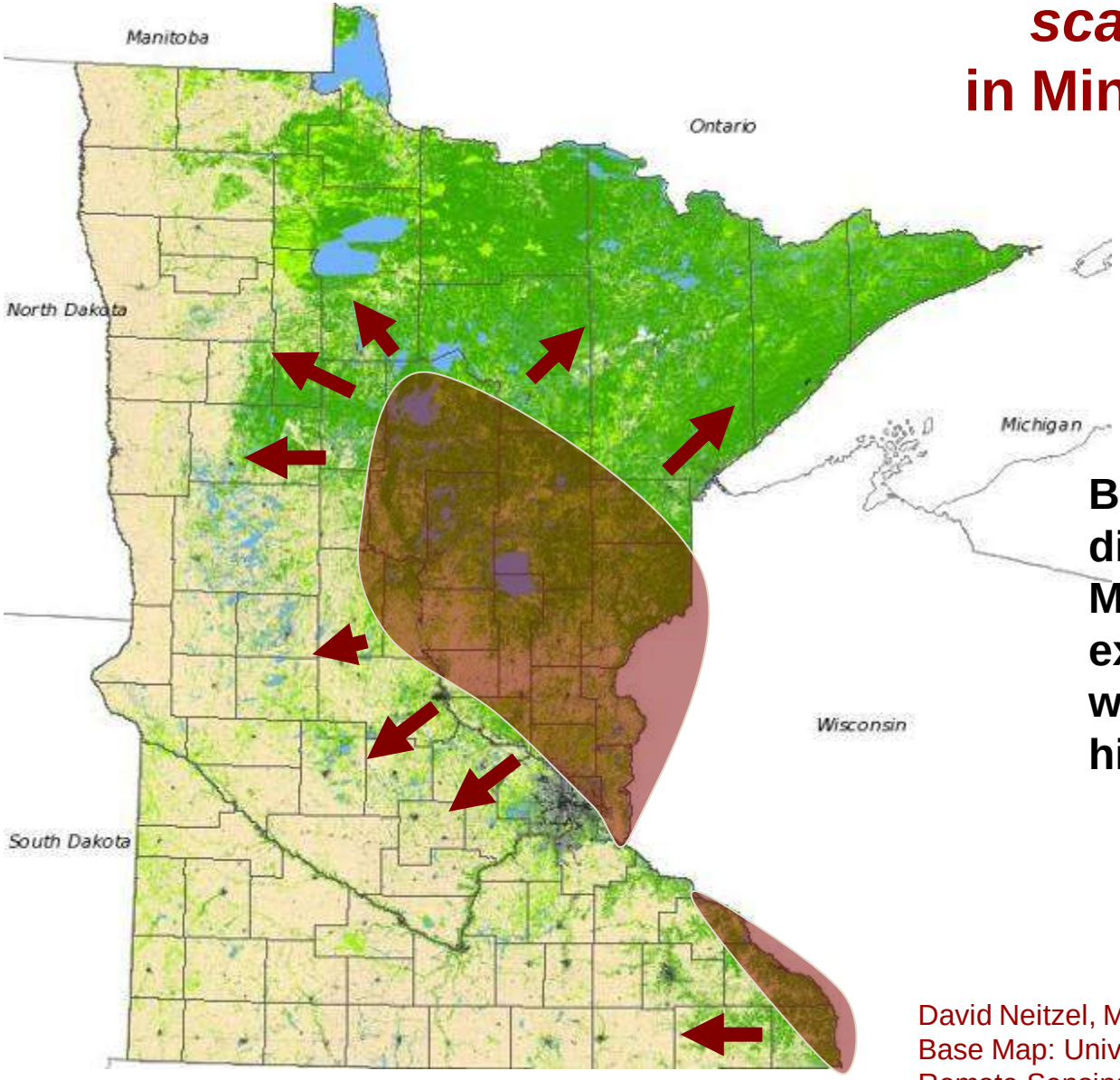
Tick-borne disease risk in Minnesota is highest in forested areas within the shaded zones.

Blacklegged ticks may also be found at lower levels in some forested areas outside this zone.

Known high risk areas for tick-borne diseases, before 2004

Known high risk areas for tick-borne diseases, added in 2004

Recent Expansion of Disease Risk from *Ixodes scapularis* in Minnesota



Blacklegged (Deer) tick distribution in Minnesota has expanded north and west of its known historical range

David Neitzel, MPH, MDH
Base Map: University of Minnesota,
Remote Sensing & Geospatial Analysis Laboratory

Rare or Emerging Tick-borne Diseases in Minnesota

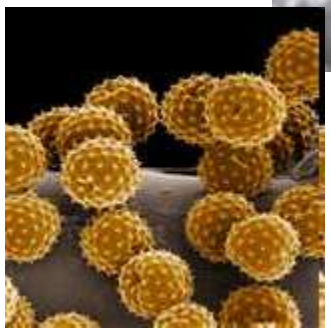
	Agent	Tick Vector	
Ehrlichiosis	*Ehrlichia* spp.	Lone star tick (*Amblyomma americanum*)	
Rocky Mountain spotted fever	*Rickettsia rickettsii*	Wood/dog tick (*Dermacentor* sp.)	
Powassan encephalitis	Powassan virus (prototype and deer tick virus lineages)	Blacklegged tick, Woodchuck tick (*Ixodes* spp.)	

Climate Change and Tick-borne Disease Risk

Increased temperature	- Longer tick growing/feeding season - Lower mortality in winter - New tick species - New disease agents
Increased precipitation/humidity	- Increased blacklegged tick survival in warm season - Increased time available for tick feeding each day

Public Health Impacts

- **Air pollution and allergens**
  - **World Health Organization (WHO) estimates two million premature deaths are caused worldwide by air pollution per year**
  - **Exacerbate chronic respiratory and cardiovascular diseases, including asthma, COPD, and cardiac dysrhythmias**
  - **Allergic diseases are the sixth leading chronic disease in the U.S.**



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Public Health Impacts

- **Water quality and quantity**
  - **Exacerbate the frequency and intensity of storms and droughts**
  - **Extreme water flows cause more erosion, resulting in turbidity and concentrated pulses of pollutants**
  - **Increase growth of toxic algal blooms**
  - **Some areas already facing shortages, like the metro-west, west, central-west, and south-west Minnesota**

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Public Health Impacts

- **Waterborne and foodborne diseases**
  - **may affect the quality of both surface water and groundwater**
  - **Many pathogens also can be acquired through recreational or drinking water**

August 23, 2007 Stockton. Photo by Patsy Lynch/FEMA

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Vulnerable Populations

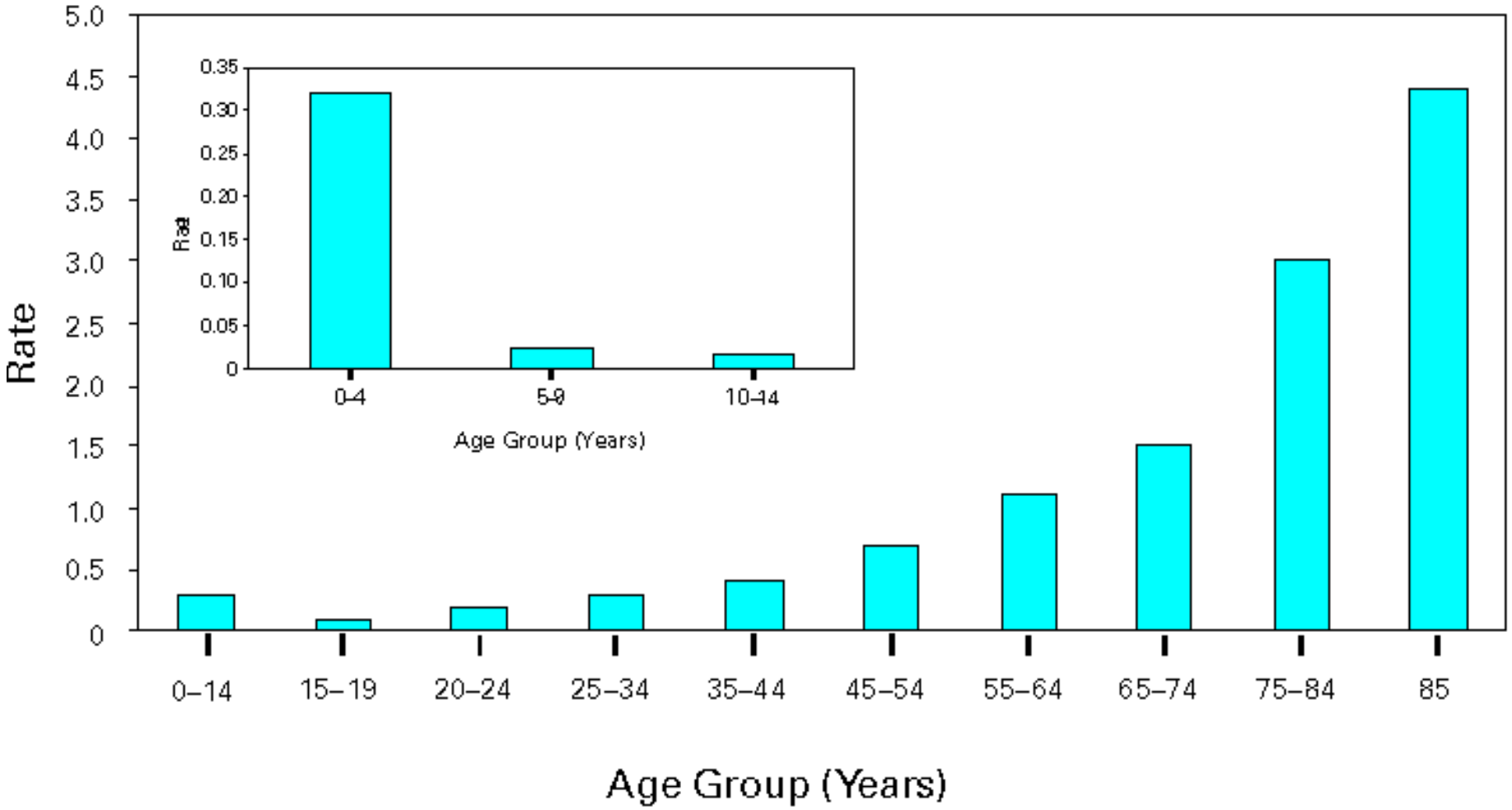
- Personal adaptation: anyone who has difficulty adapting to rapid changes in their environment may be at risk for health impacts due to climate change
- Awareness
- Age
- Biological/medical conditions
- Social determinants

  of health

Social Determinants of Health

- Social and economic interactions
- Physical environment
- Health practices
- Coping skills
- Language/cultural barriers
- Access to health care services
- http://www.health.state.mn.us/strategies/social.pdf

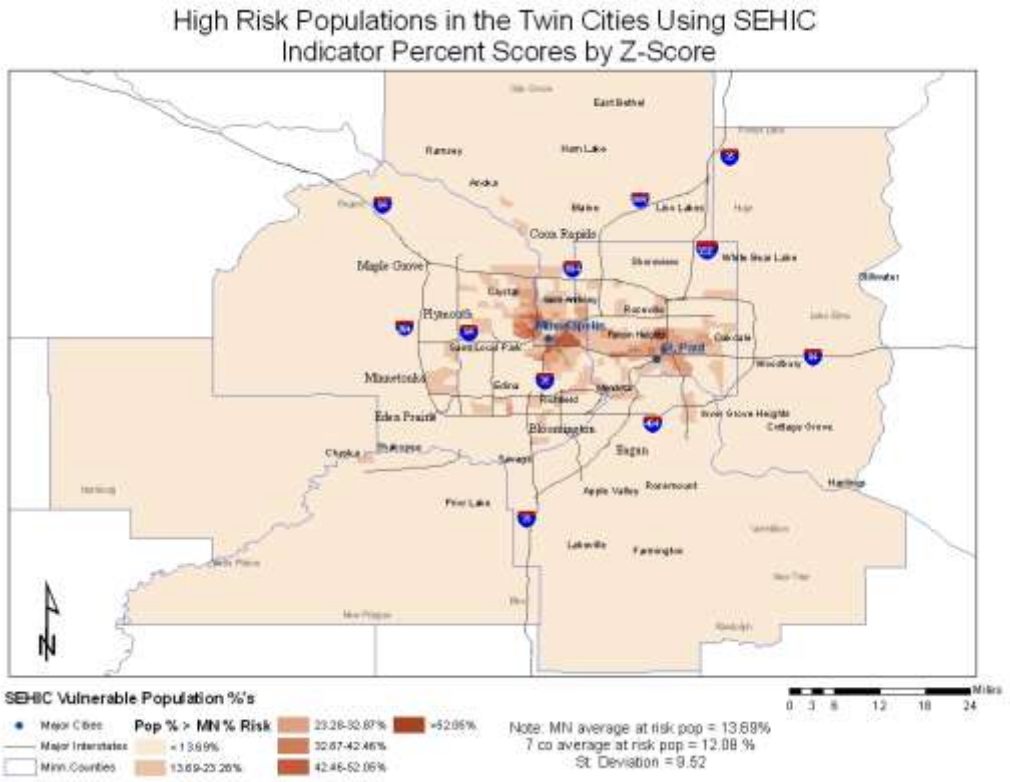
FIGURE 1. Average annual rate* of heat-related deaths†, as the result of weather conditions, by age group — United States, 1979–1997



*Per 1 million population.

†Underlying cause of death attributed to excess heat exposure classified according to the *International Classification of Diseases, Ninth Revision* (ICD-9), as code E900.0 "due to weather conditions (deaths)."

An Indicator for At-Risk Elderly



Calculation Notes: SEHIC vulnerability Population % = MN below poverty line population + MN number of elderly living alone (Dunlap, 2009, Council for State and Territorial Epidemiologists, 2009)

MDH Next Steps

- Develop a strategic plan for local public health departments
- Perform health impact assessments of 7-county metro area comprehensive plans for activities that relate to public health and climate change
- Develop methods for identifying vulnerable populations
- Continue to educate, facilitate data sharing and develop partnerships

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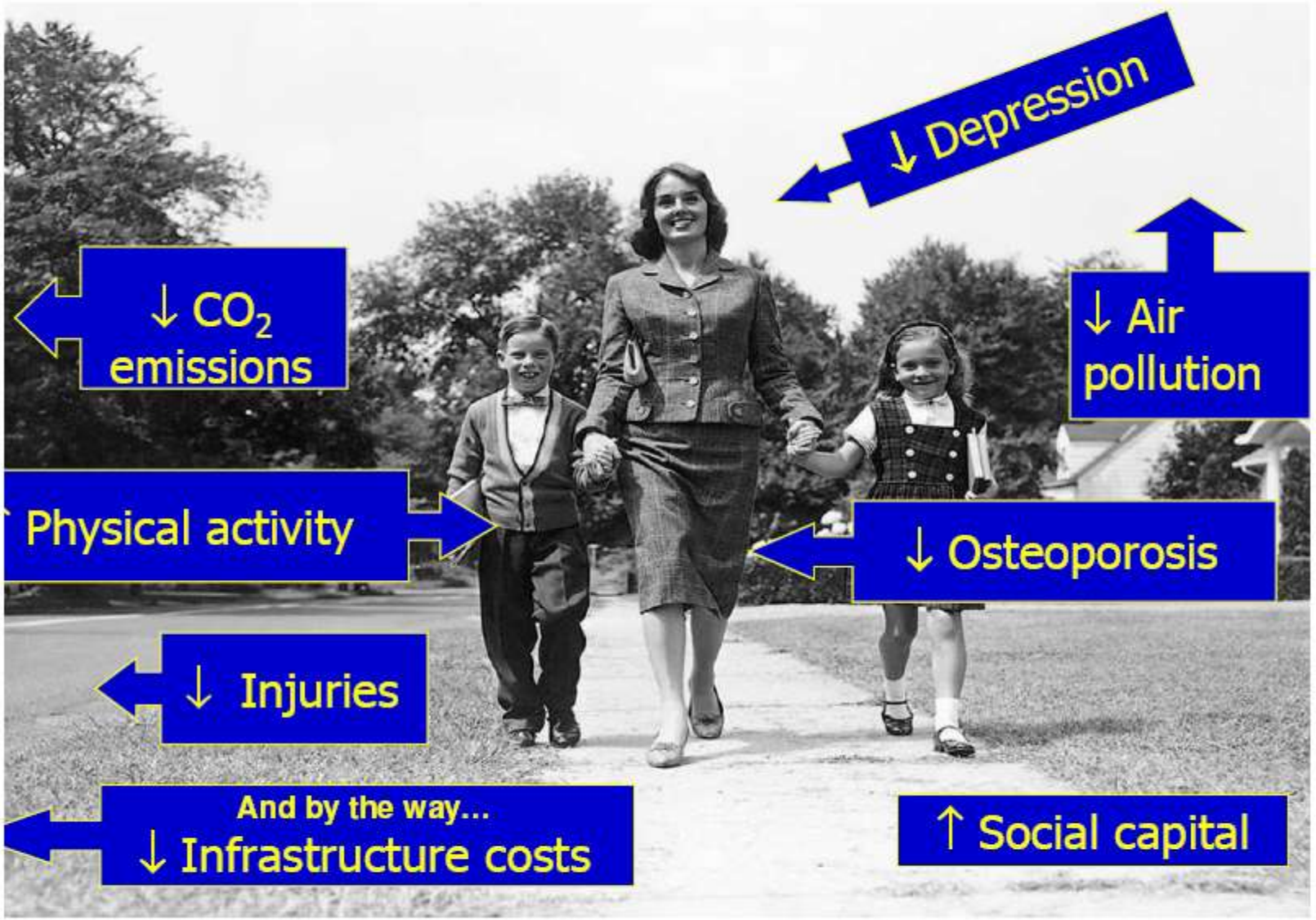

Taking the Pulse Of A Changing Nation: *Findings from a Survey on Climate Change and State/Territorial Health Agencies*

Source: Frumkin, H. 2007, 'Climate Change: The Public Health Approach,' *Presentation to the Institute of Medicine*. Available from: http://www.iom.edu/Object.File/Master/46/407/Frumkin.pdf

astho

Thank you!

References:

Are We Ready? Preparing for the Public Health Challenges of Climate Change. 2008. www.edf.org

Confronting Climate Change in the US Midwest: Minnesota. July 2009. www.ucsusa.org/mwclimate

S. Galatowitsch, L. Frelich, and L. Phillips-Mao, "Regional Climate Change Adaptation Strategies for Biodiversity Conservation in a Midcontinental Region of North America," *Biological Conservation* 142 (2009): 2012–2022.

Intergovernmental Panel on Climate Change: http://www.ipcc.ch/

Dr. Mark Seeley: http://climate.umn.edu/seeley/

MN Climatology Working Group: http://climate.umn.edu/

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