Minnesota's Changing Water Future

Research, Insights and Opportunities

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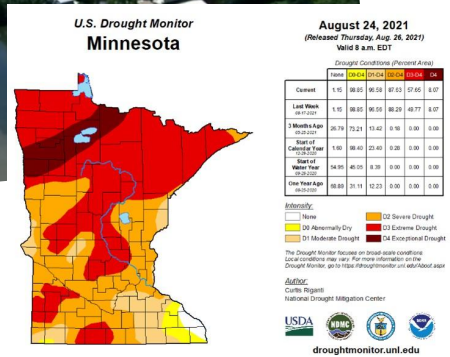
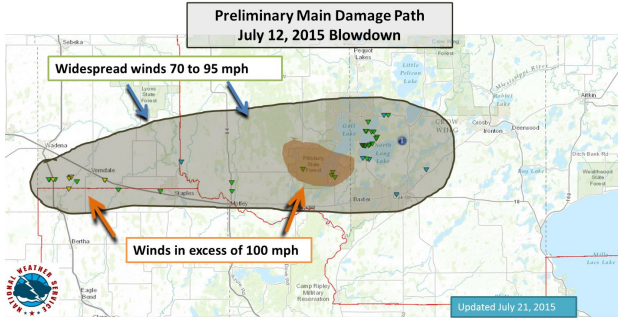
Photos: UMN Extension & H. Roop

Growing Risks. Expanding Needs.





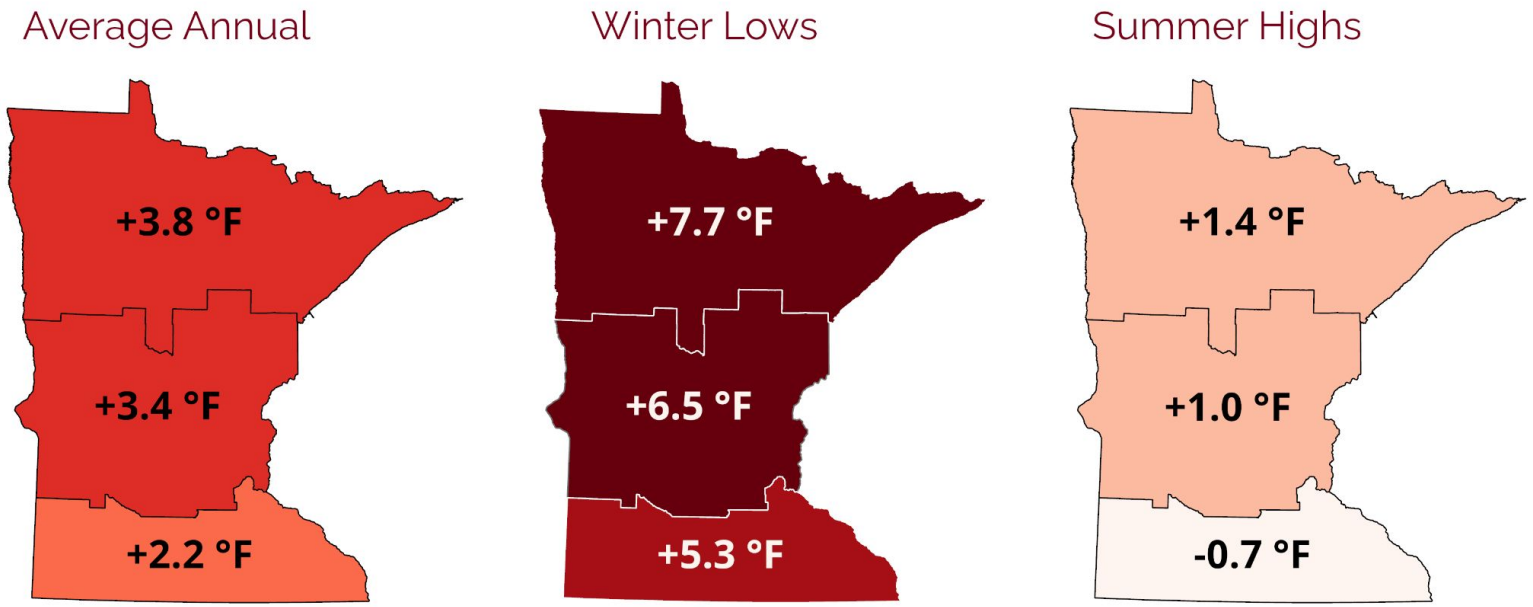
Observed Changes in Precipitation

Heavy rains are now more common in Minnesota and more intense than at any time on record. We have documented increases in 1-inch rains, 3-inch rains, and the size of the heaviest rainfall of the year. Since 2000, Minnesota has seen a significant uptick in devastating, large-area extreme rainstorms.

Photo UMN Extension

Source: MN DNR, 2025

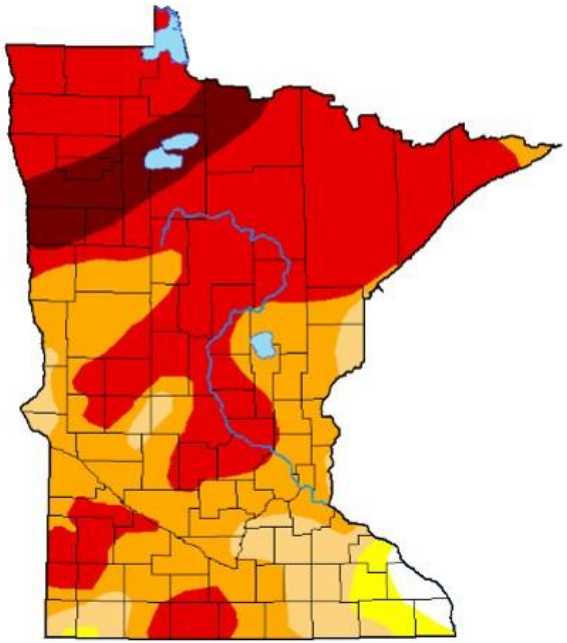
Observed Temperature Change in Minnesota (1895-2024)



Average annual temperature has increased by 3.2°F

Data: UMN CAP & MN DNR, 2024

2021 Drought



August 24, 2021
(Released Thursday, Aug. 26, 2021)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	1.15	98.85	96.58	87.63	57.65	8.07
Last Week 08-17-2021	1.15	98.85	96.56	88.29	49.77	8.07
3 Months Ago 05-25-2021	26.79	73.21	13.42	0.18	0.00	0.00
Start of Calendar Year 12-29-2020	1.60	98.40	23.40	0.28	0.00	0.00
Start of Water Year 09-29-2020	54.95	45.05	8.39	0.00	0.00	0.00
One Year Ago 08-25-2020	68.89	31.11	12.23	0.00	0.00	0.00

Intensity:
None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:
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National Drought Mitigation Center

USDA NDMC

droughtmonitor.unl.edu

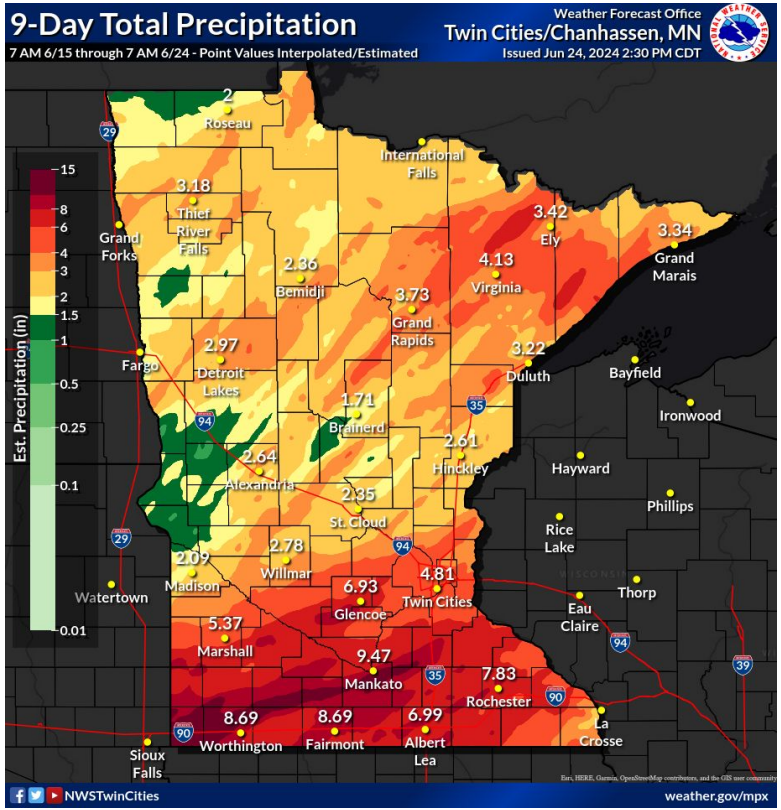

Photo: Eric Hylden/Grand Forks Herald

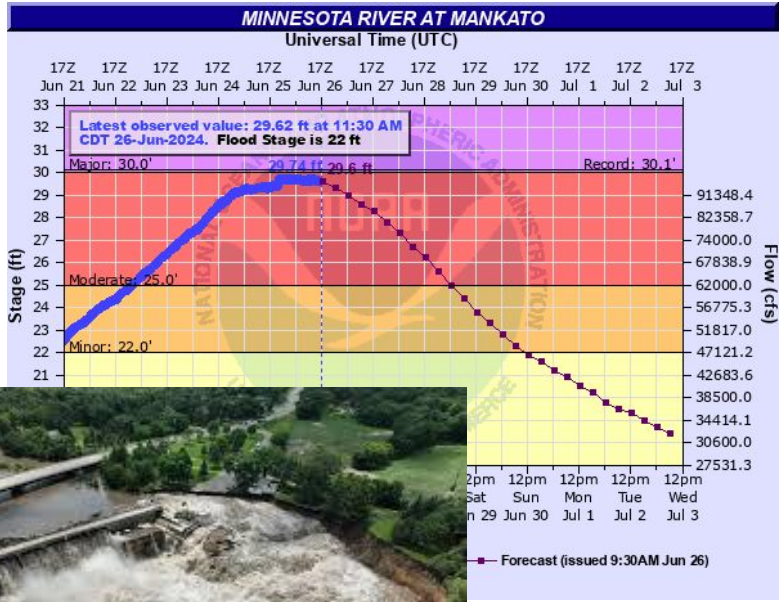
July 2021 was the driest on record for the northern Red River Valley

Estimated costs of billion-dollar drought events to affect Minnesota from 1980 to 2024 (CPI-Adjusted): $10-20 Billion

NOAA, 2025

2024 June Floods





Rapidan Dam, flooding on the Blue Earth River, June 2024; Blue Earth County

CPI-Adjusted Estimated Cost: $1.1 billion (total flood events 1980-2024: $5-10 billion)

NOAA, 2025

Across the Midwest,

transitions from wet to dry extremes

are happening **more quickly** and

more frequently.

Photos: UMN Extension; Data: www.drought.gov

Impacts Extend Beyond Our State Border

"Nearly all of the Mississippi River basin has seen below-normal rainfall since late August…**The timing is bad because barges are busy carrying recently harvested corn and soybeans up and down the river.**"

- Associated Press, October 6th, 2022

Weather and climate extremes are causing economic and societal impacts across national and state boundaries through **supply-chains, markets, and natural resource flows.**

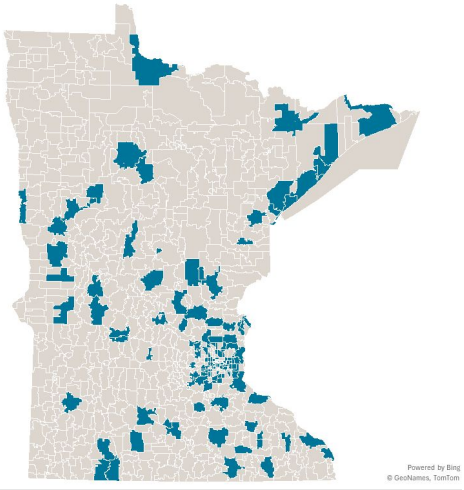
IPCC, 2022, Photo: AP, Thomas Berner

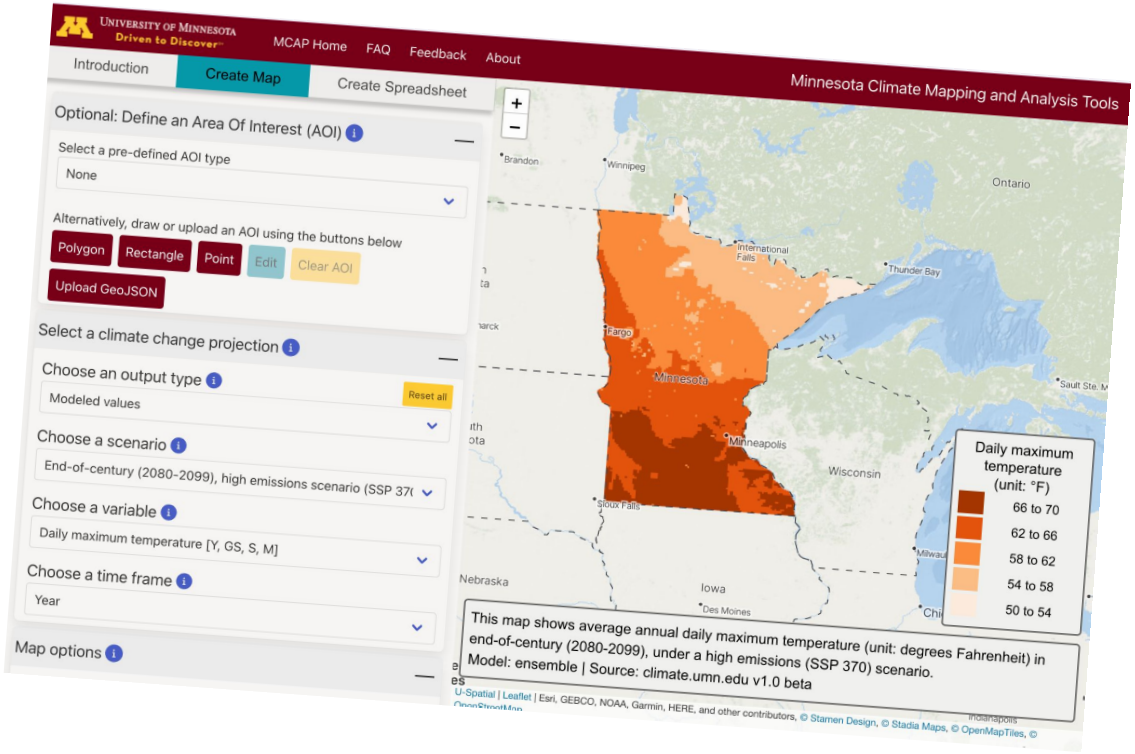
The rearview mirror is no longer sufficient to plan & prepare.

Minnesota's Localized Climate Projections

MN Climate Mapping and Analysis Tools - 2.5-mile scale projections out to 2100

MN CliMAT Users by Zip Code

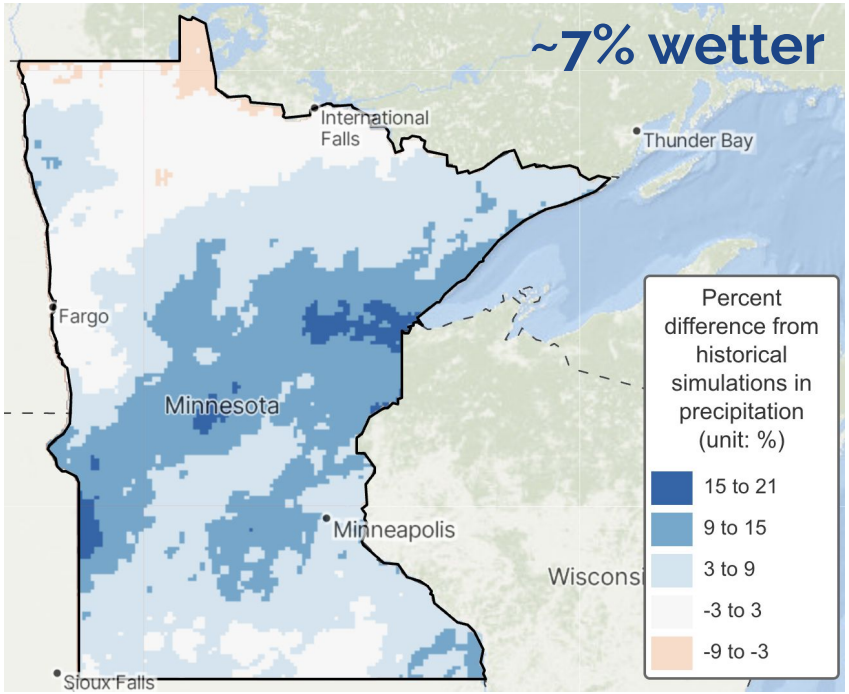




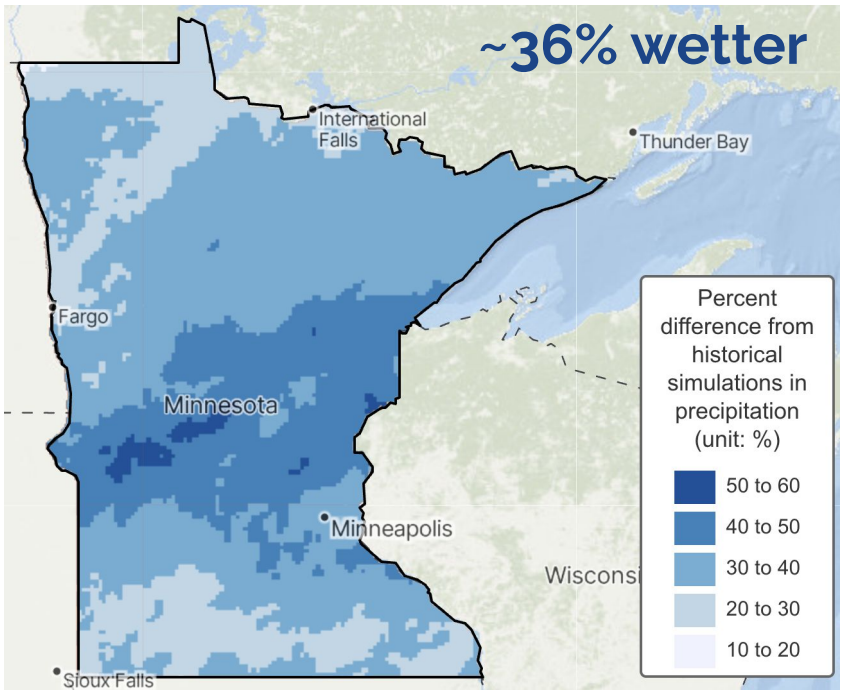
app.climate.umn.edu

Average percent change in spring precipitation

Mid-century (2040-2059)



End-of-century (2080-2099)

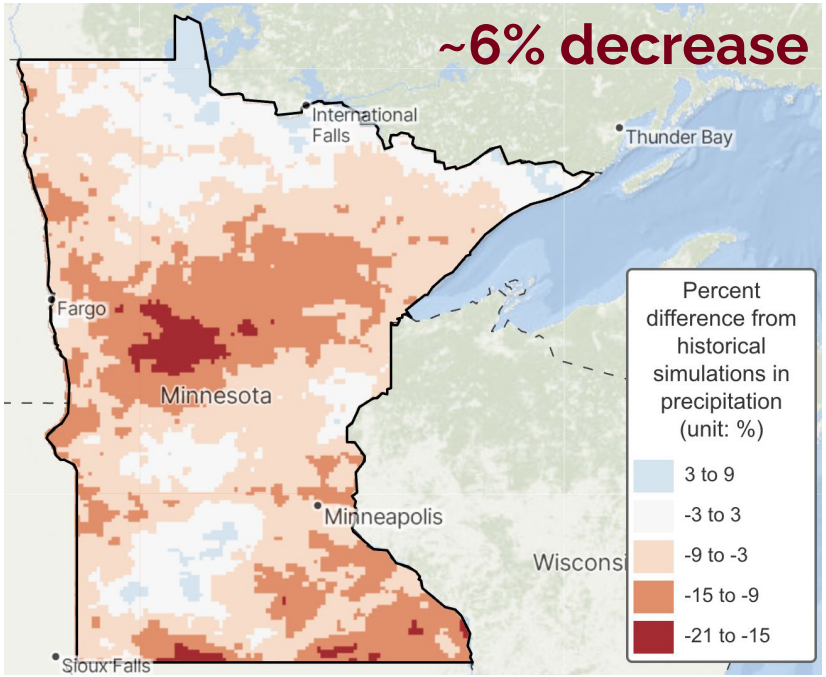


very high emissions (SSP585); relative to 1995-2014

Data: UMN Climate Adaptation Partnership, 2025

Average percent change in summer precipitation

Mid-century (2040-2059)



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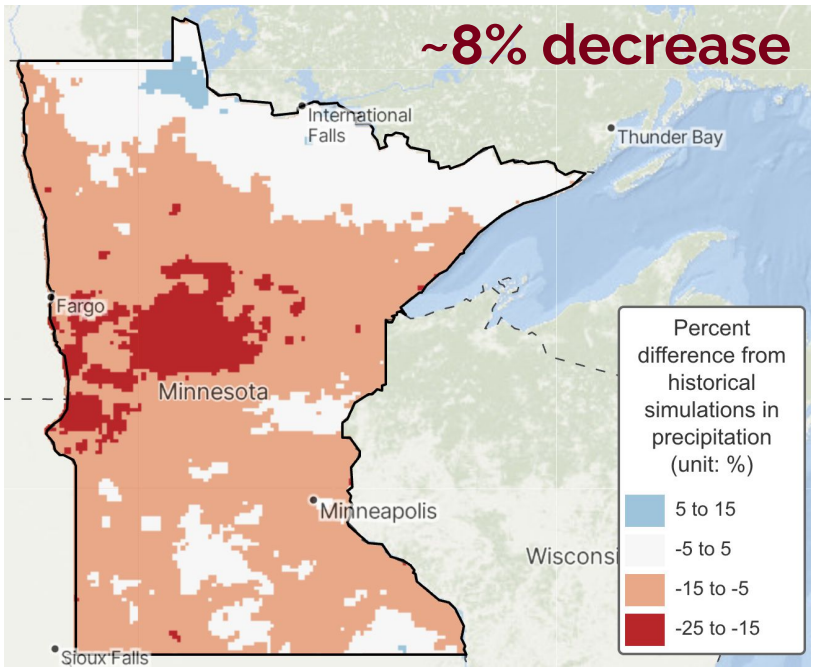

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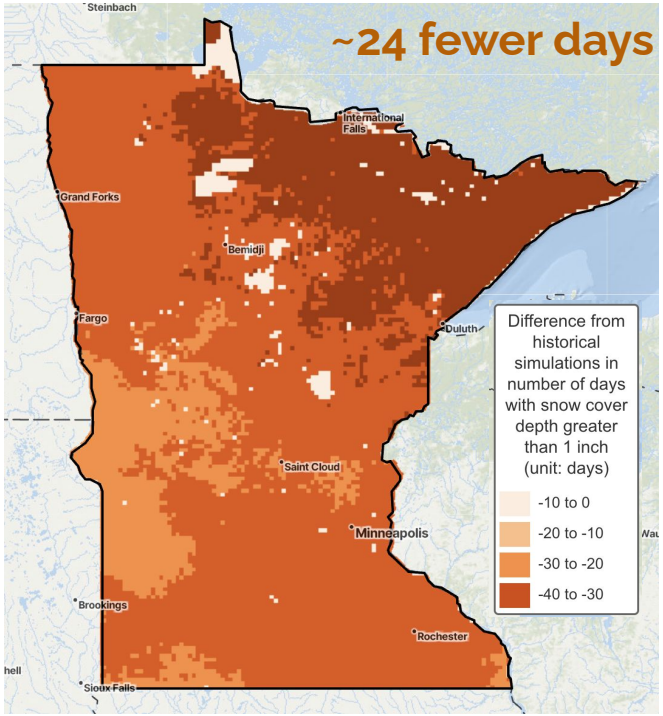
Data: UMN Climate Adaptation Partnership, 2025

Changing Winters - Days with snow cover exceeding 1 inch

Mid-century (2040-2059)



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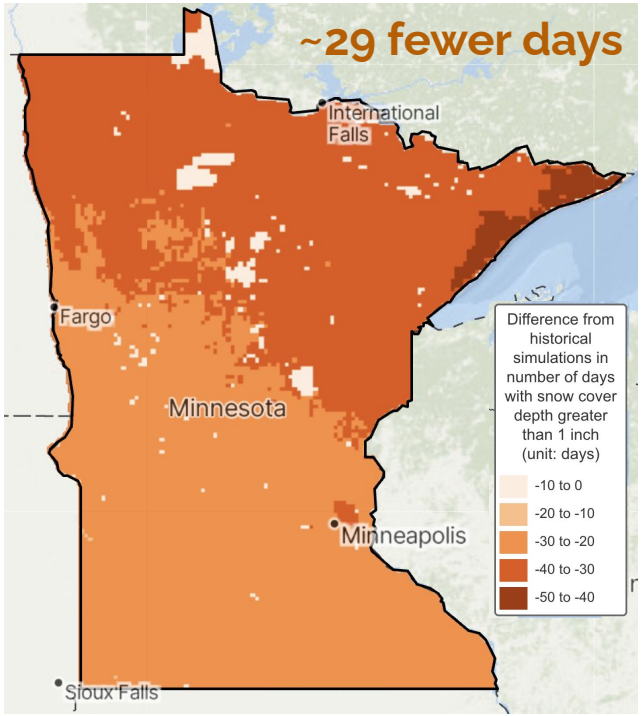
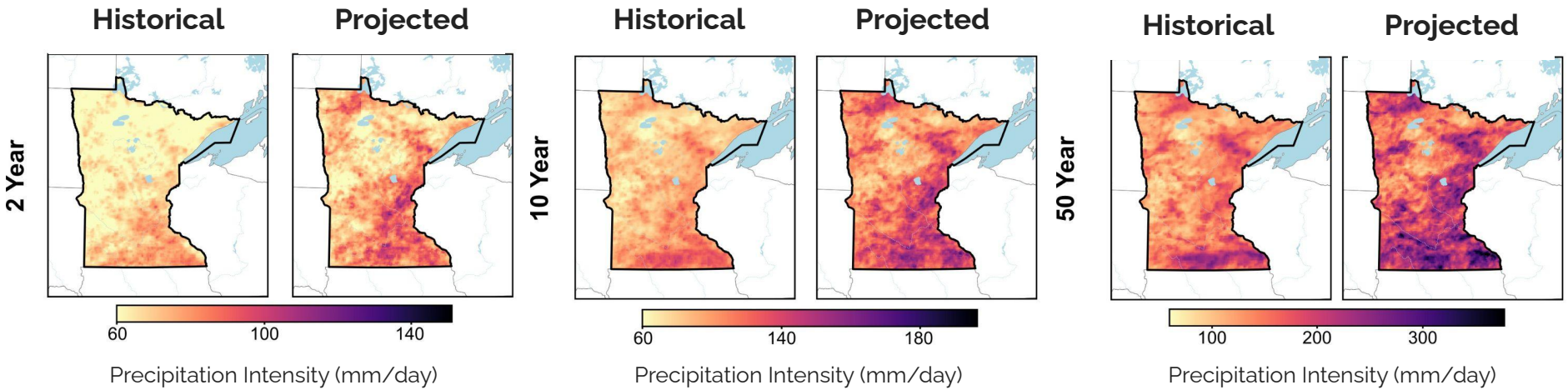


high emissions (SSP370); relative to 1995-2014

Data: UMN Climate Adaptation Partnership, 2025

Estimating Future Precipitation Extremes for Stormwater Management & Infrastructure Design

Intensity, duration and frequency maps for 2-, 10-, and 50-year 1-day duration events

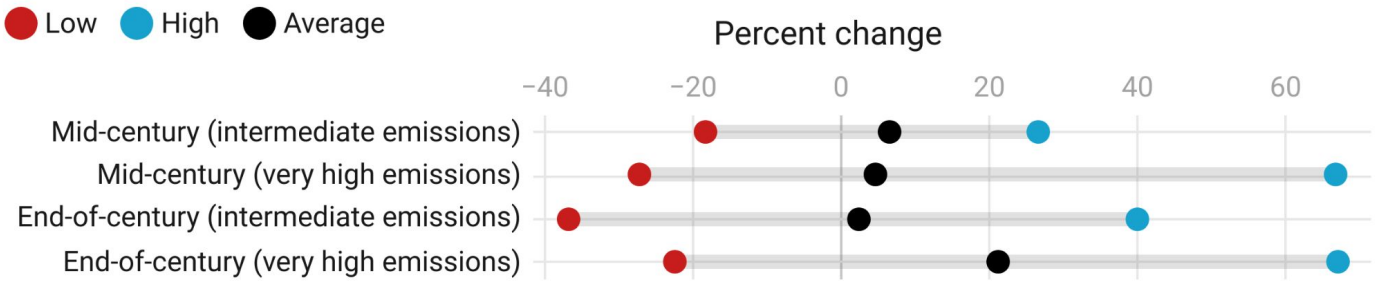


Projected end-of-century values based on SSP 3-7.0 scenario.

Preliminary Data. Subject to Change

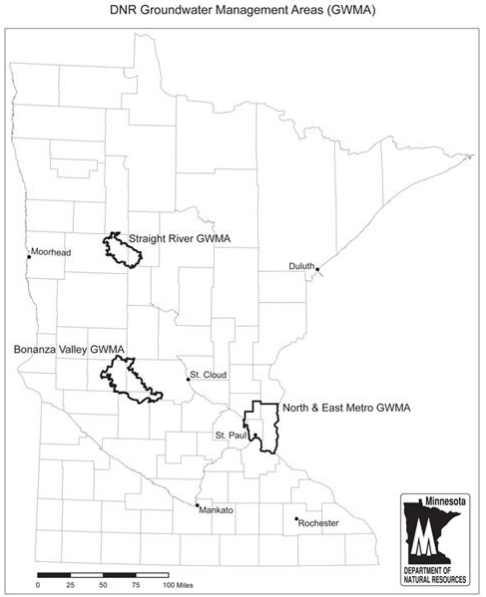
Future Recharge in Minnesota's Groundwater Management Areas

Projected future changes in net infiltration, a precursor of groundwater recharge, averaged across Minnesota DNR's three Groundwater Management Areas.



Historical period is 1995-2014, mid-century is 2040-2059, and end-of-century is 2080-2099. Intermediate emissions scenarios is SSP2-4.5 and very high emissions scenario is SSP5-8.5. Minnesota DNR's three groundwater management areas are Bonanza Valley, Straight River, and the North and East Metro.

Source: University of Minnesota Climate Adaptation Partnership and USGS • Created with Datawrapper



Groundwater recharge in some of our key agricultural regions is expected to shift toward the extremes to **much higher** *and* **much lower**.
Areas of stressed groundwater are anticipated to be even more stressed.

Preliminary Data. Subject to Change

Navigating Shifting Risks & Baselines

- Warming has shifted the baseline against which we manage Minnesota's hazards and risks – from climatic to economic.
- Many Minnesotans are already bearing the costs of our shifting weather & climate risks.
- Policy & governance conditions – across scales of governance - are a key driver of future risk management decisions.
- A proactive stance in policy & regulation will limit inequities and impacts across communities & economic sectors.

We must reduce risks through adaptation.

Adaptation can bring multiple benefits:
improved agricultural productivity, innovation, health, food security, livelihood, biodiversity conservation, and reduction of risks & damages.

Long-term planning and accelerated implementation, particularly in the next decade, is important to close adaptation gaps.

IPCC, 2022

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