

# MINNESOTA CLIMATE CHANGE VULNERABILITY ASSESSMENT **2014**

## Executive Summary



Minnesota  
Department of Health

MINNESOTA CLIMATE & HEALTH PROGRAM, ENVIRONMENTAL IMPACTS ANALYSIS UNIT

**Minnesota Department of Health**

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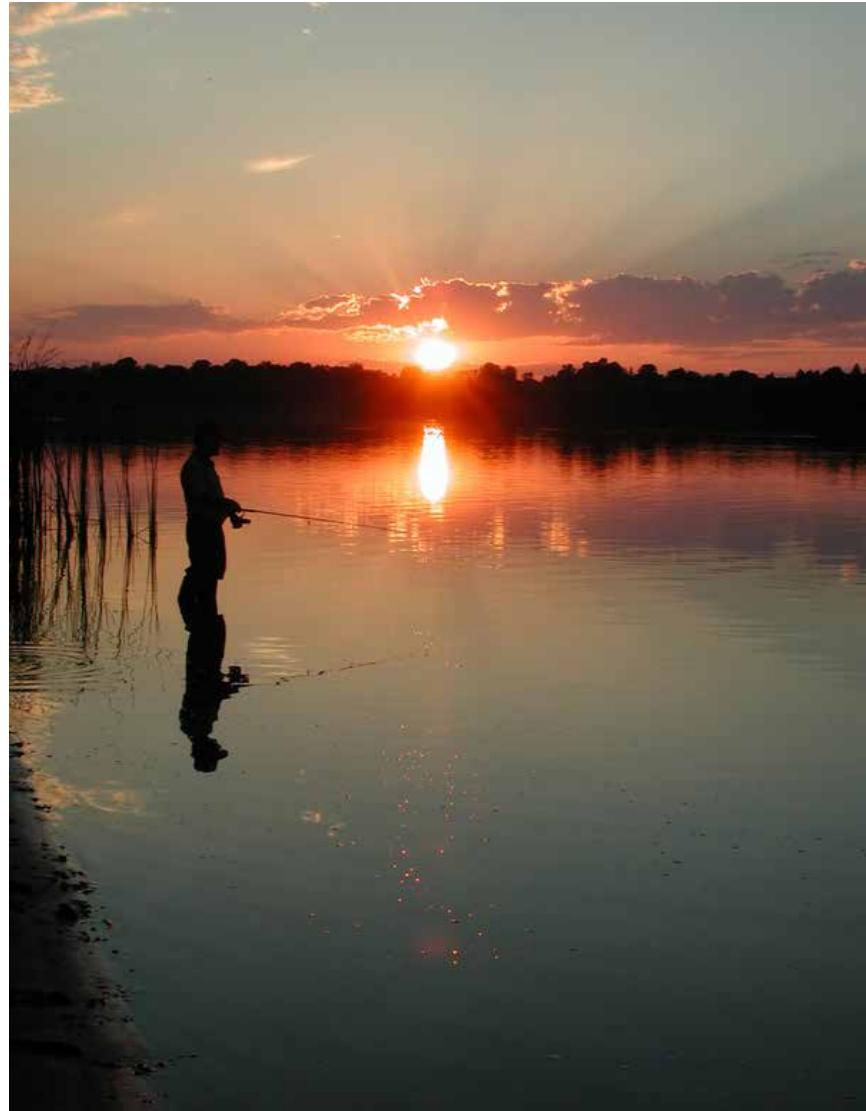
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# Introduction

This document summarizes information and recommendations from the Minnesota Climate Change Vulnerability Assessment. The full report is available upon request at [health.climatechange@state.mn.us](mailto:health.climatechange@state.mn.us).

Extreme heat, heavy downpours, flooding, drought, vector-borne diseases, and poor air quality have affected and will continue to affect Minnesotans. Many of these hazards are expected to increase, occurring more often and with greater magnitude in the future due to climate change. These "climate hazards" present major challenges to the health and quality of life of Minnesotans. This report advances our understanding of several of these climate hazards and the populations that are most vulnerable to the hazards. With this information, state and local government, companies, institutions and community organizations can begin important discussions about the risks of climate change to their communities, how best to prepare for them, and how to protect everyone, including the most vulnerable, to ensure a healthy and prosperous state.

In 2013, the Minnesota Department of Health (MDH) established a team of experts to review scientific literature and evaluate existing datasets to conduct a climate change vulnerability assessment for the state of Minnesota. The effort culminated in the Minnesota Climate Change Vulnerability Assessment, which assessed population vulnerabilities based on retrospective data for the following climate hazards: extreme heat events, air pollution, vector-borne diseases, flooding and flash flooding, and drought. MDH chose the specific climate hazards because of their linkages to climate change and the ability to obtain statewide datasets. Populations vulnerable to the climate hazards were determined from the literature and were defined as groups of people that share a similar characteristic or characteristics that make them more susceptible to the impacts of a hazard. For

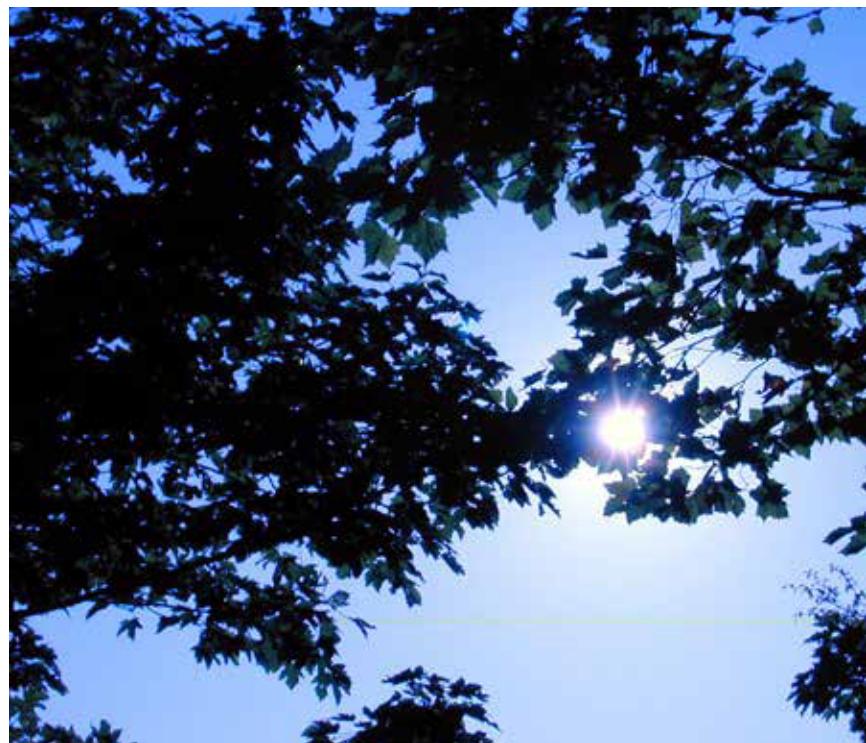


example, characteristics that can increase population vulnerability include age, education level, income, and health status. Additionally, some populations may be more at risk of impacts from climate hazards due to their increased exposure. Populations at risk for health impacts due to extreme heat events or air pollution as a result of increased exposure include workers in outdoor occupations and athletes. While the terms "vulnerable" and "at risk" appear similar, for this report, "vulnerable" describes characteristics that are inherent or difficult to change, such as age or race; and "at risk" describes people who have increased exposure to the climate hazard. The report was limited to existing statewide datasets and does not include all hazards that are affected by climate change nor all vulnerable populations.

MDH used geographic information systems (GIS) to display vulnerable populations by county and the occurrence of climate hazards at varying geographic scales across the state. A total of 38 maps were developed describing both the historic occurrence of the climate hazards and the populations most vulnerable to the hazards. For three climate hazards, extreme heat events, air pollution and flooding, MDH created county-level composite vulnerability scores, which combine both the historic occurrence of the climate hazard and the vulnerable populations. The composite maps can be found in the full report available upon request at [health.climatechange@state.mn.us](mailto:health.climatechange@state.mn.us). MDH also developed two summary maps that describe counties with the greatest number of the specific climate hazards and counties with the greatest percentages of populations most vulnerable to the climate hazards.

Limitations of the Minnesota Climate Change Vulnerability Assessment include reliance on past climate hazard and demographic data; limited data availability; varying levels of data accuracy; potential masking of disparities through data aggregation and geographic display; lack of

evidence between data quartiles and corresponding health risk; and lack of validation of the methodology used in the composite vulnerability scores. Most importantly, the maps capture past occurrence of climate hazards. They do not represent future risk due to climate change and changing demographics. While there are limitations, the Minnesota Climate Change Vulnerability Assessment does provide information to develop a baseline of certain climate hazards and the populations vulnerable to the hazards.



# Overview of the Five Main Climate Hazards

## Extreme Heat

### DESCRIPTION OF CLIMATE HAZARD RISK:

Historically, counties in central and southern Minnesota have met or exceeded the heat index values for excessive heat warnings and heat advisories more often than counties in northern Minnesota.

### VULNERABLE POPULATIONS:

Everyone is affected by heat, but certain populations are more vulnerable to extreme heat, such as older adults, young children and babies, persons living in poverty or those without access to air-conditioning, persons of color, persons with pre-existing health conditions, persons using certain medications, homeless persons, persons living in nursing homes or who are bedridden, and persons living alone. Populations at higher risk to extreme heat include outdoor workers, athletes exercising outside, persons living in urban areas, and persons living in top-floor apartments.



## Air Pollution

### DESCRIPTION OF CLIMATE HAZARD RISK:

Particle pollution and ozone, which are primary sources of health concerns related to air pollution, are higher in the Twin Cities metropolitan area. Air quality that exceeds the National Ambient Air Quality Standards for particulate matter (PM) and ozone occurs two to three days per year in the Twin Cities metropolitan. The higher particle pollution in the metropolitan area is a result of higher localized primary and secondary PM<sub>2.5</sub> emissions from the metropolitan area, as well as, transport of secondary PM<sub>2.5</sub> from the Midwest and Lake Michigan area. The highest ozone levels occur immediately downwind from the urban center.

### VULNERABLE POPULATIONS:

Populations vulnerable to the negative health effects from PM and ozone include young children, older adults, persons of color, persons with existing cardiovascular or respiratory diseases, such as asthma or chronic obstructive pulmonary disease. Those at increased risk include outdoor workers and outdoor exercisers.



## Vector-Borne Disease

### DESCRIPTION OF CLIMATE HAZARD RISK:

Habitat suitable for ticks that carry tick-borne diseases, i.e., Lyme disease and human anaplasmosis, include forested areas in most of the central and northern counties, as well as southeastern counties. Habitats suitable for mosquitoes that carry West Nile virus include agricultural areas, in western and central Minnesota.

### VULNERABLE POPULATIONS:

Although people of any age may contract these vector-borne diseases, vulnerability to the most severe symptoms is higher for older adults or persons with impaired immune systems. People at risk for Lyme disease or human anaplasmosis include anyone who lives, works or travels in wooded areas known to have blacklegged ticks, particularly when exposed to brush and leaf litter from mid-May through mid-July. People at risk of West Nile virus transmission include anyone who lives in or visits western and central Minnesota during warm, dry summers.

## Flooding and Flash Flooding

### DESCRIPTION OF CLIMATE HAZARD RISK:

Historic flood events, which include any high flow, overflow, or inundation by water that causes or threatens damage, including river flooding but excluding flash floods, generally correspond with the major rivers and floodplains in Minnesota. The areas with the greatest number of flash floods, defined as 24-hour rainfall events of six inches or greater, include northeast and southeast Minnesota.

### VULNERABLE POPULATIONS:

Specific populations that are more vulnerable during floods include the following: older adults, particularly if they are living alone; persons who rely on others for care due to a physical or mental infirmity; persons with limited economic resources; persons of color; persons living in substandard housing or mobile homes; persons without a vehicle; and persons who are not proficient in English.

## Drought

### DESCRIPTION OF CLIMATE HAZARD RISK:

There is significant variability in drought across the state; and no area is immune. Drought can affect water quality and quantity, wildfires, air quality, crop production and power infrastructure, such as electricity generation. Drought is more likely to have indirect impacts, such as economic or cultural impacts on communities, businesses and farms dependent on agriculture and/or certain crops or vegetation.

### VULNERABLE POPULATIONS:

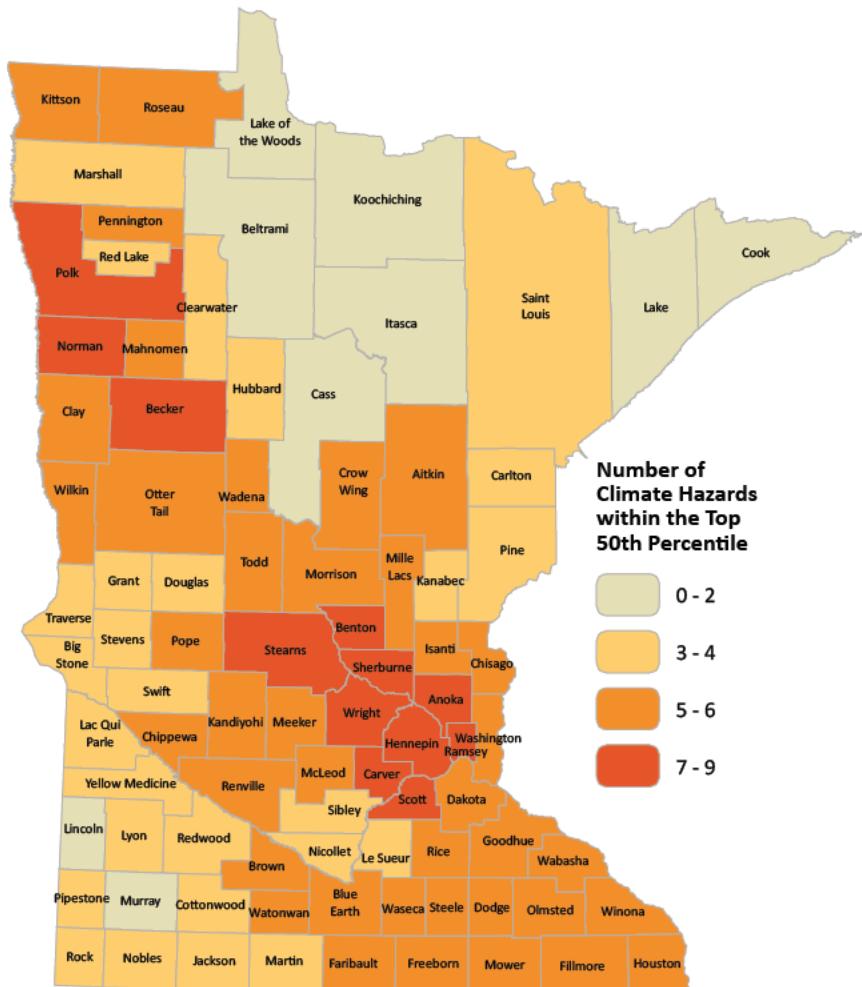
Young children, older adults and persons with respiratory conditions, such as asthma, are more vulnerable to negative health effects from wildfire smoke and ash and dust kicked up from dry fields by strong winds as a result of dry conditions.

# Composite Climate Hazard Risk Map

The Composite Climate Hazard Risk Map shows the number of climate hazards per county that had more occurrences/incidences than the median, or half of the counties (i.e., 50<sup>th</sup> percentile). The map includes the following climate hazards: number of extreme heat events, number of days exceeding fine particle pollution air quality standard, number of days exceeding ozone air quality standard, Lyme disease incidence, human anaplasmosis incidence, West Nile virus incidence, number of flood events, number of flash floods, percentage of months of extreme drought, and longest run of months of extreme drought. A score of ten would mean that the county has had all of the climate hazards occur in that county within the top 50<sup>th</sup> percentile.

All counties had at least one climate hazard occur within the top 50<sup>th</sup> percentile, except two: Lake and Koochiching counties. Seven counties had one to two climate hazards; 27 counties had three to four climate hazards; 39 counties had five to six climate hazards; and 12 counties had seven to nine climate hazards within the top 50<sup>th</sup> percentile.

This map shows that almost all counties in Minnesota have been impacted by the climate hazards examined in the report; however, some counties have experienced more climate hazards than others. Because this report does not review all hazards related to climate change nor does it review future risk of these hazards, all counties need to understand, plan and prepare for their changing climate hazard risks.

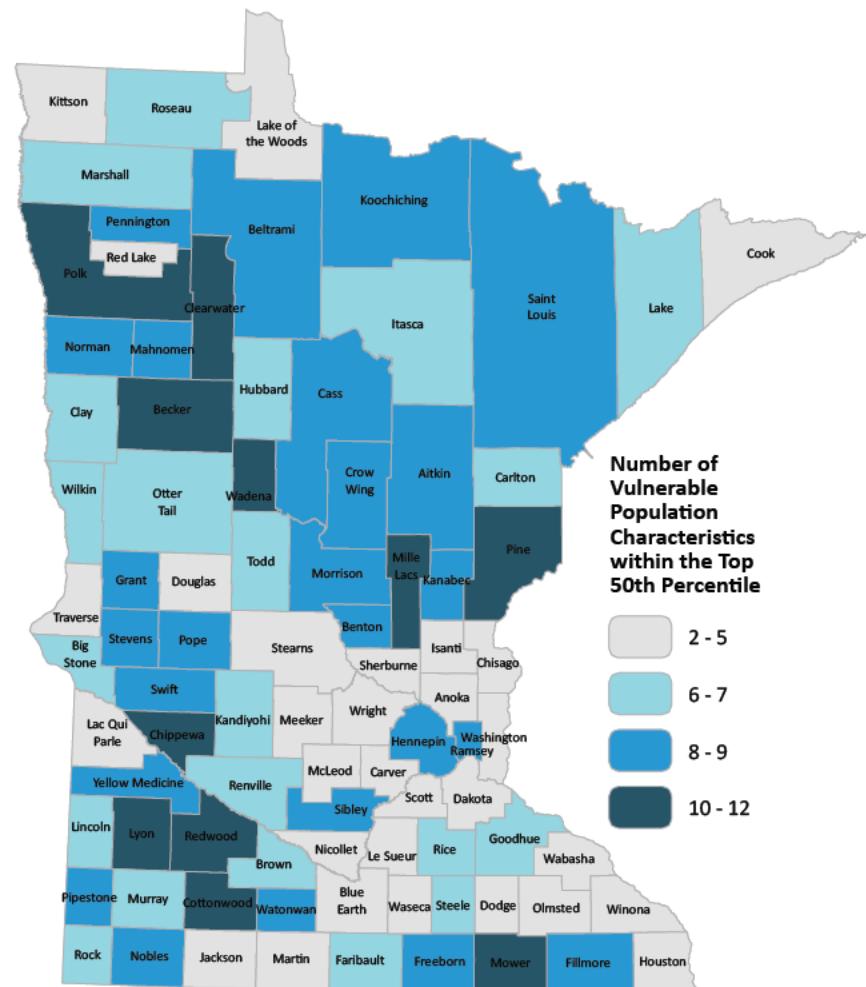


# Composite Population Vulnerability Map

The Composite Population Vulnerability Map shows the number of vulnerable populations per county where the percentage of the population with that vulnerability characteristic was greater than the median, or half of the counties (i.e., 50<sup>th</sup> percentile). The map includes the following vulnerable populations: persons 65 years old and older; persons 65 years old and older living alone; population less than five years old; population in poverty; people of color; workers employed in agriculture, forestry, fishing, hunting and mining industries; workers employed in construction industry; asthma emergency department visits; asthma hospitalizations; chronic obstructive pulmonary disease hospitalizations; older adults living below 150 percent of poverty; families with children in poverty; housing units that are mobile homes; households with no vehicles; and limited English proficiency. A score of 15 would mean that the county contains every vulnerable population and all of the populations are within the top 50<sup>th</sup> percentile.

All counties had at least two vulnerable populations within the top 50<sup>th</sup> percentile. Thirty counties had two to five vulnerable populations; 21 counties had six to seven vulnerable populations; 25 counties had eight to nine vulnerable populations; and 11 counties had ten to 12 vulnerable populations within the top 50<sup>th</sup> percentile.

The prevalence of vulnerable populations throughout Minnesota suggests the need for more analyses to better understand the distribution of vulnerable populations within each county. While assessing vulnerable populations at a county level provides some information about the vulnerability of the county, averaging percentages of vulnerable populations over a large geographic area masks areas that may have a concentration of vulnerable populations. MDH encourages all counties to further assess vulnerable populations in their jurisdiction at a finer spatial scale, including by township, city and neighborhood when possible, and many counties and cities have begun to do this. Identifying vulnerable populations in a community will help organizations allocate resources to the populations and areas



that are less able to cope with climate hazards. Additionally, MDH only examined vulnerable populations to the climate hazards reviewed in the report and substantiated in the literature. MDH also did not assess future demographic changes. The Composite Population Vulnerability Map represents the first step in understanding population vulnerability within a county.

# Final words

Climate hazards as described in the report, i.e., extreme heat, air pollution, vector-borne diseases, flooding and flash flooding, and drought, have affected every county to varying degrees. Many of these climate hazards will change and increase in the future. Additionally, all counties contain vulnerable populations, and these populations may change and grow overtime. Understanding who is more vulnerable and where the most vulnerable populations reside will greatly improve planning for climate hazards and will help allocate limited resources to those most affected by climate hazards. State and local government, organizations, and individuals can use the Minnesota Climate Change Vulnerability Assessment to create a baseline or historic understanding of their communities' risk, learn more about potential future risks, host discussions about the impacts of climate change, and begin planning for current and future climate changes to protect themselves and their communities.



FOR A COPY OF THE COMPLETE MINNESOTA CLIMATE CHANGE VULNERABILITY ASSESSMENT, PLEASE CONTACT MDH AT [HEALTH.CLIMATECHANGE@STATE.MN.US](mailto:HEALTH.CLIMATECHANGE@STATE.MN.US).

## What can you do?

Consider your personal vulnerability. Are you vulnerable to the impacts of climate change? Are you more at risk? Consider personal preparedness, such as:

- Creating a disaster plan for you and your family:
  - <http://www.health.state.mn.us/oep/prepare>
  - <https://dps.mn.gov/divisions/hsem/planning-preparedness/preparedness/Pages/personal-preparedness.aspx>.
- Learn more about preparing for extreme weather events and other climate-related hazards:
  - <http://www.ready.gov/natural-disasters>.
- Get involved with local planning efforts.

Planners, emergency managers and public health emergency preparedness professionals understand your community's historic, current and future risk of climate hazards and plan for vulnerable populations.

- Identify and locate the vulnerable populations for the climate hazards in your community. Examples can be found at: <http://www.health.state.mn.us/divs/climatechange/data.html>.
- Use the vulnerability assessment and additional information on future risks to prioritize policies and interventions in the comprehensive plan, emergency preparedness all hazard plan, and emergency management hazard mitigation plan.