Local Government
Climate Adaptation Planning

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WICCI Climate Analysis
Chris Kucharik - UW Agronomy

Dan Vimont, Steve Vavrus, Michael Notaro,
David Lorenz - UW Center for Climatic Research
What about climate concerns us?

Humans experience climate as weather...
What about climate concerns us?

...and weather can take a human toll!
Scientific consensus on climate change

“There is a strong, credible body of evidence, based on multiple lines of research, documenting that climate is changing, and that these changes are in large part caused by human activities.”

— US National Research Council, 2010

Wisconsin Initiative on Climate Change Impacts

- Understanding ways we can adapt to the consequences of climate change.

www.wicci.wisc.edu
Wisconsin’s Historic Temperature Change

Wisconsin has been warming since 1950
Daytime High Temperature Change

Nighttime Low Temperature Change
Temperature Extremes

Sub-zero nights
*much less frequent*

Very hot days
*little change*
Dates of Spring and Fall Freeze

Wisconsin growing season

1-4 weeks longer since 1950
Annual Average Precipitation Change

Wisconsin rainfall has changed

\[ \uparrow 7'' - \downarrow 4'' \text{ since 1950} \]
Objective, statistically downscale global climate models to scales relevant for decision makers (around 6x6 mile resolution)

WICCI Climate Assessments and Projections
UW-Center for Climatic Research
Summary of Wisconsin’s **Projected** Climate

- Primarily warmer winter and nighttime temperatures
- More frequent hot summer days and heat waves
- Moderate increase in frequency and intensity of precipitation
- Significant increase in rain during winter and spring

*Short term variability (weather) and extreme events cannot be projected*
Projected Change in Max Annual Temperature

+6°F  1980-2055 (SRES A1B)

How relevant is annual average temperature?
Projected Change in Max Temperature by Season
1980-2055 (SRES A1B)

- **Winter**: +6-7°F
- **Spring**: +5-6°F
- **Summer**: +4-5°F
- **Fall**: +6°F
Projected Change in Peak Temperatures
1980-2055 (SRES A1B)

10-25 days >90°F

0-5 days >100°F

Heat waves are projected to be more frequent, hotter and longer
Since 1982, heat waves have caused more deaths (216) than all other natural disasters combined - NWS
Projected Change in Annual Precipitation

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

How significant is a 10% increase?
Projected Change in Precipitation by Season 1980-2055 (SRES A1B)

Winter +20-25%

Summer +0-5%

Spring +10-20%

Fall +5-10%
Seasonal shift in temp and precipitation

Winter Precip +20-25%
Winter Temp +6-7°F

Riverine flooding during winter and spring
Increased recharge = groundwater flooding

Rising water table can result in groundwater contamination

Especially in communities that do not disinfect

Gotkowski & Liebl, 2013
Projected Change in Heavy Rainfall

2” in 24 hours

2-5 days/decade  1980-2055 (SRES A1B)

Moderate but significant increase
Heaviest Rainfall

More frequent

More Intense
38 River gauges broke records
810 Square miles of land flooded
161 Communities overflowed 90 million gallons raw sewage
2,500 Drinking water wells tested - 28% contaminated

$34M in damage claims paid

Source: FEMA, WEM
Extreme Rainfall in Wisconsin

11.75" in 24 hours
Stoddard, Vernon County
August 18, 2007

6.73" in one hour
Milwaukee
July 22, 2010

Milwaukee Journal-Sentinel
Challenges of Climate Adaptation

Long planning horizon - Climate change occurs over decades, what planning and management strategies are on the same time scale?

Predictive uncertainty - Are management strategies flexible enough to respond to the range of climate projections and impacts?

Sustainable alternatives – More of the same may not be the best long term adaptation strategy?

Win-Win strategies both protect society and reduce carbon
Local Government Climate Planning

*How will projected changes in climate affect your work?*

**The Team**
Operations and infrastructure managers, public health and public safety

**The Process**
1) Identify climate vulnerabilities in the systems you manage
2) Assess the feasibility of adaptation strategies
3) Look for shared opportunities
4) Prioritize risk and fiscal impact
5) Draft a plan for public review and input
6) Implement adaptation strategies
Where are the adaptation opportunities?

- Facilities and Budget
- Government Services
- Groundwater Management
- Infrastructure
- Public Health
- Public Safety
How far do we need to look ahead?

Planning Horizons

- Local budgets 1-2 years
- Staffing levels 3-5 years
- Buildings 25-50 years
- Roads, Sewers, etc. >50 years

**Communities should be prepared for today’s rare weather extremes, they will become more common** - WICCI
Tools for Assessing Vulnerability

What would happen if the 2008 Baraboo rainfall was centered over your community?
# Climate Vulnerability Worksheet

<table>
<thead>
<tr>
<th>Changing Climate Conditions</th>
<th>Area of Responsibility or Activity</th>
<th>Anticipated Impact</th>
<th>Scope of Impact</th>
<th>Time Frame of Change</th>
<th>Consequence of Impact</th>
<th>Vulnerability of Systems</th>
</tr>
</thead>
</table>

Use the following (WICCI A1B) scenarios for mid-21st century

### Temperature

- **Annual Average Temperature** + 6°F
- **Average Maximum Temperature** + 6°F
- **Annual Peak Temperature** 110-112°F

#### Twenty more Days over 90°F

- **Public Health**
  - More / longer heat waves
  - Need plan for vulnerable people
  - Deferred
  - Vulnerable people can succumb to prolonged heat
  - Increased heat related deaths and hospital admissions

- **Five hundred more cooling degree days**

- **More frequent-longer heat waves**

### Precipitation

- **Annual Precipitation** +2"

- **Rainfall frequency and intensity increasing**

- **Extreme rainfall event (6" in 24hrs)**

- **Increased rainfall in winter and spring**

- **Increased groundwater recharge**
## Vulnerability Worksheet (pg2)

<table>
<thead>
<tr>
<th>Estimated Risk to System</th>
<th>Adaptation Opportunity</th>
<th>Adaptation Goals</th>
<th>Feasibility of Options</th>
<th>Required Authority</th>
<th>Potential Internal Partners</th>
<th>Potential External Partners</th>
<th>Time Frame of Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High - Medium - Low</td>
<td>Anything that can be done in anticipation of the impact</td>
<td>Objectives / Milestones</td>
<td>Cost, physically possible, socially acceptable</td>
<td>Who can make the decision to implement</td>
<td>Who in County government should be involved</td>
<td>Who else should be involved</td>
<td>When should it begin (or when can it begin)</td>
</tr>
<tr>
<td>High</td>
<td>Identify vulnerable people and cooling shelters</td>
<td>Plan in place by 2014</td>
<td>Will require dedicating staff to plan development</td>
<td>Public Health</td>
<td>Emergency Management, Police, Fire</td>
<td>Community organizations, Hospitals</td>
<td>Immediately</td>
</tr>
</tbody>
</table>
Questions?

Discussion
Projected change in annual mean temperature

1971 - 1989
High 46.6
Mean 42.8°F
Low 40.5

2046 - 2065
High 52.3 (10%)
Mean 48.7°F
Low 45.8 (10%)