



Energy Infrastructure Siting - Evaluating Climate Change in Environmental Review

Louise Miltich | Energy Environmental Review and Analysis Director

- Brief overview of energy infrastructure environmental review program
- Case study
- Next steps

Energy Infrastructure Environmental Review/Siting



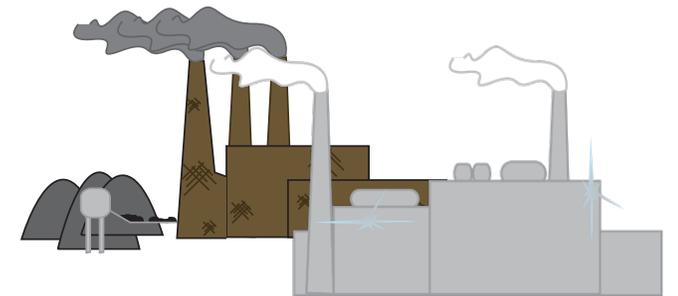
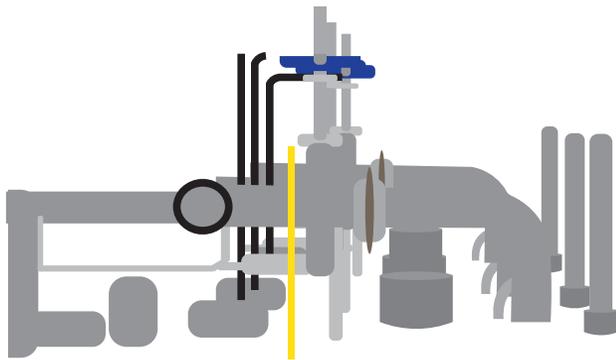
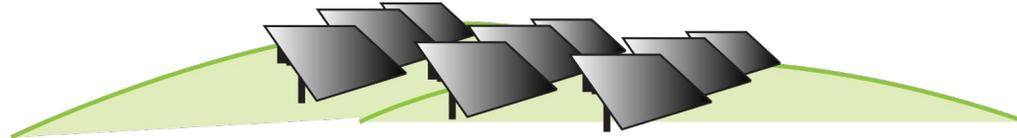
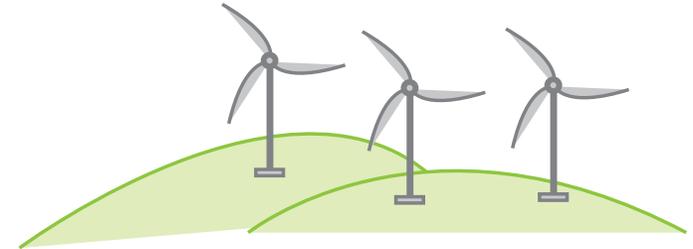
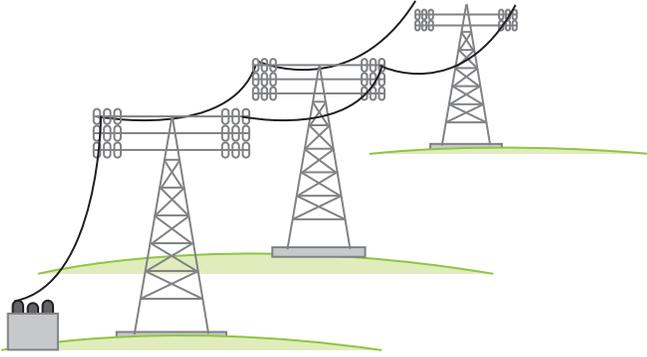
- Environmental Review
- Agency Coordination
- Compliance



- RGU (facilities environmental review)
- Permitting Authority (sites/routes)

“Downstream” Permitting Agencies

Energy Infrastructure Environmental Review/Siting



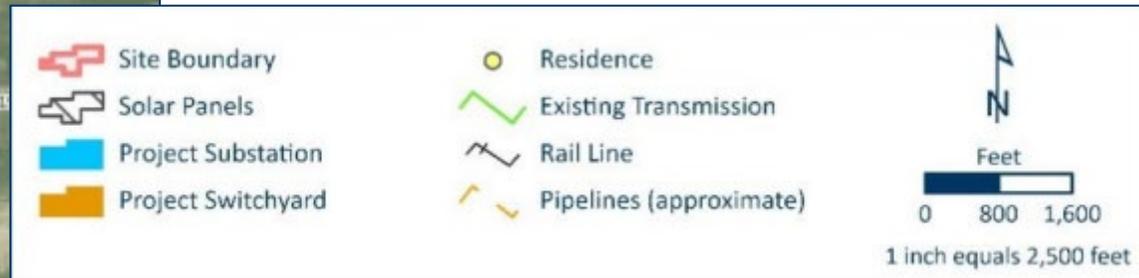
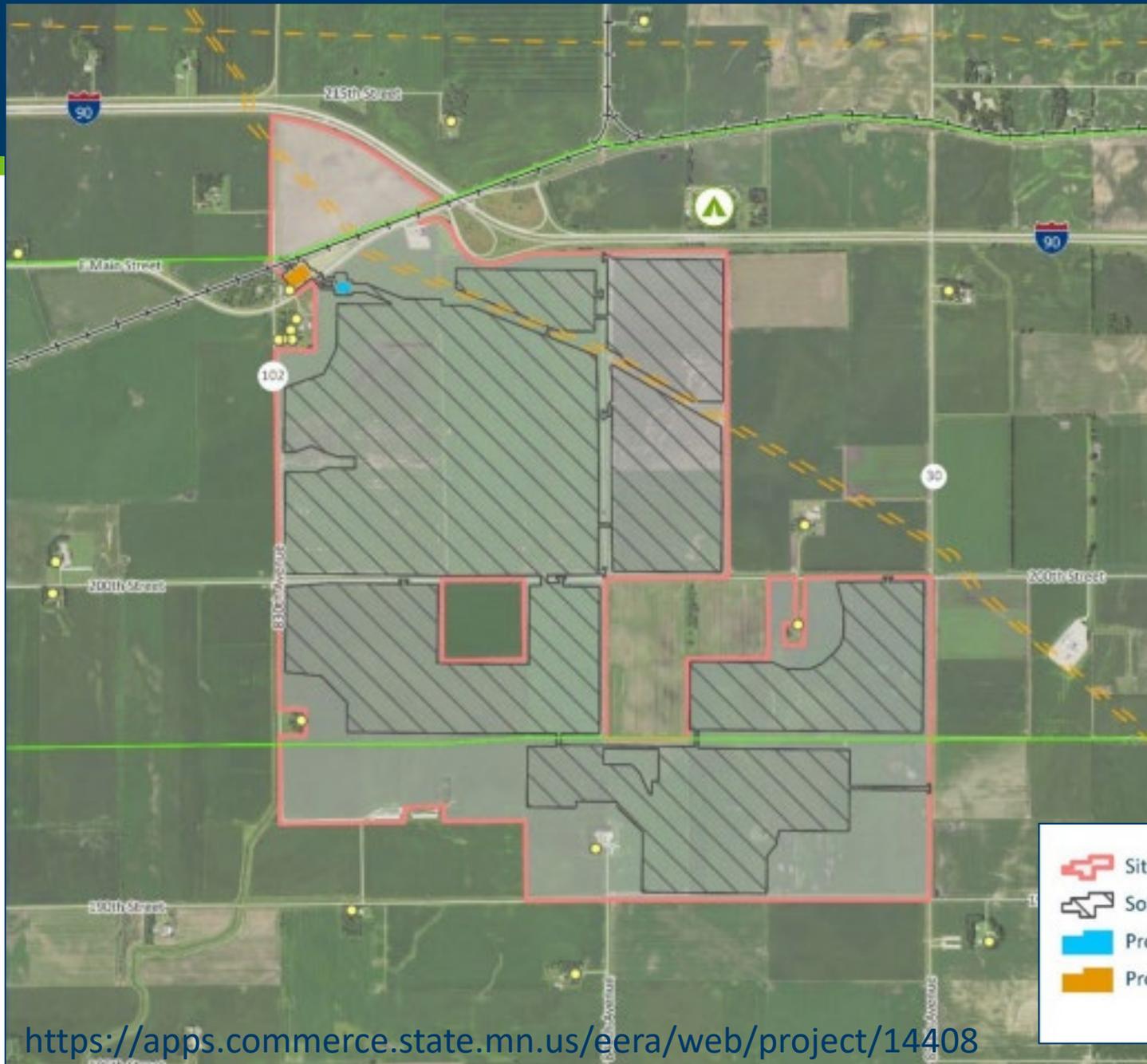
Energy Infrastructure Environmental Review/Siting

- Environmental Assessment (EA)
- Environmental Impact Statements
- Site permit
 - Construction
 - Operation

What does GHG and climate information do for us?

- GHG emissions information
 - Comparison of technologies and techniques
 - Costs to ratepayers
- Climate information
 - Better permit conditions
 - Improved planning

150 MW Hayward Solar Project



150 MW Hayward Solar Project



5/25/2022

mn.gov/commerce

Climate questions

- Frequency and intensity of rainfall events?
- Frequency and severity of damaging storm events?
- Frequency and severity of heat wave events?
- Frequency and severity of drought events?



- Construction
 - Construction stormwater management
 - Soil handling/erosion control
 - Construction timing
 - Dust suppression

- Operation
 - Stormwater management (evaluation of onsite stormwater retention)
 - Electricity Production
 - Damage to panels
 - Vegetation establishment

How does this evaluation translate?

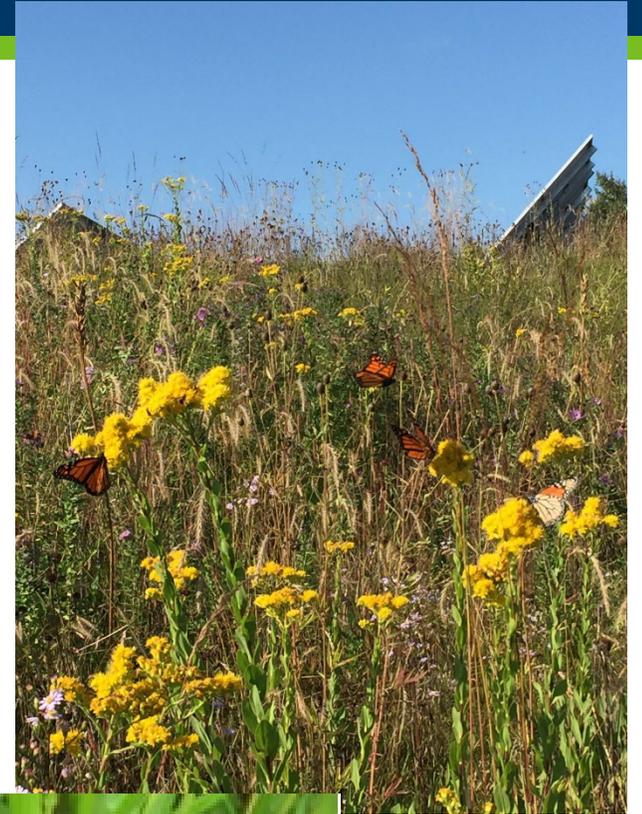
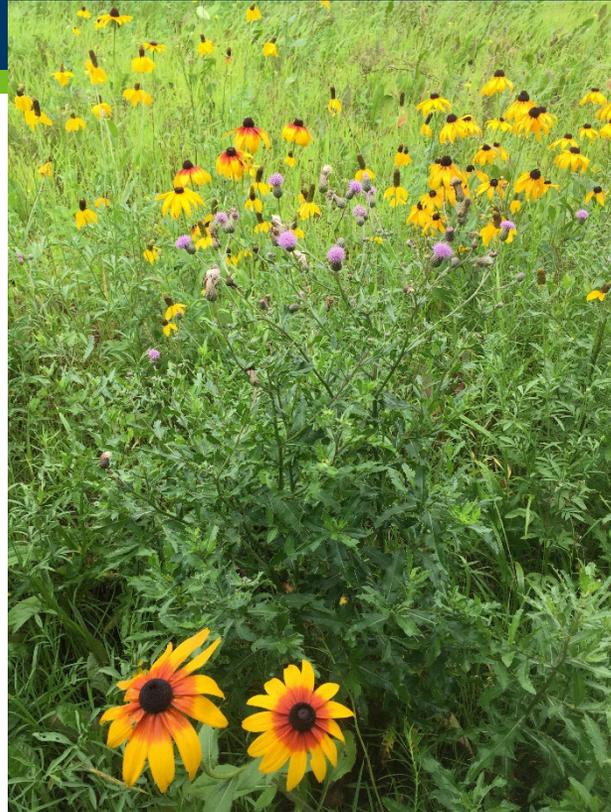
Permit Language

4.3.8 Beneficial Habitat The Permittee shall implement site restoration and management practices that provide for native perennial vegetation and foraging habitat beneficial to gamebirds, songbirds, and pollinators; improving soil water retention and reducing storm water runoff and erosion. **The Permittee shall develop a vegetation management plan using best management practices established by the Minnesota DNR and the Minnesota Board of Soil and Water Resources.**

How can this evaluation affect the outcome?



How can this evaluation affect the outcome?



- Expand understanding of:
 - Climate parameters
 - Impacts on each resource area
 - Solutions
- High Voltage Transmission Line Projects
- Pipeline Projects

Thank you!

Contact:

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651-539-1853

Resources:

[Hayward solar EERA project webpage](#)

[Hayward solar EA](#)

[Guidance for Developing Vegetation Establishment and Management Plans for Solar Facilities](#)



Basic Tools for Climate Adaptation and Planning in Minnesota

Kenny Blumenfeld | Sr. Climatologist, Minnesota DNR

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651-296-4214

Snapshot of observed and projected climatic changes

Climate changes observed and projected in Minnesota

Climate Parameter	Observations (through 2010s)	Projections (2041-2070)
Winter temperatures	Increasing rapidly, loss of cold extremes	Continued increases, with narrowing of winter season
Rainfall	Increasing all seasons, more extreme events	Increases likely but timing and seasonality uncertain
Snowfall	Increasing, more extreme events	Seasonal decreases likely, but some extreme event increases possible
Heat waves & extreme heat	No trend but season expanding	Increases expected by 2050, if not sooner
Drought	Decreasing frequency, duration & coverage; <u>Severity</u> comparable to historical ranges	Increases possible: frequency, duration & coverage Increases likely: <u>severity</u> , even if drought becomes less common; longer dry spells and more “flash drought” possible
Tornadoes, hail, t-storm winds	Trends unclear but season expanding	Projections unclear; seasonal expansion will continue

- Highlight some of the highest-quality, most relevant tools for climate adaptation planning in MN

This presentation specifically:

- Tools and resources for understanding Minnesota's climate at multiple temporal (time) and geographical scales, past, present, and future

Before beginning

- The following tools can be used to augment presentations, planning documents, case-studies etc.
- Tools can be used as-is, or data can be extracted and used in other programs
- Data quality varies from station to station
- Contact the State Climatology Office with any questions you may have
 - 651-296-4214
 - kenneth.blumenfeld@state.mn.us
 - climate.dnr@state.mn.us

Identify a climate question relevant to your area or work

Examples:

- Has it become wetter or drier recently in my area?
→ And what time scale matters most?
- Is the May-September growing season getting warmer or cooler?
- How does this year's precipitation to date compare with a "normal" year? How about a record year?
- What proportion of recent months have been warm, cold, wet, or dry (compared to normal)?
- What would "normal" temperatures and precipitation look like for June through August?
- How many below zero lows did we have last winter?

Other important questions

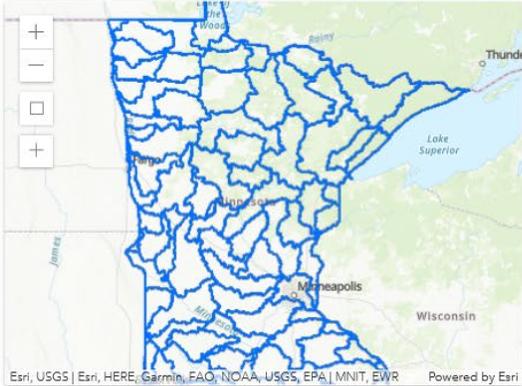
1. What *can't* these tools and data do?
2. What do I wish they did?
3. What other information will help answer the questions I have?

Climate Explorer: Historical Climate and Projections for Minnesota

<https://arcgis.dnr.state.mn.us/ewr/climateexplorer/main/historical>

m Minnesota Climate Explorer ¹
DNR Analyze Minnesota's historical or projected future climate. FAQ
Questions? climate.dnr@state.mn.us

HISTORICAL **PROJECTED (FUTURE)**



Esri, USGS | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA | MNIT, EWR Powered by Esri

AREA

Select a geographic unit: ¹

Major Watersheds ▾

Select area(s):

If selecting multiple areas, they must be adjacent.

Select ▾

Selected areas

DATA OPTIONS

Select a climate variable: ¹

Average Temperature ▾

Select a time frame: ¹

Time scale (avg): 1-Month ▾

Month ending: January ▾

Data start year: 1895 ▾

Data end year: 2021 ▾

PLOT DATA **CLEAR DATA OPTIONS**

ADDITIONAL OPTIONS (optional)

Compare to these years: ¹

Start: 1895 ▾

End: 2021 ▾

Show trend for these years: ¹

Start: 1895 ▾

End: 2021 ▾

Show smoothed time series ¹

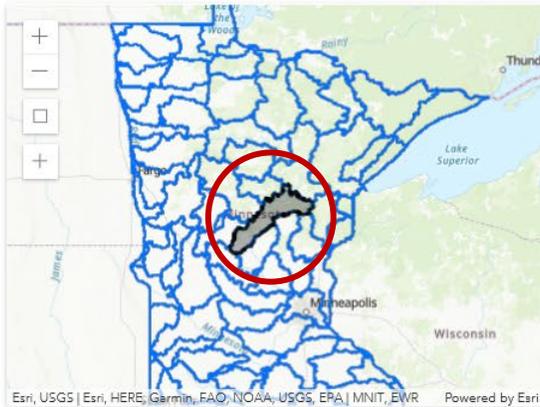
Climate Explorer: Historical Climate and Projections for Minnesota

- Graph and analyze past and projected future climate information at a variety of scales across Minnesota
- Specify a geographic area, climate variable, month(s) to examine, and whether interested in historical climate data, or projected data for the future.
- “HISTORICAL” tab creates a *time series*
 - a single value each year, based on the area, range of months, range of years, and climate variable selected.
- “PROJECTED (FUTURE)” tab graphs the range range and average value from model projections for the middle and end of the 21st century
 - All model values provided by University of Minnesota

Climate Explorer: Historical Climate and Projections for Minnesota

HISTORICAL

PROJECTED (FUTURE)



AREA

Select a geographic unit:

Major Watersheds

Select area(s):

If selecting multiple areas, they must be adjacent.

Mississippi River - Brainerd

Selected areas CLEAR

Mississippi River - Brainerd

DATA OPTIONS

Select a climate variable:

Average Temperature

Select a time frame:

Time scale (avg): 1-Month

Month ending: January

Data start year: 1895

Data end year: 2021

PLOT DATA CLEAR DATA OPTIONS

ADDITIONAL OPTIONS (optional)

Compare to these years:

Start: 1901

End: 2000

Show trend for these years:

Start: 1970

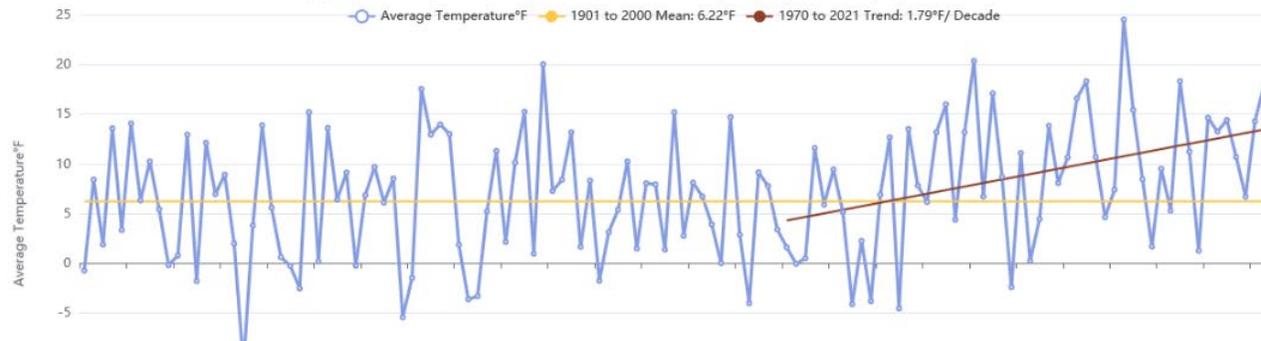
End: 2021

Show smoothed time series:

Metadata

Average Temperature For Mississippi River - Brainerd; January

All graphs generated by Minnesota Department of Natural Resources, using temperature and precipitation data from NOAA.



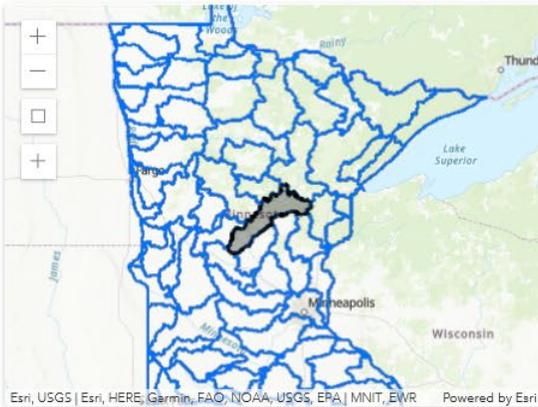
Download Data:

Year	Average Temperature°F	1901 to 2000 Mean: 6.22°F	1970 to 2021 Trend: 1.79°F/Decade
1895	-0.74	6.22	
1896	8.41	6.22	
1897	1.88	6.22	
1898	13.57	6.22	
1899	3.33	6.22	
1900	14.05	6.22	
1901	6.32	6.22	
1902	10.23	6.22	

Climate Explorer: Historical Climate and Projections for Minnesota

HISTORICAL

PROJECTED (FUTURE)



AREA

Select a geographic unit:

Major Watersheds

Select area(s):

If selecting multiple areas, they must be adjacent.

Mississippi River - Brainerd

Selected areas CLEAR

Mississippi River - Brainerd

DATA OPTIONS

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Average Temperature

Select a time frame:

Time scale (avg): 1-Month

Month ending: January

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Data end year: 2021

PLOT DATA CLEAR DATA OPTIONS

ADDITIONAL OPTIONS (optional)

Compare to these years:

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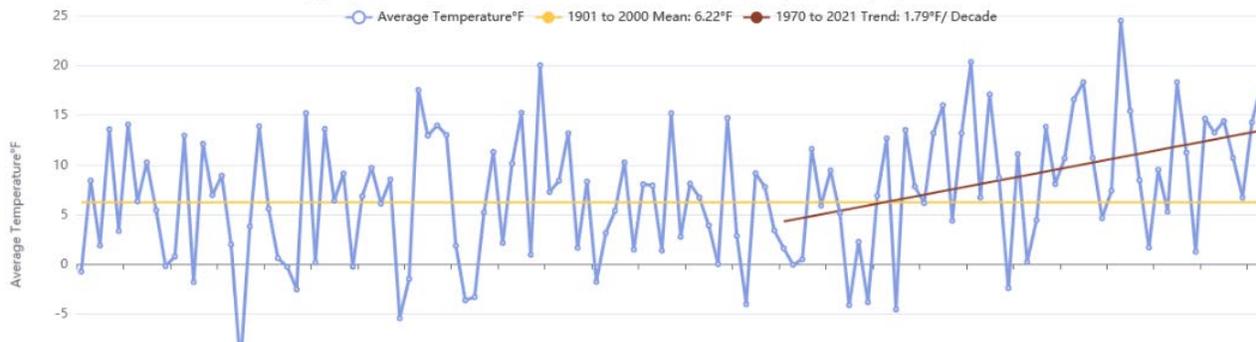
End: 2021

Show smoothed time series:

Metadata

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Download Data:

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Climate Explorer: Historical Climate and Projections for Minnesota

Esri, USGS | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA | MNIT, EWR
Powered by Esri

HISTORICAL **PROJECTED (FUTURE)**

Major Watersheds ▾

Average Temperature ▾

Select area(s):

If selecting multiple areas, they must be adjacent.

Mississippi River - Brainerd ▾

Selected areas CLEAR

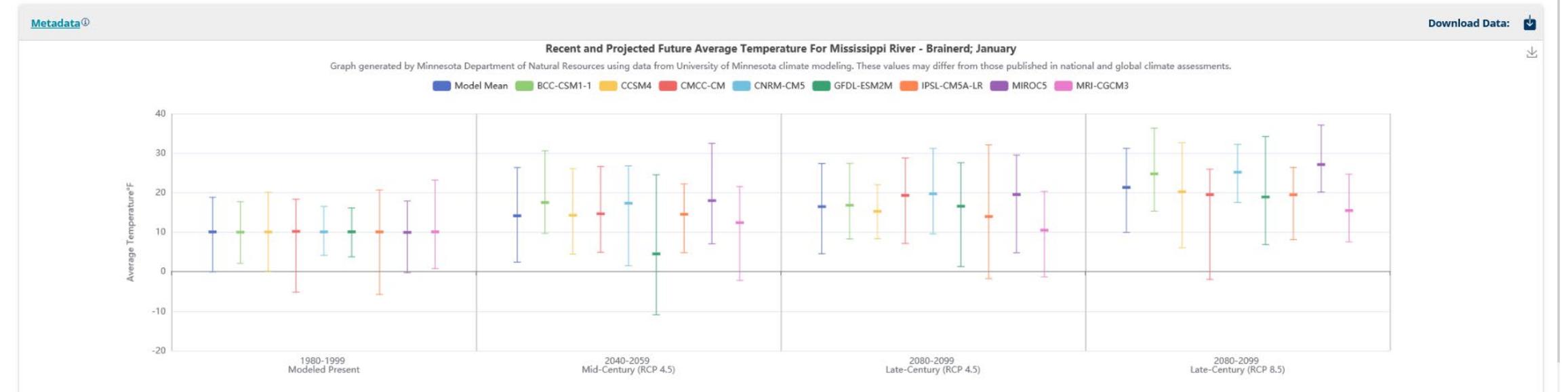
Mississippi River - Brainerd

Portion of year to analyze: ¹

Time scale (avg): 1-Month ▾

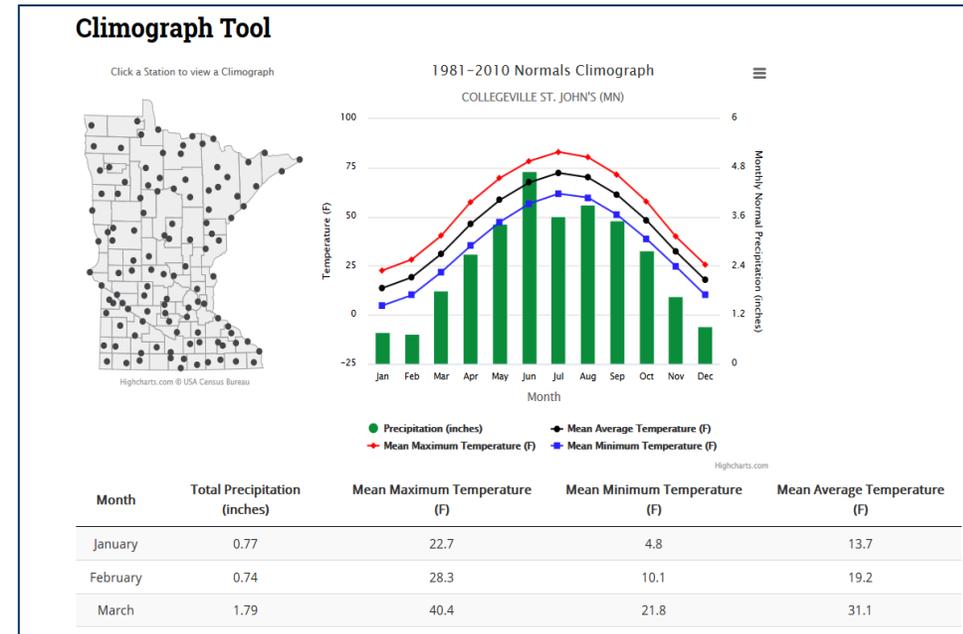
Month ending: January ▾

PLOT DATA CLEAR DATA OPTIONS



Climographs: understanding “normal”

- Graph *normal* temperature and precipitation over the course of a year.
- Normal values calculated from adjusted 1991-2020 averages by the NOAA/ NCEI
- Steps: click location of interest and examine normal monthly climate values



https://www.dnr.state.mn.us/climate/summaries_and_publications/climographs.html

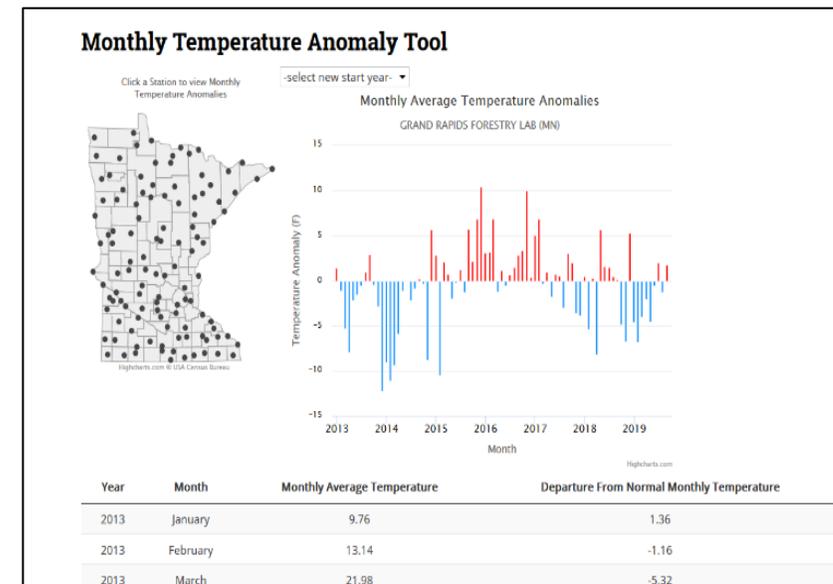
Monthly precipitation or temperature anomalies

- Compares several consecutive years to 1991-2020 averages or “normal.”
- Normal values calculated from adjusted 1991-2020 averages by the NOAA National Center for Environmental Information (formerly NCDC).
- **Some stations better than others!**

https://www.dnr.state.mn.us/climate/climate_monitor/monthly-precipitation-anomaly-tool.html

https://www.dnr.state.mn.us/climate/climate_monitor/mthanomtool.html

→ **Uses:** looking back over multiple years to see predominant wet/dry or warm/cold conditions



Monthly precipitation or temperature anomalies

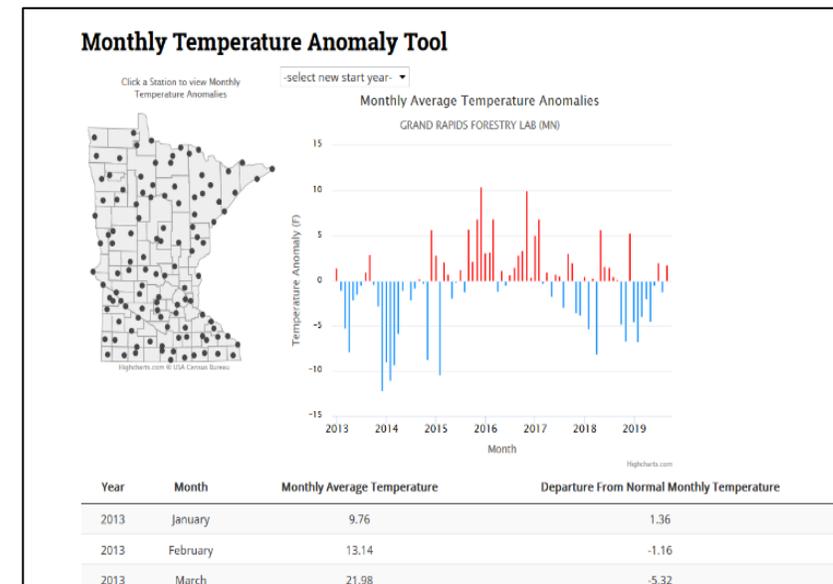
Steps

1. Select a location of interest (data quality will vary)
2. When graph appears, zoom in on portion of graph by clicking and dragging
3. Click “Reset zoom”
4. Change start year (from drop-down box) to different decade and examine differences

→ Hint: for precip, start with 1985 or 1986 and compare with default graph

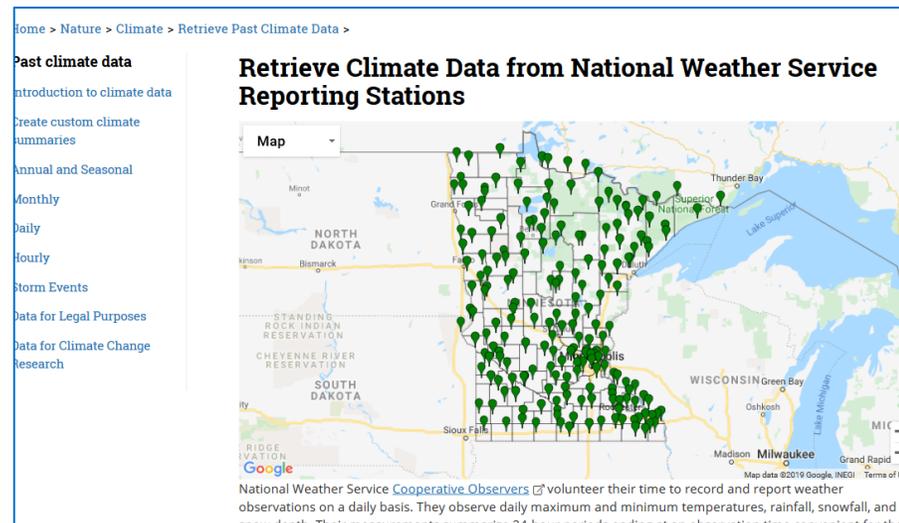
https://www.dnr.state.mn.us/climate/climate_monitor/monthly-precipitation-anomaly-tool.html

https://www.dnr.state.mn.us/climate/climate_monitor/mthanomtool.html



NWS Data Retrieval

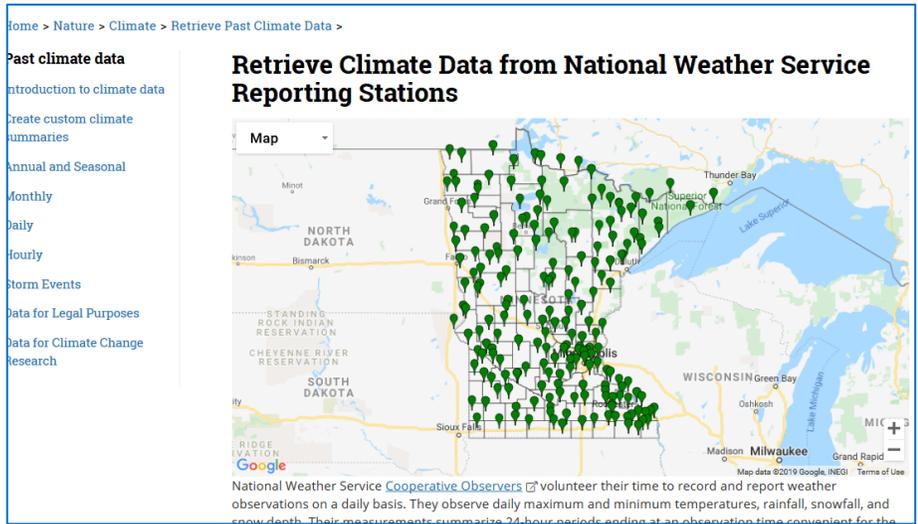
- Daily or monthly-scale Temp and Precip data (including snowfall and snow depth)
- Ideal for deep, location-specific analyses
- Some stations better than others!



https://www.dnr.state.mn.us/climate/historical/acis_stn_meta.html

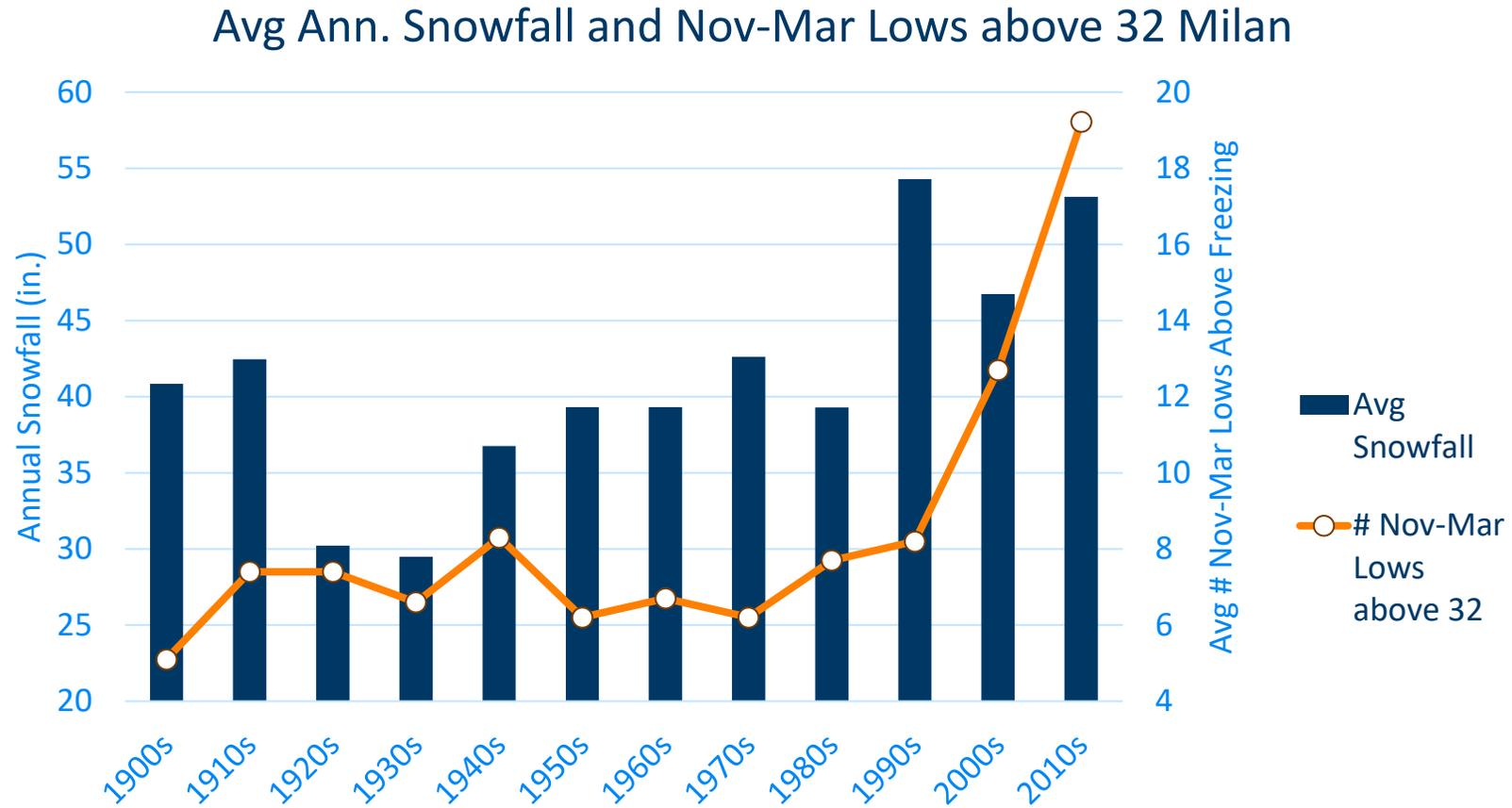
Steps

1. Select a location of interest (data quality will vary)
2. Select Monthly or Daily data
3. Use data to create detailed analyses



https://www.dnr.state.mn.us/climate/historical/acis_stn_meta.html

Combined trends: more snow AND more thaws

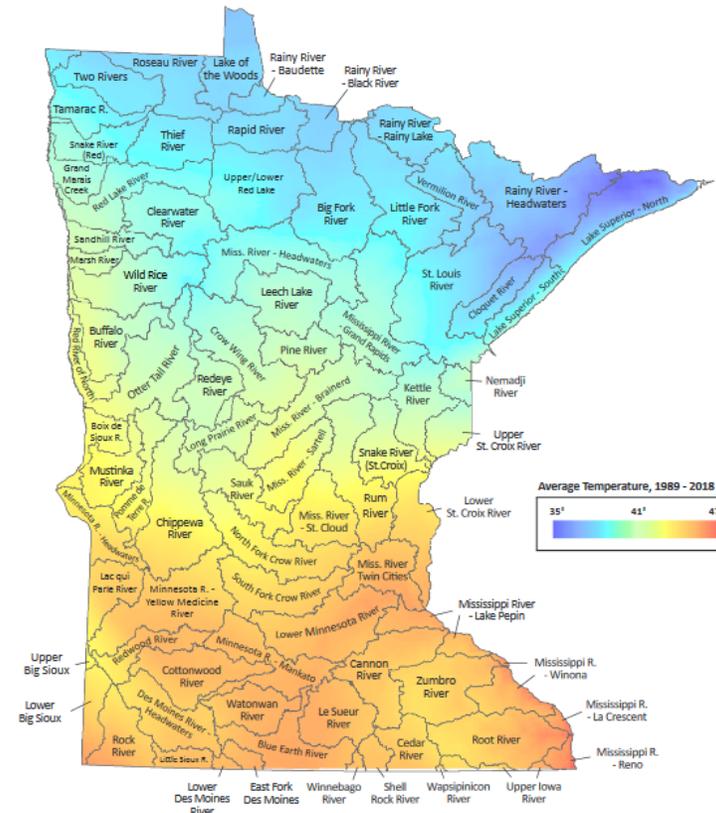


DNR Watershed Climate Summaries

- From DNR Watershed Health Assessment Framework (WHAF) team
- Utilizes same data in Climate Trends Tool
- Comprehensive climate summaries for every major watershed in MN
- Essential for watershed management

Climate Summary: Index Map

Click on the watershed name to open the climate summary.



https://files.dnr.state.mn.us/natural_resources/water/watersheds/tool/watersheds/climate_summary_index_map.pdf

Thank You!

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