Wisconsin Initiative on Climate Change Impacts (WICCI)

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WICCI Science Council Co-Chairs

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*Dan Vimont, UW-Madison CCR

Intergovernmental Panel on Climate Change (IPCC), 2007 (4th Assessment Report)

* Co-Leaders of WICCI's “Wisconsin Climate Working Group”

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Evidence of Climate Change in Wisconsin
One of many signs of warming in Wisconsin...

Lake Mendota

Decrease in duration of ice cover on lakes

Source: J. Magnuson, UW-Madison
Earlier arrival of spring in Wisconsin

<table>
<thead>
<tr>
<th>Bird migration</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geese Arrival: 29 days</td>
<td><em>Baptista</em> first bloom: 18 days</td>
</tr>
<tr>
<td>Cardinal first song: 22 days</td>
<td><em>Butterfly weed</em> first bloom: 18 days</td>
</tr>
<tr>
<td>Robin arrival: 9 days</td>
<td><em>Marsh milkweed</em> first bloom: 13 days</td>
</tr>
</tbody>
</table>

55 ecological indicators of spring occurred on average 1.2 days earlier per decade from 1936 to 1998.

Climate Change in Wisconsin: Historical Trends
Weather Station Network for Wisconsin
(Daily temperature and precipitation data since 1950)

Source: Map from Serbin and Kucharik (2009); photos from C. Kucharik, UW-Madison

Photo credit: NOAA
Change in Annual Average Temperature (°F) from 1950 to 2006

Statewide average 1.5° F warmer

(from Serbin and Kucharik 2009)
The greatest amount of warming is occurring in Winter and Spring, especially in northwest Wisconsin.

(from Serbin and Kucharik 2009)
Nighttime lows are warming faster than daytime highs, especially in summer.
Extreme Temperature Trends

Change in the frequency of $<0^\circ$ F nights per year from 1950 to 2006

Decline in extremely cold winter nights, especially in northwest Wisconsin

Change in the frequency of $\geq90^\circ$ F days per year from 1950 to 2006

Very little change in hot summer days

(from Serbin and Kucharik 2009)
Change in Wisconsin's Seasons

Change in Date of Last Spring Freeze from 1950 to 2006:

6 – 20 days earlier

Change in Date of First Fall Freeze from 1950 to 2006:

3 – 18 days later

(from Serbin and Kucharik 2009)
Increase of up to 4 weeks in the length of the growing season in days from 1950 to 2006.
Recent Precipitation Trends

Change in Annual Average Precipitation (inches) from 1950 to 2006

Statewide average 15% increase, but highly variable across Wisconsin

(from Serbin and Kucharik 2009)
Change in Average Precipitation (inches) from 1950 to 2006

Winter
- ~15% increase

Spring
- 10–15% increase

Summer
- 5–10% decrease
- ~15% increase

Fall
- ~20% increase

(from Serbin and Kucharik 2009)
Climate Change in Wisconsin: Future Projections
Downscaling: Focus global projections to a scale relevant to climate impacts in Wisconsin

Climate Modeling:

Used 14 Global Climate Models (GCM’s) having daily data in IPCC 2007 assessment

Downscaling verified using same Wisconsin weather station data analyzed for historical climate trends

Provides a range of probable climate changes (probability distribution) essential for impact assessments

Source: Adapted from D. Vimont, UW-Madison
Annual Temperature Change

Projected Change in Annual Average Temperature (° F) from 1980 to 2055

Probability Distribution of 14 Global Climate Model Projections

Wisconsin projected to warm by 4 – 9 ° F by mid-21st Century

Source: Adapted from D. Vimont, UW-Madison
Projected Change in Seasonal Temperatures
1980 to 2055 (°F)

Warming is most pronounced in winter
Projected change in the frequency of $<0^{\circ}$ F nights per year from 1980 to 2055

Projected change in the frequency of $\geq 90^{\circ}$ F days per year from 1980 to 2055

Fewer extremely cold winter nights

More hot summer days
Projected Change in Precipitation from 1980 to 2055

Change in Annual Average (inches)

Probability Distributions of 14 Climate Model Projections by Month

Models predict winter and early spring will be wetter
Models uncertain about amount of summer rainfall

Source: Adapted from D. Vimont, UW-Madison
Monthly Frequency of >3-inch Rainstorms in 24 hr
Madison, Wisconsin
(Future projections averaged for all 14 GCM’s)

Exceedance Probability

January | February | March | April | May | June | July | August | September | October | November | December
---|---|---|---|---|---|---|---|---|---|---|---
1961-2000 | 0 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10
2046-2065 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.11
2081-2100 | 0 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10

Increase in extreme precipitation events during spring & fall

Source: K. Potter, UW-Madison.
Based on statistically downscaled data developed by Kucharik, Lorenz, Notaro, and Vimont, UW-Madison.
How Could Wisconsin Adapt to Climate Change?
Mitigation vs. Adaptation

Change in rate of GHG emissions*

- Very little
- Minor
- Major

*Scenarios from IPCC 2007

Global surface warming (°C)

1900 2000 2100

3.6 °F

Modified from: IPCC 2007

Modified from: Wisconsin's Strategy for Reducing Global Warming

Mitigate

Adapt

Wisconsin Initiative on Climate Change Impacts
Wisconsin Initiative on Climate Change Impacts (WICCI)

Objectives:
Assess and anticipate climate change impacts on specific Wisconsin natural resources, ecosystems and regions
Evaluate potential effects on industry, agriculture, tourism, and other human activities
Develop and recommend adaptation strategies

Science Council

Working Groups

Operations & Outreach Unit

Advisory Committee
Collaborative and Interdisciplinary

**Science Council:**
Members represent an array of disciplines and expertise within the University of Wisconsin System (UW), the Wisconsin Department of Natural Resources (WDNR) and other state and federal agencies, universities and institutions.

**Working Groups:**
Experts in working group topic areas coming from WDNR, other state and federal agencies, UW, non-profit organizations, and private sector. Working groups are a mix of researchers, managers, and practitioners from around the state.

**Advisory Committee:**
Stakeholders from across Wisconsin who bring a wide variety of perspectives including representatives from the utilities, state and local government, agriculture, transportation, tourism, forestry, public health, conservation and environmental organizations, Native Americans, etc.

**Outreach Committee:**
Experts in communications and outreach from UW-Madison, UW Sea Grant, UW-Extension, and WDNR.
Current & Developing Working Groups

- Water Resources
- Human Health
- Milwaukee
- Coldwater Fish
- Stormwater
- Wildlife
- Green Bay
- Coastal Communities
- Forestry
- Central Sands Hydrology
- Plants & Natural Communities
- Loss of Winter
- Agriculture
- Soil Conservation
Impacts of Climate Change Are Pervasive
How will climate projections be used?

*Risk*: Probability of climate event occurring multiplied by severity of impact

Identify threshold / response surface

Define present day risk with present day probability distribution

Compare future risk with future probability distribution

Explore how adaptation strategies can impact risk

Source: Adapted from Dan Vimont, UW-Madison
Loss of Winter in Wisconsin

Culture
Sense of Place
Recreation
Tourism
A Clear Threshold
29°C and 50% rain vs. Snow

Warmer
Madison Wisconsin

Shorter Snow Season

Dan Vimont, UW-Madison
Probabilities of Snow vs. Rain

Dan Vimont
A Clear Threshold
Trout in Wisconsin Streams
July-August Water Temperatures ≤ 22°C

Photo Matt Mitro WDNR
NOW

17,900 km of stream

Present

12,500 km of stream

Matt Mitro & John Lyons WDNR
4,800 km of streams -73%

16,000 km of streams +28%

Present Gain Loss

Matt Mitro & John Lyons WDNR
Present

Gain

Loss

300 km
-98%

2,100 km
-83%

Matt Mitro & John Lyons WDNR
Catfish Gains Do Not Offset Trout losses

John Lyons W DNR 2009
Expect the Unexpected
Forestry Working Group

Loss of Northern Tree Species

Impacts of Warmer Winters on Logging


Photo: Karin Fassnacht, WDNR
Wildlife Working Group

Loss of species

Overabundance of other species

Loss of natural habitats and biodiversity (also Natural Places Working Group)
Increase in respiratory health problems from air pollution and climate change

Increase in vector-borne infectious diseases from more intense storms

Increase in waterborne infectious diseases from more intense storms
Stormwater Working Group

Damage to communities and transportation systems from extreme storm events

Rock Springs, WI, June 2008
Photo: Michael Kienitz

Madison, WI, July 2006
Photo: Gordy Stephenson
WICCI’S First Adaptive Assessment Report
Fall 2010

Synthesis of climate impact assessments of WICCI Working Groups

Recommendations on adaptation strategies for decision makers
Future Activities

- Expanding Outreach Efforts
  - New website now online
  - Newsletters
  - Outreach Committee initiatives

- Collaboration beyond Wisconsin’s borders
  - Upper Great Lakes Region
  - USGS Regional Science Hub

- Subsequent Adaptive Assessments
WICCI was created from a partnership between the UW-Madison Nelson Institute for Environmental Studies and the Wisconsin Department of Natural Resources.

http://www.wicci.wisc.edu/