Climate Change, Precipitation Trends and Water Quality

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Map - Kate Barrett
Wisconsin Precipitation Trends: 1950-2006
Projected change in annual precipitation

+ 5-15% 1980-2055 (SRES A1B)

It’s likely to become wetter, not drier
Climate risks to water quality

**Temperature**

**Hot**
- Increased water temperature
  - Algal blooms, Habitat loss

**Windy**
- Sediment re-suspension
  - Turbidity

**Dry**
- Low flows and water levels
  - Withdrawal, Bank erosion

**Precipitation**

**Wet**
- High flows and water levels
  - Bank erosion, Contaminants

**Intense**
- More erosion and flooding
  - Soil erosion, Contaminant re-suspension

**Icy**
- Increased salt use
  - Chloride concentrations
Seasonal change in max temperature

1980-2055 (SRES A1B)

Winter +6-7°F

Spring +5-6°F

Summer +4-5°F

Fall +6°F
Increasing surface water temperature:

More frequent algal blooms
Climate Vulnerability

Increasing water temperature:
Higher surface wind speeds

Higher wind speeds:
Increased turbidity

Southern Lake Michigan Turbidity Index 1956–2000
(10 and 25 mg/L exceedances)

Warmer winters + less ice cover: Increased surface evaporation

Lower Great Lakes water levels

Winter +6-7°F

December 2012
Climate Vulnerability

Higher temp + Less summer rain = **Drought**

Summer temperature **+4-5°F**

Summer rainfall **+0-5%**

An incentive to irrigate?
Potential reductions in stream base flow?

Wisconsin Driftless Area Irrigation Well Locations

Wisconsin Driftless Area
High Capacity Irrigation Wells

Source: WDNR 2013
Created by Bob Small
Projected change in annual peak temperatures

**1980-2055 (SRES A1B)**

+10-25 days >90°F

+0-5 days >100°F
Heat waves and drought = increased water use

Wisconsin has over 7,500 high capacity wells
Projected changes in Wisconsin’s precipitation

Projected change in > 2” rain + 2-5/10yr

1980-2055 (SRES A1B)

Source: Center for Climatic Research, Nelson Institute, University of Wisconsin - Madison
The trend continues over time

Projected change in > 2” rain + 4-7/10yr

1980-2090 (SRES A1B)
Historical NARCCAP Storm intensity

Both are projected to increase

Projected Return Period 1971-2000 vs. 2041-2070

Storm frequency

Storm intensity

-Vavrus and Behnke
Soil loss from increased precipitation

“Climate Impacts on erosion difficult to predict, best estimate +130-150%

Climate Vulnerability

Figure 3. Wisconsin Buffer Initiative estimates of sediment delivered to watershed outlet.

(1 t/acre = 224 tonnes/sq km) - Diebel et al. 2005

“Soil conservation and water quality are compatible with current and emerging expectations of Wisconsin’s farmlands, provided that practices we largely know how to do are widely implemented by our farmers.”

- WICCI Soil Conservation Working Group
Runoff from large storm events transports nutrients and sediment to lakes, degrading water quality and causing eutrophication.
Seasonal change in precipitation

1980-2055 (SRES A1B)

- **Winter**: +20-25%
- **Summer**: +0-5%
- **Spring**: +10-20%
- **Fall**: +5-10%
Seasonal change in max temperature

1980-2055 (SRES A1B)

- **Winter**: +6-7°F
- **Spring**: +5-6°F
- **Summer**: +4-5°F
- **Fall**: +6°F
Climate Benefit

Increased groundwater recharge

Winter +6-7°F

Winter +20-25%

Black Earth Creek Watershed
1971-1999 vs 2041-2069

45%
More winter/spring precipitation

- Flooding from increased winter spring rains
- Heavier snow and/or ice storms
Changing winter weather

*Minneapolis weather changing to...*

Warmer Winters ⇒ Less snow?
Changing winter weather

....Rockford weather.

Warmer Winters $\Rightarrow$
More freezing rain?

Melts (rain)
Freezes
Increased road de-icing

Madison Salt Application and Yahara Lakes Chloride
1962-2012

City of Madison
Questions?