

# Planning for Climate & Health Impacts in Southwest Minnesota

Emergency Management Considerations for HSEM Region 5

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**m**  
DEPARTMENT  
OF HEALTH

# ABOUT THE REGIONAL PROFILE

## EXTREME WEATHER IS A FAMILIAR CONCERN FOR MINNESOTANS

While experience has helped Minnesotans adapt to historical weather patterns, climate change trends are pushing us to adapt even further to weather patterns and extreme events that pose major threats to our health, homes, environment, and livelihood. Over 50 years of storm data on record document that Minnesota has experienced an increase in the number and strength of weather-related natural disasters, particularly those related to rising temperatures and heavy downpours. These events cost our state millions in property loss, damaged infrastructure, disrupted business, medical care and support services, and put residents and responders at risk. Understanding how our weather is changing now and into the future will help planners and decision-makers in emergency management and supporting fields extend our progress in climate adaptation and lead to more resilient communities.

## CLIMATE PROJECTION DATA AS A TOOL

Climate projections can help us prepare for the future. These data result from highly sophisticated global climate models and provide a general idea of trends in temperature and precipitation many decades into the future at ever-increasing time and spatial scales. Like every dataset, there are limitations to our understanding and application of the information to real-life decision-making. Yet despite limitations, climate projection data offer a crucial glimpse into our potential futures, and allow us to start considering the best way to allocate our preparedness dollars and management resources to reduce the severe impacts of extreme weather.



*Ice storm (Mark Steil, 2013)*

## PUTTING CLIMATE CHANGE INTO CONTEXT

Sometimes, climate change and extreme weather events and the impact on our communities appear distant and abstract. That is why the Minnesota Department of Health's Minnesota Climate & Health Program teamed up with state and local emergency management and preparedness professionals as well as state climatologists to develop a custom climate profile for each of the six Homeland Security and Emergency Management (HSEM) regions across the state. Each regional profile includes a description of climate change trends along with a summary of climate projection data to illustrate these trends. Regional climate data are presented alongside population projection data, as it's important to consider both our climate future and population future as we plan to minimize risk and build resilience against climate impacts.

Additionally, each regional profile provides a local case study, a "focusing event," to illustrate the links between extreme weather and natural disasters and what climate projection data can (and cannot) signify for similar events in the future. Each case study features a recent natural disaster that impacted the HSEM region and provides a comparison between temperature and precipitation measures related to that event alongside historical baseline trends and future projection estimates. Taken together, the six HSEM regional profiles provide an extensive overview of climate change trends for Minnesota and describe the potential impact of these trends for emergency management and preparedness professionals and their partners.

## FOR MORE INFORMATION

A long form report, including all six profiles, individual county data, and a more comprehensive description of climate change trends and supporting research will be available at:

[Minnesota Climate & Health Planning Tools & Data](http://www.health.state.mn.us/divs/climatechange/data.html)  
([www.health.state.mn.us/divs/climatechange/data.html](http://www.health.state.mn.us/divs/climatechange/data.html))

# REGION 5 OVERVIEW

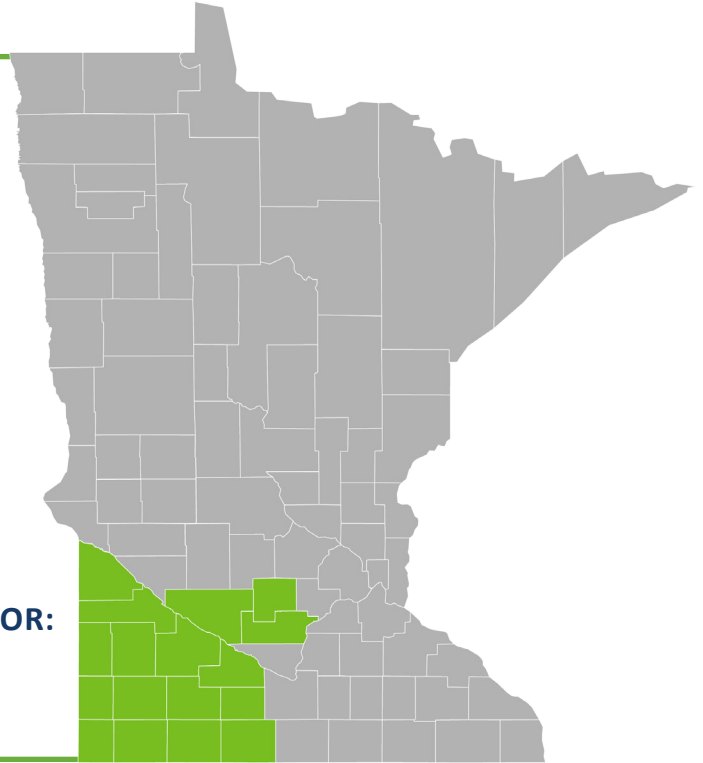
## REGION 5: Southwest Minnesota

### COUNTIES

- Brown
- Chippewa
- Cottonwood
- Jackson
- Lac Qui Parle
- Lincoln
- Lyon
- Martin
- McLeod
- Murray
- Nobles
- Pipestone
- Redwood
- Renville
- Rock
- Sibley
- Watonwan
- Yellow Medicine

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## MINNESOTA CLIMATE & POPULATION TRENDS

### OUR KNOWLEDGE OF CLIMATE CHANGE IS EXPANDING RAPIDLY

Climate records show that across the Midwest and here in Minnesota we are experiencing an increase in warmer, wetter conditions as well as an increase in extreme weather events and related natural disasters. Experts expect these conditions to continue well into the future. By mid-century, Minnesotans can expect much warmer winters, more severe summer heat waves, a higher frequency of very heavy rain events and a higher frequency of late growing season drought conditions.

Many communities in Minnesota rely on economies rooted in agriculture and outdoor recreation, such as wintertime tourism, including snowmobiling, ice fishing, and skiing. Future climate conditions may stress agricultural economies by delaying planting and fieldwork, increasing disease and pest pressure, and reducing crop yields due to cycles of flooding and dry spells. Rapidly warming winter temperatures will turn snowfall into rain and reduce the depth and timing of lake ice cover, affecting winter recreation.

Extreme rainfall events will increase flood risk, particularly in floodplain areas, disrupting transportation and utility service, and damaging property and infrastructure. In addition, surface runoff may lead to soil erosion, lake pollution, and reduced drinking water quality. Nutrient runoff in particular, along with warmer temperatures, are likely to contribute to a larger occurrence of harmful algal blooms on waters, many valued for recreation. Changing climate conditions are likely to strain the viability of native species, including popular recreational fish, invite encroachment by invasive species, and increase the geographic range and types of ticks and mosquitoes.

Some of these trends are evident in the current climate projection data that are available. However, because these data are often averaged or summarized for large areas over large time periods, they can mask the local peaks in temperature and precipitation that can trigger disasters. Until more finely-scaled climate projection data become available to Minnesota planners and decision-makers, the current data still remain useful for exploring the future ahead and establishing a baseline understanding of what our weather challenges may be moving forward.

# REGION 5 CLIMATE PROFILE

*Use the following information on temperature, precipitation, and vulnerable populations to help plan for future weather-related incidents.*

## TEMPERATURE

**There has been an increase in winter and summer temperatures.** Our average winter lows are rising rapidly, and our coldest days of winter are now warmer than we have ever recorded. In fact, Minnesota winters are warming nearly 13 times faster than our summers. The continued rise in winter temperatures will result in less snow pack, which will increase chances for grassland/wildfires as well as drought. The warmer winter temperatures will also have major consequences for our ecosystems, including native and invasive species, whose growth, migration, and reproduction are tied to climate cues. The increase in Lyme disease across Minnesota is also likely influenced in part by the loss of our historical winters, due to a longer life-cycle period for ticks. Freeze-thaw cycles are likely to increase as well, damaging roads, power lines, and causing hazardous travel conditions. By mid-century our average summer highs will also see a substantial rise, coupled with an increase in more severe, prolonged heat waves that can contribute to drought and wildfires and pose a serious health threat, particularly to children and seniors. Here are temperature trends for HSEM Region 5:



Average Summer Maximum Temperature for HSEM Region 5		
1981-2010	2050-2075	Change
82.1 °F	89.6 °F	+7.5 °F



Average Winter Minimum Temperature for HSEM Region 5		
1981-2010	2050-2075	Change
7.9 °F	16.9 °F	+9.0 °F

## PRECIPITATION

**There has been an increase in total average as well as heavy precipitation events, with longer periods of intervening dry spells.** Our historical rainfall patterns have changed substantially, giving rise to larger, more frequent heavy downpours. Minnesota’s high-density rain gauge network has captured a nearly four-fold increase in “mega-rain” events just since the year 2000, compared to the previous three decades. Extreme rainfall events increase the probability of disaster-level flooding. However, there is also an increased probability that by mid-century heavy downpours will be separated in time by longer dry spells, particularly during the late growing season. Over the past century, the Midwest hasn’t experienced a significant change in drought duration. However, the average number of days without precipitation is projected to increase in the future, leading Minnesota climate experts to state with moderate-to-high confidence that drought severity, coverage, and duration are likely to increase in the state. Modeling future precipitation amounts and patterns is less straight-forward compared to temperature. Some climate models do a better job than others representing rainfall for the Midwest, and available data sources only provide average estimates on a monthly scale, masking the spikes in extremes that trigger flood and drought disasters. Trend data provided here for HSEM Region 5 are summarized for early summer, when historically Minnesota receives most of its rainfall, and for early fall when rainfall scarcity may threaten crop harvests and local agricultural economies:



Average Early Summer Precipitation for HSEM Region 5		
1981-2010	2050-2075	Change
3.8"	4.4"	+0.5"



Average Early Fall Precipitation for HSEM Region 5		
1981-2010	2050-2075	Change
2.5"	2.4"	-0.1"

## VULNERABLE POPULATIONS

**There has been an increase in the older adult population.** Extreme weather events cause a range of health impacts and disruptions that vary across population groups. The vulnerability of a group is a function of its sensitivity to a hazard, exposure to risks, and capacity for responding or coping with the impacts. Children and older adults are often identified as groups vulnerable to climate change threats, including extreme weather and natural disasters. For example, physiologically these groups have a lower capacity to tolerate extreme heat and are often dependent on others for transportation to cooling centers. These groups are also often critically dependent on others during a disaster, such as needing help to evacuate during a flood or wildfire, or to find alternative housing if displaced. Planning for the specific needs of vulnerable populations strengthens local efforts to reduce the impact of extreme weather-related events. Population trend data provided here for HSEM Region 5 are intended to highlight the changes in two key demographic groups for the region, but planners and managers should also consider future changes in other populations of concern, such as those with low incomes, immigrant groups, indigenous peoples, persons with disabilities, or vulnerable occupational groups (such as outdoor workers):



Childhood Population (0-14) Projection Estimates for HSEM Region 5		
2015	2050	Change
51,634	42,313	-18.1%



Elder Population (65+) Projection Estimates for HSEM Region 5		
2015	2050	Change
53,580	59,580	+12.4%

## REGION 5 CASE STUDY

The following case study is intended to illustrate the links between climate and weather and natural disasters. Acting as a “focusing event,” the case study demonstrates how a previous weather-related event (i.e., ice) impacted important economic drivers, environmental resources, and population health. Then, the Climate Projection Data section compares weather data from the case study with baseline and projected weather data to show the possibilities of future disaster events. This case study highlights the relevancy of climate projection data for understanding future climate and weather risks in Minnesota.

**EVENT: ICE STORM**

**DATE: APRIL 9-12, 2013**

A devastating ice storm hit southwestern Minnesota in the spring of 2013. Southwestern Minnesota is in a relatively high-frequency corridor of ice storms, partially due to the Buffalo Ridge where the higher elevation often cools the air just enough to turn rain into freezing rain. A combination of freezing rain and wet, heavy snow brought down trees and powerlines throughout the area leading to widespread power outages and extremely dangerous driving conditions. The heaviest coating of ice was around the cities of Worthington and Luverne with nearly an inch of ice reportedly coating these areas. Conditions required the city of Worthington to declare a state of emergency and resort to rolling blackouts to keep homes habitable and avoid having to open emergency shelters. To enable disaster relief support, the federal government declared five counties disaster areas in the aftermath of the storm: Cottonwood, Jackson, Murray, Nobles, and Rock.

## REGION 5 CASE STUDY: KEY IMPACTS

It is nearly impossible to capture all the various impacts from a natural disaster. These impacts broadly include costly infrastructure damage, disrupted utility service, prolonged work and school absences, acute physical injury, and persistent strains on mental health, on scales ranging from the community to the household to the individual.

The extensive costs associated with the 2013 April ice storm event are difficult to capture in a single estimate. One report puts damage costs at about \$71 million. However, this estimate does not take into account the loss to businesses that were forced to close or medical expenses for injuries linked to slips, falls, or car accidents.

The following are just a few examples of the adverse impacts on HSEM Region 5 communities and others from the 2013 April ice storm:

### **DISRUPTION OF ESSENTIAL SERVICES:**

Widespread power outages left many communities and farms without electricity or heat during a prolonged period of cold temperatures. More than 100,000 customers across southwest Minnesota were impacted by power disruptions. Some rural customers did not have power restored for multiple days. The widespread loss of power affected communications along with electric, heat, and water services to homes, schools, businesses, and fire stations.

**BUDGET STRAINS:** In several small communities, costs of responding to the disaster consumed their public works budget for the entire year. To assist with hazards and power loss, the Governor activated the National Guard.

**DIRECT HEALTH THREAT:** Snow- and ice-covered roads, coupled with downed trees and utility poles, made for extremely dangerous driving conditions. During a single 8-hour period on April 10th, State Patrol reported at least 736 crashes and spinouts, 39 involving serious injuries.

**EVACUATIONS & CLOSURES:** Due to power outages, one medical center was forced to run entirely on its own generators, while others, including a nursing home and a juvenile detention center, needed to evacuate residents and patients to other areas. In order to reduce demand on the fragile power grid and ensure public safety, a number of businesses, schools, and campgrounds were closed.



*Powerlines down in Worthington, Minnesota (Mark Steil, 2013)*



“

*During a single 8-hour period on April 10th, State Patrol reported at least 763 crashes and spinouts, 39 involving serious injuries.*

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*Top: Car covered in fallen branches in Worthington, Minnesota (Julie Buntjer, 2013)  
Bottom left: Ice storm in Westbrook, Minnesota (Paul Jones, 2013)  
Bottom right: Bus off the road in Elk River, Minnesota (Mandi Cline-Elken, 2013)*

# CLIMATE PROJECTION DATA

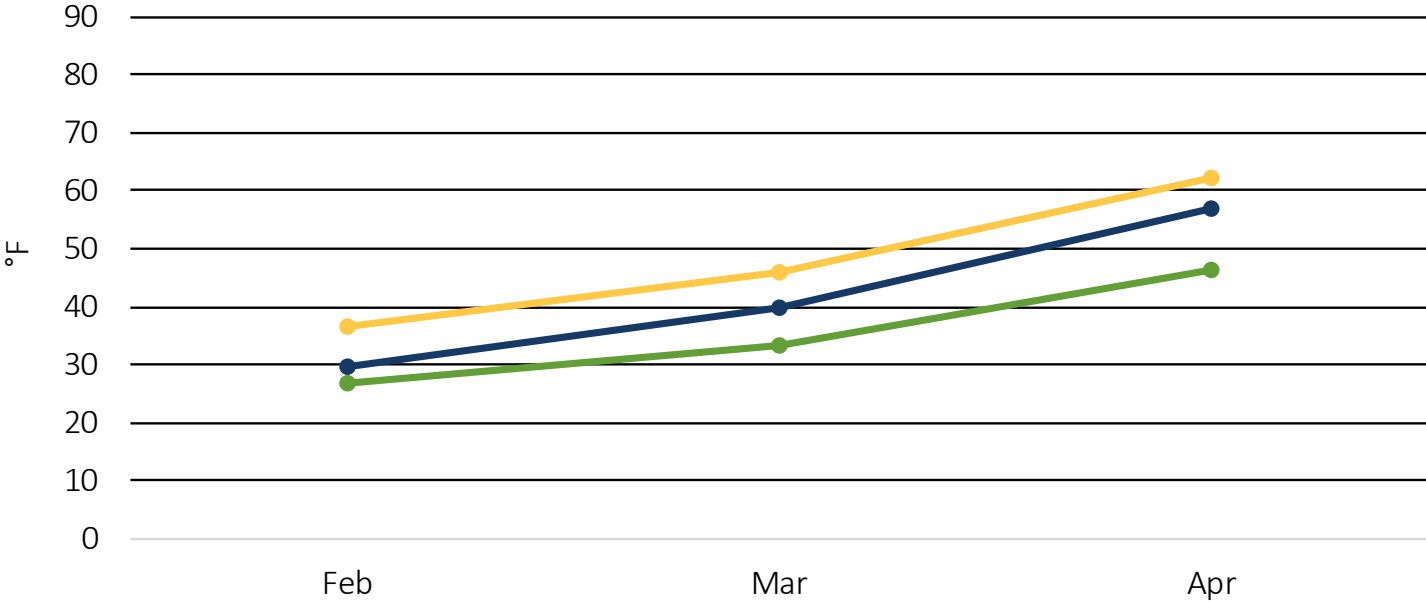
Following are visual representations of climate projection data for Region 5. Data for all counties included in Region 5 were averaged to derive regional estimates. (Data for individual counties are available in the long-form report.) The graphs below compare future temperature and precipitation projection data (in yellow) with a historical climate baseline (in blue) and climate measures from the regional case study event (in green). Because preceding conditions can influence a disaster event, data from February through April are provided to provide context.

**LEGEND**

- **Historical:** 1981- 2010
- **Case Study:** 2013 ice storm
- **Projected:** 2050- 2074

### Maximum Temperature

Trend comparison to 2013 ice storm data

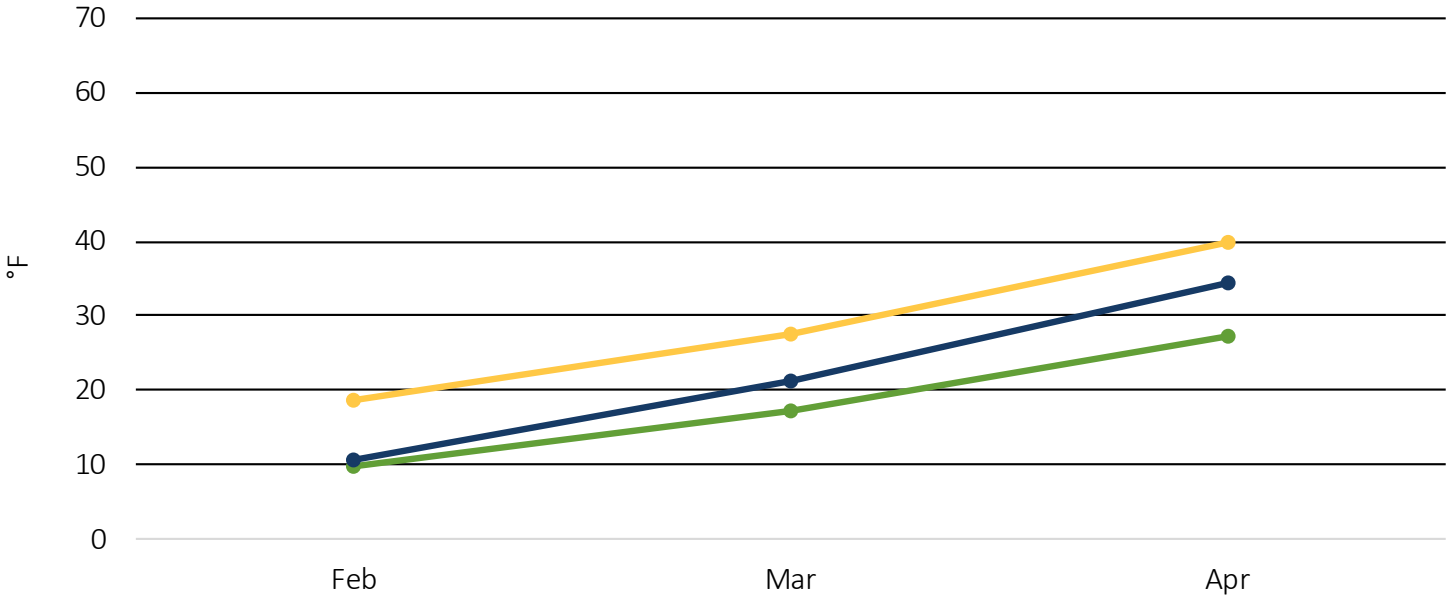


	February	March	April
Historical: 1981- 2010	29.7	39.9	57.1
Case Study: 2013 ice storm	26.8	33.3	46.5
Projected: 2050- 2074	36.4	46.0	62.3



## Minimum Temperature

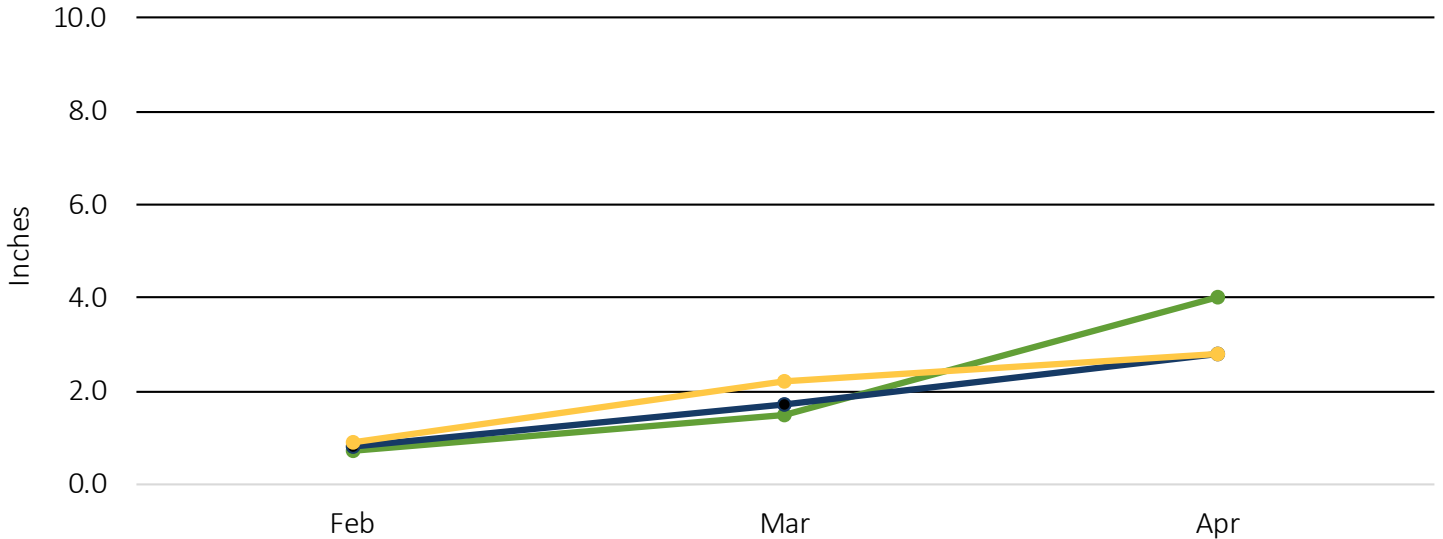
Trend comparison to 2013 ice storm data



	February	March	April
Historical: 1981- 2010	10.7	21.1	34.3
Case Study: 2013 ice storm	9.9	17.2	27.4
Projected: 2050- 2074	18.6	27.6	39.8

## Total Precipitation

Trend comparison to 2013 ice storm data



	February	March	April
Historical: 1981- 2010	0.8	1.7	2.8
Case Study: 2013 ice storm	0.7	1.5	4.0
Projected: 2050- 2074	0.9	2.2	2.8

# SUMMARY

**CLIMATE DATA EXPERTS** expect that future climate conditions across the Midwest will continue to change and affect our environment, economy, and public health. Such conditions are projected to lead to a higher frequency of late growing season drought conditions, elevated winter temperatures with reduced snowpack, prolonged high heat days, and extreme rainfall events. Climate experts also anticipate an increased frequency of severe storms, including heavy ice and snowstorms, like the April 2013 event. Yet, researchers are still working to understand the relationships between climate change and these diverse types of hazardous weather. A fair amount of uncertainty exists as to when, where, why, and how these storms will arise. Currently there is no straight-forward answer to the question, “Will Minnesota experience more extreme snow and ice storms in the future?” Although warmer and shorter winters will lead to more liquid-precipitation events, it is also probable that those same conditions will convert some systems that historically would have been snowstorms into ice storms. Additionally, the higher terrain of the Buffalo Ridge will always make freezing rain somewhat more likely than more topographically-even parts of the state, so the odds of additional ice storms in the future are naturally higher than in most other parts of Minnesota.

This is an area where the available climate projection data alone may not be enough to provide a clear picture of future weather events for planning efforts. In fact, a review of the data in the graphs above suggest that Region 5 counties may experience fewer extreme cold-related weather events since temperatures are increasing well above those associated with the 2013 ice storm. Thus, it is important to track climate research and expert consensus on future climate trends in order to critically assess and apply projection data.

**CLIMATE DATA IS A CRITICAL TOOL** in planning for resilient communities into the future. Assessing threats from climate change and planning effective mitigation and response strategies is a key element for emergency managers and other planners to reduce future risk. It is crucial to understand the potential impacts of climate change and the associated priorities and vulnerabilities of communities, including population, the environment, critical infrastructure, and more. However, vulnerability is a nuanced concept and most effective as an indicator of risk when planners seek to understand and address vulnerability as close to the individual level as possible and in association with a specific hazard.

*Climate data is a critical tool in planning for resilient communities into the future.*

Population projections for HSEM Region 5 show a decrease in children but an increase in elders. As older populations tend to have a greater need for health care services, disrupted access due to ice covered roads or power outages is a major concern. Additionally, older individuals are more susceptible to slips, falls, and injuries and have a longer recovery period. Considering the impacts of climate change to vulnerable populations is just one example of how to prioritize mitigation and response planning.

**CLIMATE PROJECTION DATA** continues to improve and should be considered as a priority to advance for Minnesota. Currently, global climate models that produce climate projection data for the Midwest are more accurate at simulating future temperature changes than they are for precipitation. However, the accuracy and resolution of these models are advancing rapidly as are their ability to model the future prevalence in short-duration, high-intensity localized heavy rainfall events.

Minnesota would benefit from a statewide high-quality climate projection dataset that is derived using the climate and environment features unique to our state, similar to datasets developed for other states. Meanwhile, data from national resources, like the U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA), can still provide a powerful input to regional scenario-planning efforts by allowing planners, managers, and analysts a means of “unpacking” general climate change predictions for the Midwest by looking at potential monthly fluctuations in coarse precipitation and temperature measures for Minnesota and its counties.

## NEXT STEPS: MINIMIZE RISK & BUILD RESILIENCE

Prepare today for tomorrow's climate hazards. Emergency managers, planners, elected officials, and the public play a critical role in creating safe and healthy communities, especially in the face of extreme weather events. There are steps you can take to minimize local risk and build more resilient communities:



**BRING EVERYONE TO THE TABLE:** Build an inclusive yet nimble team to collectively identify climate hazards and potential impacts. Be sure to include members of the community; local department professionals responsible for built, natural, and health resources; planning commissioners; faith-based and cultural organizations; research centers; and commercial organizations. Including diverse perspectives throughout your process will help support more equitable planning efforts that best leverage cross-functional resources.



**INCORPORATE CLIMATE INTO PLANNING:** Incorporate climate projection data into planning efforts, such as exercise scenarios and long-range planning, to comprehensively identify future climate hazards and potential cascading effects. Explore how these interact with non-climate hazards in the community, such as aging infrastructure, to understand potential exposure to multiple threats and prioritize actions that build the community's capacity to respond.



**CHAMPION CLIMATE & HEALTH:** Be a champion for climate and health data. Seek opportunities to learn about these data and incorporate it in your work on an iterative basis. Support its application in professional networks and articulate the need to fund dynamically downscaled climate projection datasets for Minnesota. Climate data is a critical multi-discipline tool in proactively planning for resilient communities.

## RESOURCES & REFERENCES

### TOOLS & DATA

- [Climate at a Glance: National Climatic Data Center](http://www.ncdc.noaa.gov/cag/), National Oceanic and Atmospheric Administration  
Source for all historical and much of the case study data presented in this profile.  
[www.ncdc.noaa.gov/cag/](http://www.ncdc.noaa.gov/cag/)
- [Minnesota Climate and Health Profile Report \(PDF\)](http://www.health.state.mn.us/divs/climatechange/docs/mnprofile2015.pdf), Minnesota Department of Health  
Profiles historic climate trends, future projections, and likely climate change impacts on the health of Minnesotans.  
<http://www.health.state.mn.us/divs/climatechange/docs/mnprofile2015.pdf>
- [Minnesota Climate Change Vulnerability Assessment \(PDF\)](http://www.health.state.mn.us/divs/climatechange/docs/mnclimvulnreport.pdf), Minnesota Department of Health  
Assesses five climate hazards and the populations that are most vulnerable to the hazards in Minnesota.  
<http://www.health.state.mn.us/divs/climatechange/docs/mnclimvulnreport.pdf>
- [Minnesota Population Projection Data](https://mn.gov/admin/demography/data-by-topic/population-data/our-projections/), Minnesota State Demographic Center  
Source for all population projection data presented in this profile.  
<https://mn.gov/admin/demography/data-by-topic/population-data/our-projections/>
- [National Climate Change Viewer](http://www2.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp), United States Geological Survey  
Source for all climate projection data presented in this profile.  
[www2.usgs.gov/climate\\_landuse/clu\\_rd/nccv/viewer.asp](http://www2.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp)

# RESOURCES & REFERENCES

## KNOWLEDGE & CAPACITY

- [Climate Change and Minnesota](#), Minnesota Department of Natural Resources  
Source of information on climate change trends and impacts for Minnesota, with an emphasis on natural resources.  
[https://www.dnr.state.mn.us/climate/climate\\_change\\_info/index.html](https://www.dnr.state.mn.us/climate/climate_change_info/index.html)
- [Five Steps Toward Enhancing Climate Resilience](#), Emily Wasley, DomesticPreparedness.com  
Practical action steps to help emergency managers build a path to enhance their climate resilience.  
<https://www.domesticpreparedness.com/resilience/five-steps-toward-enhancing-climate-resilience/>
- [Snowstorms and Extreme Cold](#), Department of Homeland Security  
Health and safety information aimed at individuals and households on responding to snow, ice, and extreme cold.  
<https://www.ready.gov/winter-weather>
- [U.S. Climate Resilience Toolkit](#), United States Global Change Research Program  
Information and tools to help communities adapt to climate change, featuring real-world case studies.  
<https://toolkit.climate.gov/>
- [Winter Weather](#), Centers for Disease Control and Prevention  
Health and safety information on preparing for and responding to winter weather, including power outages.  
<https://www.cdc.gov/disasters/winter/index.html>

## REFERENCES

- Cohen et al., 2018. [Warm Arctic Episodes Linked with Increased Frequency of Extreme Winter Weather in the United States](#) (PDF). Nature Communications.  
<https://www.nature.com/articles/s41467-018-02992-9.pdf>
- Minnesota Department of Natural Resources, 2013. [Winter Storm: April 9-12, 2013](#).  
[https://www.dnr.state.mn.us/climate/journal/130412\\_winter\\_storm.html](https://www.dnr.state.mn.us/climate/journal/130412_winter_storm.html)
- Minnesota Department of Public Safety, 2013. [2013 Spring Ice Storm in Southwest Minnesota](#) (PDF).  
<https://www.ready.gov/winter-weather>



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Front cover photo: Residential street during 2013 ice storm (Toronto Hydro Corporation, 2013)

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