Slide 1

# Climate Change and Wisconsin's Communities

Core Competency
for
Cooperative Extension Educators


UW Extension
Cooperative Extension

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## Overview

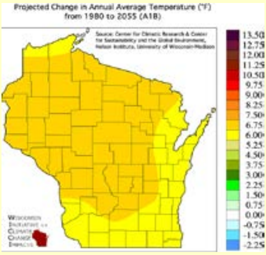
**Part 1** –The role of Extension in climate education

**2** - Challenges to building climate awareness

**3** - Understanding Earth's climate

**4** – Wisconsin's climate trends, projections and impacts

**5** - Responses to climate change

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## Why a Core Competency in Climate Change?

***A richer understanding of climate issues will allow UW-Extension county faculty and specialists to work more confidently with clients.***

**UW-Extension Climate Curriculum Team**

Bill Bland, ANRE, Co-Chair
Jennifer Kushner, Program Support
Joe Lauer, ANRE
David Liebl, CNRED, Co-Chair
Carol McCartney, WGNHS
Jay Moynihan, Shawano
Pat Robinson, ERC
Becky Sapper, LSNEER
Cathy Techtman, CNRED

- Briefly discuss institutional perspective of climate as a central factor in Extension programming
- Acknowledge the curriculum design team

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## Core Competency Learning Objectives

- Demonstrate an understanding of climate science
- Appreciate the nature of the public discourse around climate change
- See the relevance of climate education, and its relation to other UWEx evidence-based programming
- Integrate climate change considerations into UWEx outreach programs

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**Part 1**
Why UWEx has a role
in climate education

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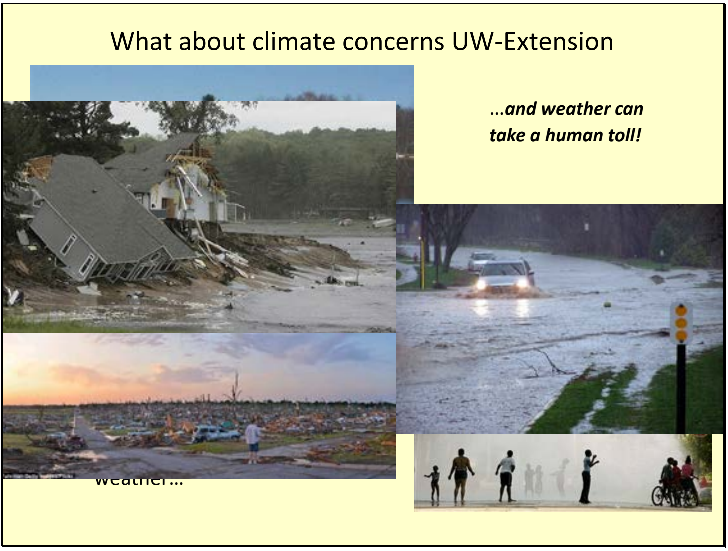


- Set the stage for the discussion of impacts (i.e. weather).
- Note the difference between weather and climate
- Climate change shifts the probability of extreme weather events

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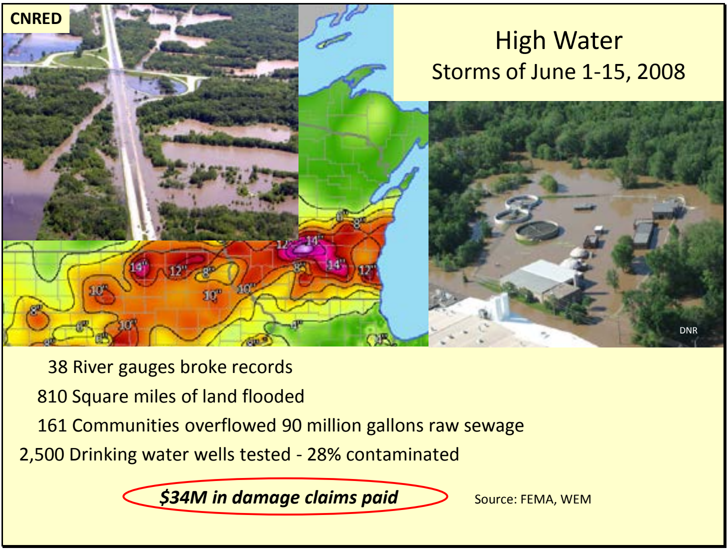


- 12” to 15” of rainfall over seven days
- I-39/I90-94 closed for three days due to flooding
- Reedsburg wastewater plant submerged, w/$800k damage…FEMA reimbursed

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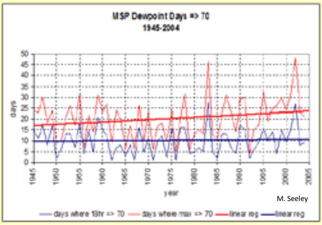
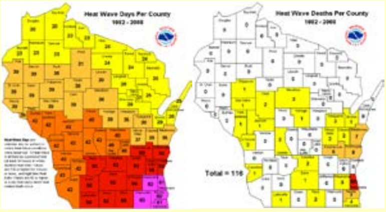
**Family Living**

## Heat

Trend in dew point of 70° F or higher in the Twin Cities




***Heat Mortality***

- Higher dew points = Heat related health care and mortality
= Increased demand for air conditioning and community heat shelters
Source: Mark Seeley, University of Minnesota

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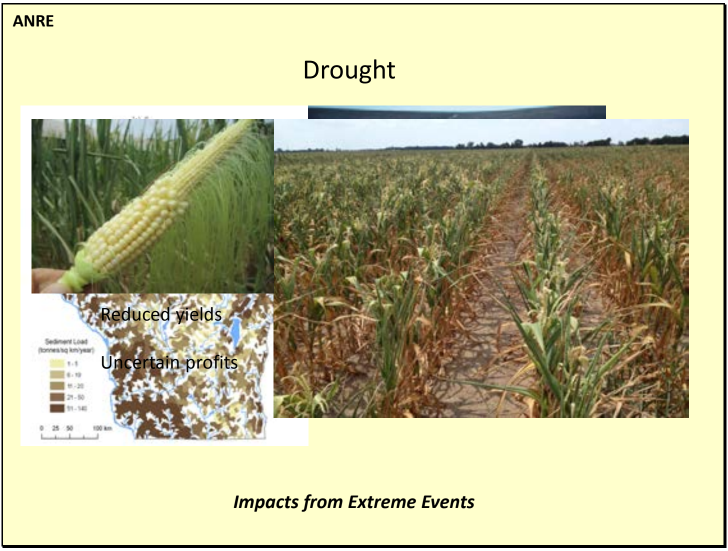


- Projected rainfall in winter and spring threatens soil resources
- Greatest vulnerability of steep slopes
- Wisconsin Buffer Initiative estimates of sediment delivered to watershed outlet (1 t/acre = 224 tonnes/sq km)

Source:  Diebel, M.W., J.T. Maxted, D.M. Robertsone, S. Han, M.J. Vander Zanden. 2009, Landscape planning for agricultural nonpoint source pollution reduction III: Assessing phosphorus and sediment reduction potential, Environ. Management 43:69-83.

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4-H

## STEM Education


***4-$H_2O$***
- Calculate carbon footprint
- Study increased in atmospheric $CO_2$


***There's No New Water***
- The water cycle
- Change can lead to drought


***Wired for Wind***
- Build wind turbine
- Reduce their reliance on fossil fuels

- 4-H2O had youth calculate their carbon footprint and study the environmental effects of an increase in atmospheric carbon dioxide
- Wired for Wind teaches youth to build their own wind turbine, calculate energy production and reduce their reliance on fossil fuels
- In the curriculum "There's No New Water", youth learn about how human's affect the water cycle and how environmental changes can lead to drought conditions

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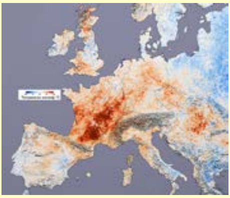
## One Example of Why Climate Change Is an Urgent Issue



**2003:** hottest summer in Europe in 500 years
*70,000* deaths

Climate change = 2-fold increase in risk


**2010:** Western Russia - hottest since yr 1500
*11,000* deaths, grain harvest reduced 30%

Climate change = 3-fold increase in risk

***Think in terms of likelihood of such events...***
***an example of climate knowledge***

- 2003 figure shows difference between 20 July – 20 August 2003, and same period 2001, 2002, 2004
Source:
- Robine, et al, Comptes Rendus Biologies, Volume 331, Issue 2, February 2008, Pages 171–178
- Stott, et al, Nature, 432, 610-614, 2004
- Otto, et al, Geophysical Research Letters , Vol. 39, L04702, 5 pp., 2012

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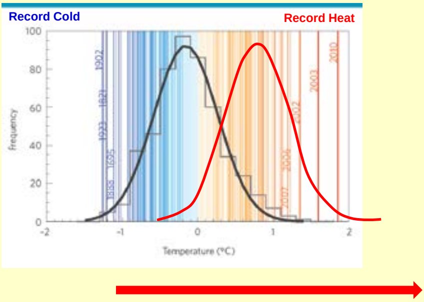
## Climate change and the probability of extreme events




Increased avg. temperature
shifts the probability of extreme heat

- Climate change shifts the probability of all weather events.
- Figure shows European temperature records 1500 – 2010
- Note that record cold becomes less frequent, while record heat becomes more frequent
- Projections of Wisconsin climate trends indicate that extreme heat events will become more likely.

Source: Rahmstorf and Coumou, PNAS November 1, 2011 vol. 108 no. 44 17905-17909

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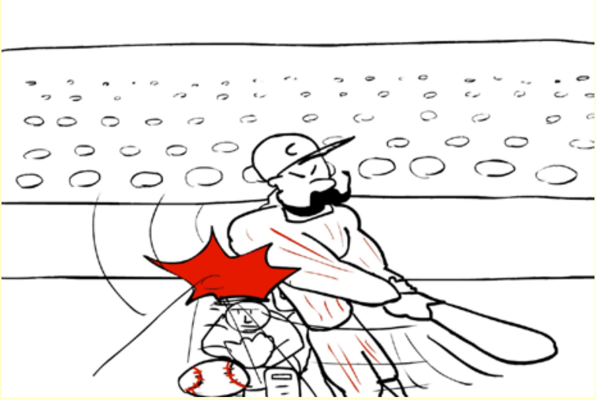
What do home runs and
weather extremes have in common



Play embedded video: Climate on Steroids
Source:
http://www2.ucar.edu/atmosnews/attribution/steroids-baseball-climate-change

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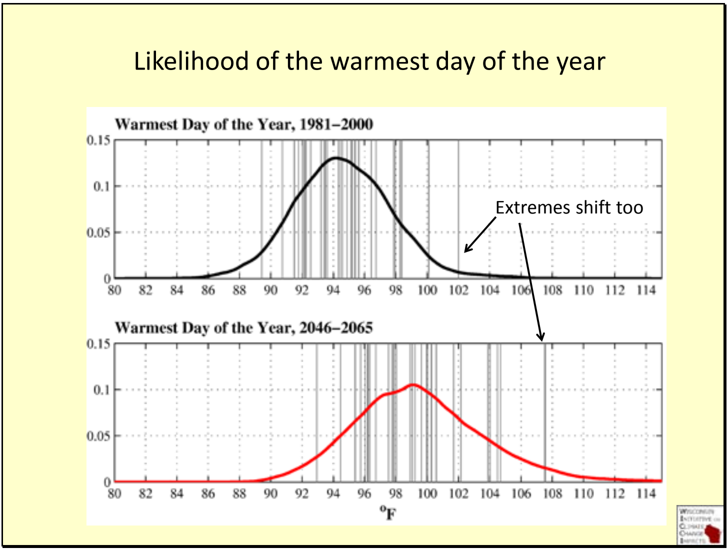


- The probability distribution of the hottest day of the year.
- Also plotted are representative temperatures for a single city in the region as grey lines (the data is from 1960-1999 for Wausau, note that the 102 high is real - 1995).
- Grey lines in the bottom graph are re-scaled using the probability distributions (note that it's not shifted exactly).

Source: Dan Vimont

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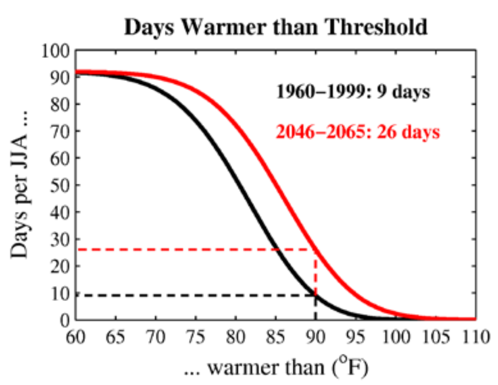
Number of days in June - August
with the maximum T above a given temperature




- This plot shows the number of days in June - August where the max temperature is above a given temperature.
- This is for Madison, but is representative.

Source: Dan Vimont

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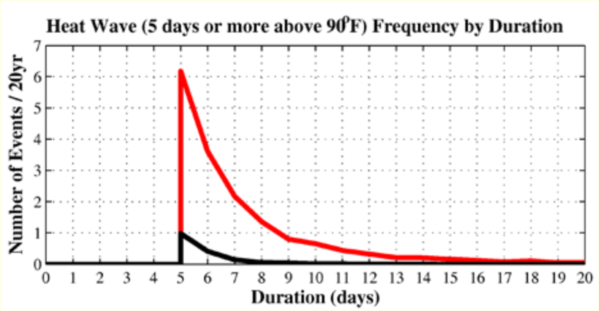
Increase in heat waves

**1981-2000** vs. **2046-2065**




***More frequent and longer***

- This shows the frequency per twenty years of a heat wave (at least 5 continous days above 90F), as a function of the duration of that heat wave

Source: Dan Vimont

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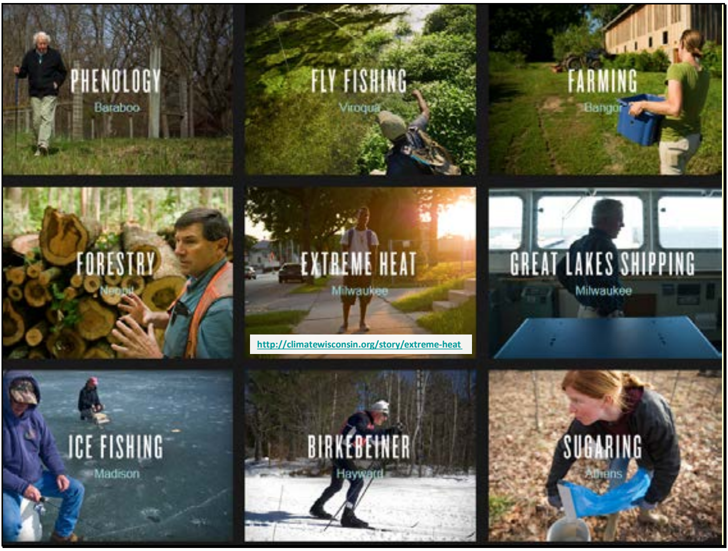


Play *Extreme Heat* clip
Click url to connect to:
http://climatewisconsin.org/story/extreme-heat

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**Discussion:**

What need do you see for Extension's engagement on climate change:

- Climate and weather are fundamental influences on prosperity
- Community attitudes about climate change affect decision making
- Extension's evidence-based educational model and reputation are a source of information in the community

***Can you think of more?***

- Prompt for ideas before revealing

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**Part 2**

Challenges to Building

Climate Awareness

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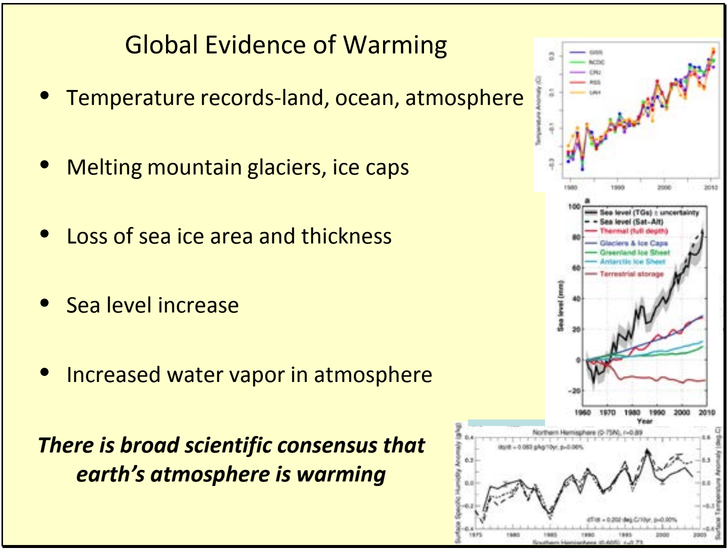


Sources:
- Foster, G., & Rahmstorf, S. (2011). *Global temperature evolution 1979–2010.* Environmental Research Letters, 6(4), 044022
- Church, J. A., White, N. J., Konikow, L. F., Domingues, C. M., Cogley, J. G., Rignot, E., Gregory, J. M., et al. (2011). *Revisiting the Earth's sea-level and energy budgets from 1961 to 2008*. Geophysical Research Letters, 38(18)
- Dai,A. 2006 *Recent climatology, variability, and trends in global surface humidity*. J. Climate 19:3589-3606

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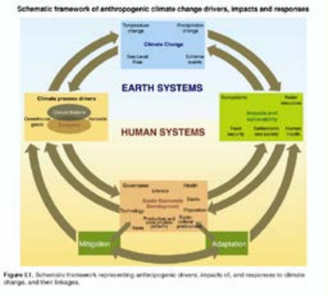
# Intergovernmental Panel on Climate Change (IPCC)

Convened 1988 - UN World Meteorological Organization;
UN Environment Program

Mission - *Assess the scientific, technical and socioeconomic information relevant for the understanding of the risk of human-induced climate change.*




Assessment Reports –
1990, 1995, 2001, 2007, 2014

- IPCC convened to study impact of human activity on climate
- Global focus of world-wide science resources
- Explicit support of policymakers

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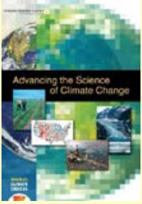
## Scientific Consensus on Climate Change

*"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**




Source: National Research Council, *Advancing the Science of Climate Change,* Washington, DC: The National Academies Press, 2010

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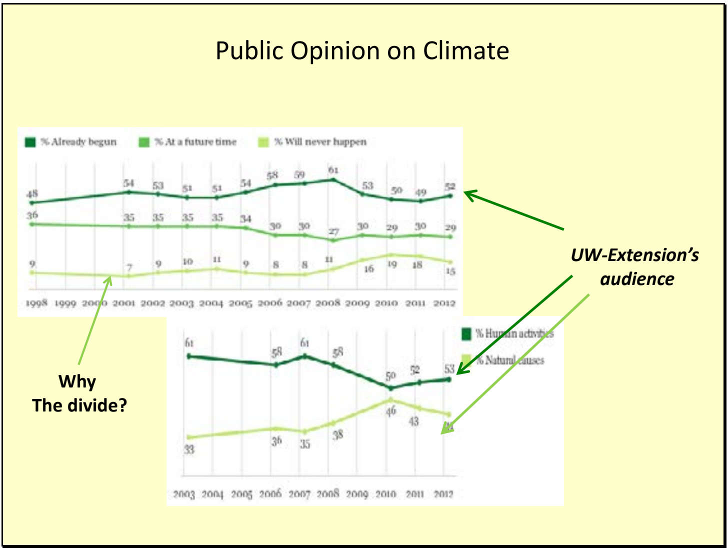


- Extension's role is to support climate mitigation and adaptation.
- Opinion about the cause of climate change is not relevant to responding to climate impacts.

Source: Gallup Polls

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## The political divide over climate

- Majorities of Democrats (78%), Independents (71%) and Republicans (53%) believe that global warming is happening.
- Only 34 percent of Tea Party members believe global warming is happening, while 53 percent say it is not happening.
- While 62 percent of Democrats say that global warming is caused mostly by human activities, most Tea Party members say it is either naturally caused (50%) or isn't happening at all (21%).

**- Source: Yale & George Mason University, 2011**

- Even though most Americans believe that climate change is real, political opinion has aligned with the climate question

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## Caught in the climate debate?

Efforts to discredit climate science:

- Often obfuscate the scientific argument
- Can be complex to refute (though information is available)
- Need only sow doubt, not disprove any science

Why all the controversy?

- Climate scientists vs. Special interests and ideologies
- Concern for the future vs. Fear of life style change
- Forward thinking vs. Head-in-the-sand

**Who do we listen to?**

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## Why is responding to climate change so difficult?

- Global problem
- Political controversy
- Human psychology
  – Abstractness and cognitive complexity
  – Blamelessness of unintentional action
  – Guilty bias
  – Uncertainty breeds wishful thinking
  – Moral collectivism
  – Long time horizons and faraway places

***Science can tell us what is going on, but not what we should do about it."***

**- Garvey (2008) The Ethics of Climate Change**

- In spite of the wealth of evidence that humans are causing rapid climate change that will burden all of humanity, but especially the poor and future generations, societies have done little in response.
- Psychologists and philosophers have been actively studying the problem, and propose that there are characteristics of the problem that make it particularly challenging for societies to address.
- A short list: That it will require a global response, and countries are so diverse that it is difficult to envision how that will occur;
That there is some uncertainty about how costly it to be, to which people and when;
There is political resistance policy to some responses that involve policy actions e.g., C tax or limits on emissions;
The complicated and technical nature of the issue make it difficult for many to grasp and engage.

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**Discussion:**

What have you observed about the climate controversy in your community?

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**Part 3**

Understanding Earth's Climate

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## Atmosphere Regulates Temperature


***Venus***
Mass 80% earth
92 earth atmospheres

96.5% Carbon Dioxide;
3.5% Nitrogen

**867°F**

***Earth***
78.08% Nitrogen
20.95% Oxygen

**60°F**

Without an atmosphere
**0° F**

***Mars***
Mass 10% earth
0.006 earth atmospheres

95.32% Carbon Dioxide
2.7% Nitrogen
1.6%Argon

**-81°F**

- Venus: Deep $CO_2$ atmosphere created by chemical processes traps more heat
- Mars: Low gravity lets gases escape = little atmosphere
- Earth: Life forms sequester $CO_2$, allowing heat to escape (note: without an atmosphere, the surface of earth would be about 0°F)

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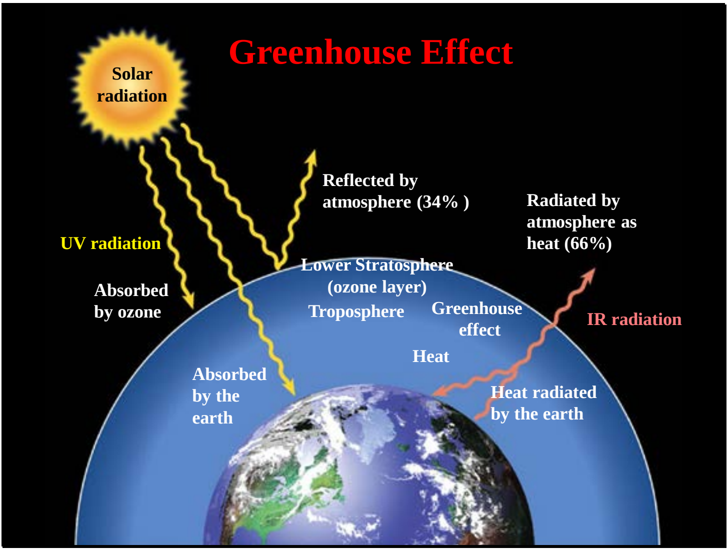


Brief discussion of heat transfer and absorption in the atmosphere

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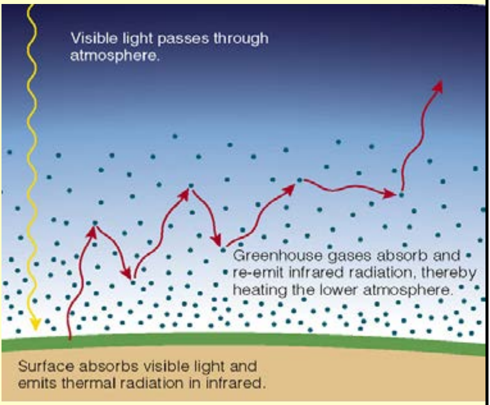
## Anthropogenic Greenhouse Gases

**<u>%</u>**
Water vapor ($H_2O$)

**<u>ppm</u>**
Carbon dioxide ($CO_2$)

**<u>ppb</u>**
Methane ($CH_4$)
Nitrous oxide ($N_2O$)
Tropospheric ozone ($O_3$)

**<u>ppt</u>**
Fluorocarbons (CFCs, HCFCs)
Carbon tetrachloride
Methyl chloroform
Sulfur hexafluoride




- Note that some greenhouse gases are more potent than $CO_2$ (e.g. nitrous oxide ~x300, methane ~x20)
- Water vapor is also a greenhouse gas, but the impact is complicated due to effects of clouds, rain, etc.
- Main point is that atmospheric $CO_2$, etc. are increasing

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## The climate idea

"Climate is properly the long average of weather in a single place"

– *The Cornhill Magazine,* 1860

The Climatic Zones and the Zodiac


Source: William Cuningham, *The Cosmographical Glasse* (London, 1559), p. 64.


Köppen climate subdivisions -1884
(30 year averages)


- Emphasize on how long the concept of climate has been accepted - Note dates (1559, 1860)
- World map shows 30 year averages
- US Map shows coarse spatial resolution of climate zones.

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## The Climate System

Sun radiates heat

- Earth’s rotation and orbit around sun intercepts heat
- Atmosphere absorbs and traps heat
- Oceans store and transport heat
- Ice and snow reflect heat and “store” cold

***Weather = Atmospheric phenomena that arise from systematic interactions in the climate system***

(Size of continents, and place, affect climate and weather)

Ways to think about climate:
- Average weather over a period of time for a specific location (place or region)
- The full range of weather experienced at a specific location
- The “base state” of weather, as driven by climate system

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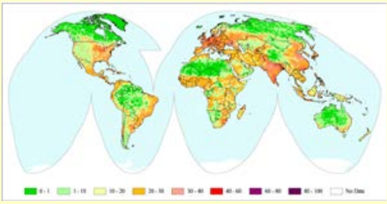
## Human Influence on Climate

- Increasing concentrations of atmospheric greenhouse gases: (carbon dioxide, chlorofluorocarbons, methane, nitrous oxide)
- Increasing concentrations of airborne particles (aerosols)



Human impact on terrestrial biomes
0=least, 100=greatest
Source; NASA

- Land Use

Humans have altered ~40% of earths habitable surface through deforestation, agriculture, and urbanization.

- IPCC Findings: Fourth Assessment Report: Climate Change 2007 (AR4)
- Human land use continues to alter regional climate
Source:
http://earthobservatory.nasa.gov/Features/footprint/

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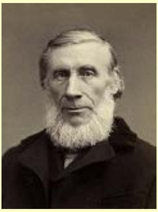
## Scientific understanding of human impact upon climate



John Tyndall

Tyndall (1859) demonstrates that $CO_2$ and water vapor can trap heat in the atmosphere

**"...the slight percentage of carbonic acid in the atmosphere may, by the advances of industry, be changed to a noticeable degree in the course of a few centuries."**

Svante Arrhenius

Arrhenius (1896) proposes that increased carbon dioxide emissions could raise atmospheric temperature

- Greenhouse effect theory over 100 years old
- Tyndall provides the physical chemistry
- Arrhenius draws the connection to atmospheric warming

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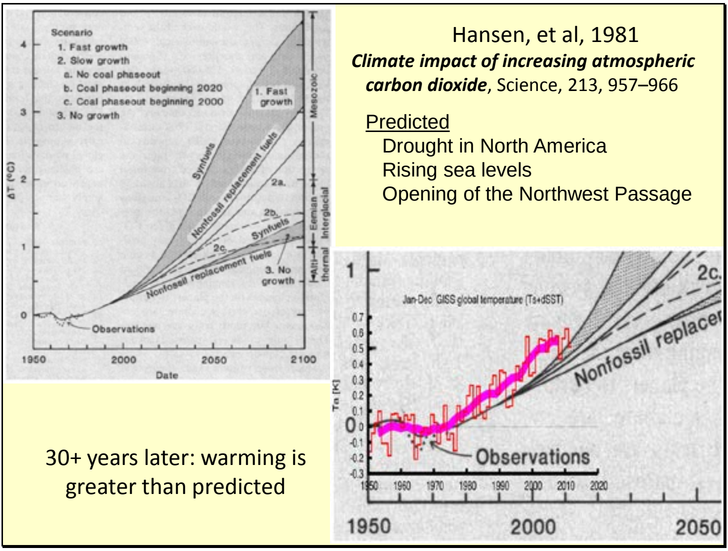


- The beginning of the modern enquiry into climate change
- Projections of warming based on different CO2 emission scenarios have been made for over thirty years

Source: http://www.realclimate.org/index.php/archives/2012/04/evaluating-a-1981-temperature-projection

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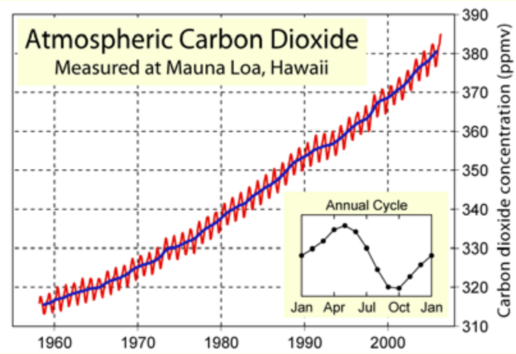
The $CO_2$ Trajectory




*Charles Keeling*

- This is the "Keeling Curve". Charles Keeling (Scripps Institute for Oceanography) started taken measurements at Mauna Loa in the late 50's.
- This curve has become the single most important time series in the global climate change debate.
- We see that we're near 390ppm of CO2, from ~280 from pre-industrial.
- Annual variation is northern hemisphere sequestration by plants

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“CO2 Was Way Higher In The Past” (?)

Play embedded video (on click)
Source: http://earththeoperatorsmanual.com/main-video/how-to-talk-to-an-ostrich

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**Discussion:**

Questions?

Clarification of climate science concepts

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**Part 4**

Wisconsin’s climate trends

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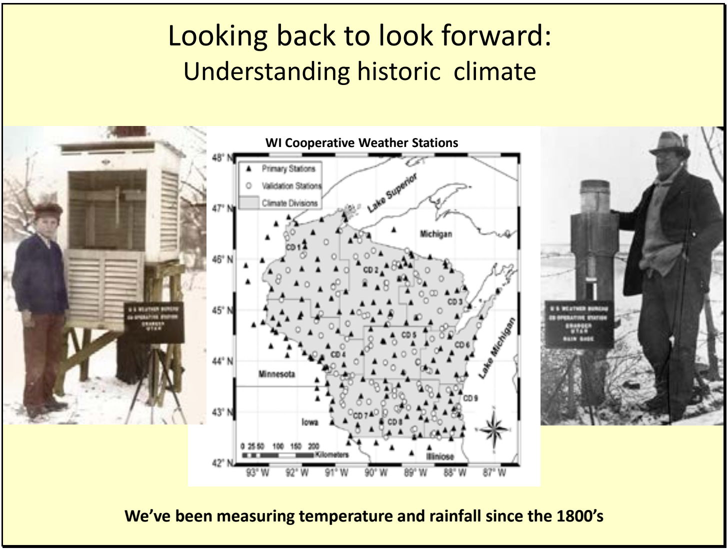


- The recent historic record is used to show that Wisconsin's climate has changed
- 176 NWS Co-Op weather stations provide data
- 1950 is when consistently good data became available for all stations

Source: Kucharik, C.J., et al, *Patterns Of Climate Change Across Wisconsin From 1950 To 2006*, Physical Geography, 2010, 31, 1, pp. 1–28.

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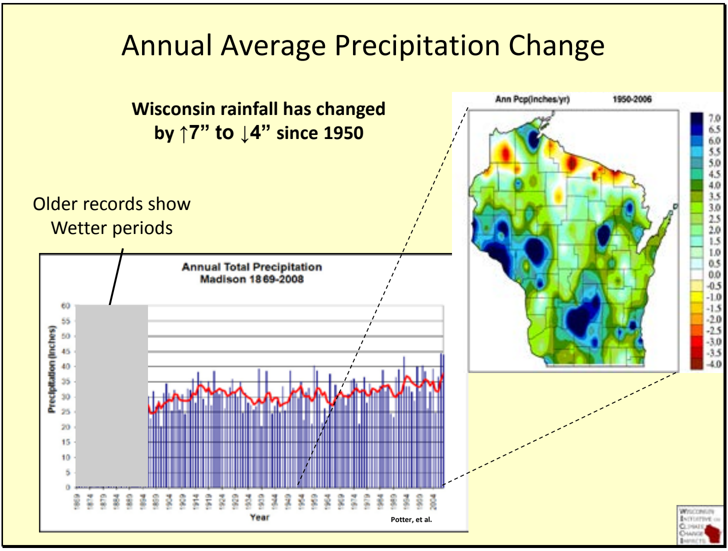


- Rainfall has been more variable by location (note drought in north central)
- However, rainfall is well below historic highs (late 1800’s)

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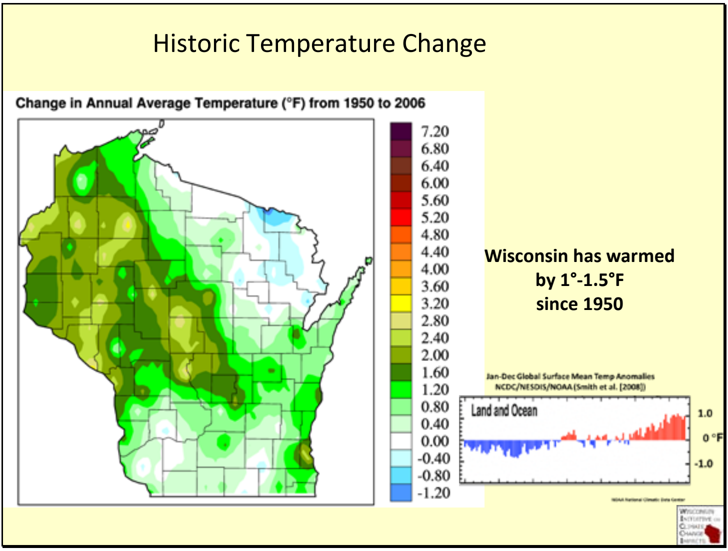


- This figure averages diurnal and seasonal temperature
- Note the spatial variability
- Compare to global temperature anomaly

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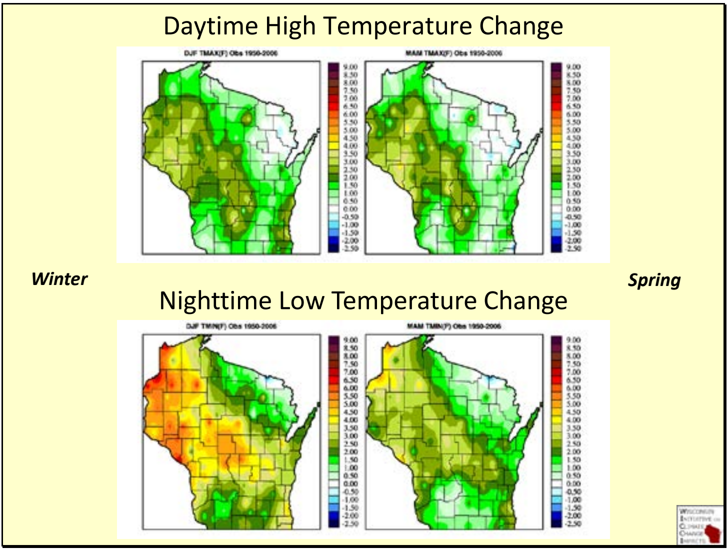


[Exercise (two by two)– what can you deduce from these slides?]

- Temperature increases are seasonal
- Warmer winter nights are responsible for overall average increase
- Summer and autumn show little change

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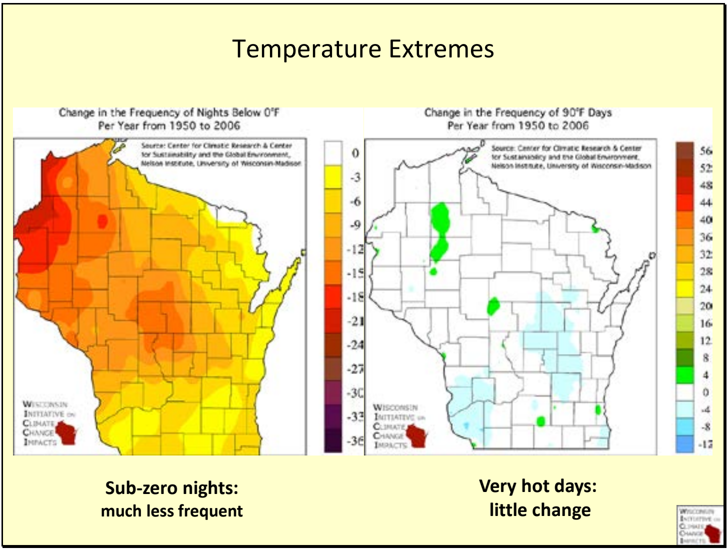


- Extreme temperature trends are consistent with the previous slide

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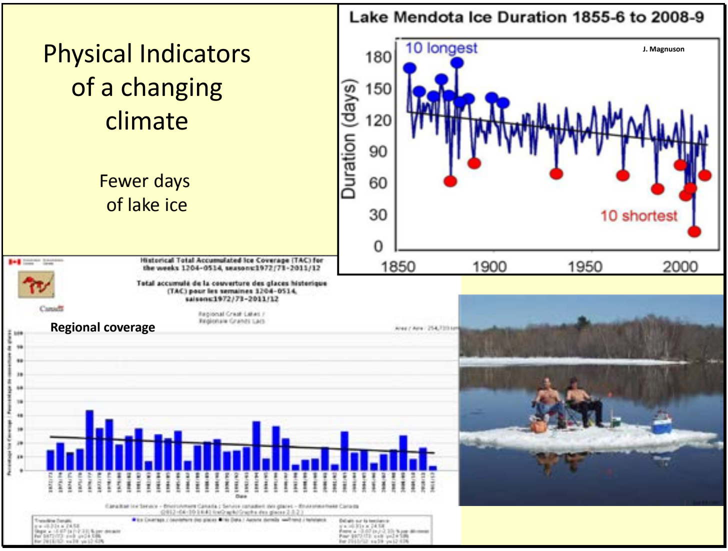


- Lake ice cover duration is an indicator of annual temperature trend, both regional and local
- Note grouping of record years….relate to probability of extreme events

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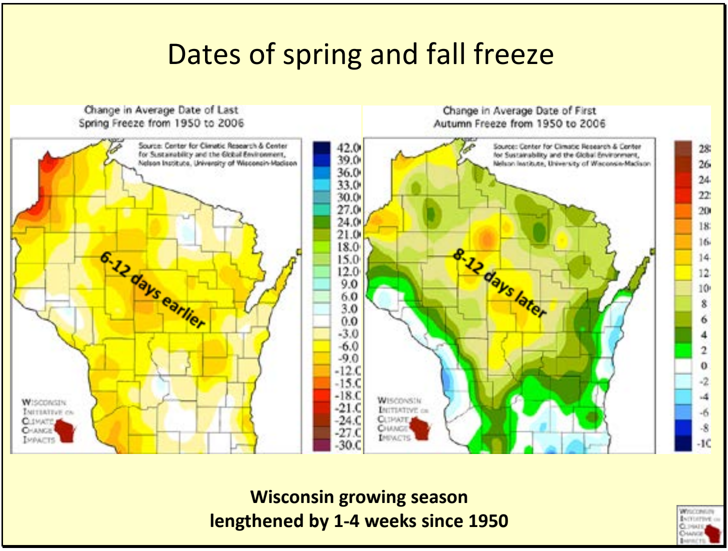


- Warmer winter means longer a growing season for most of state

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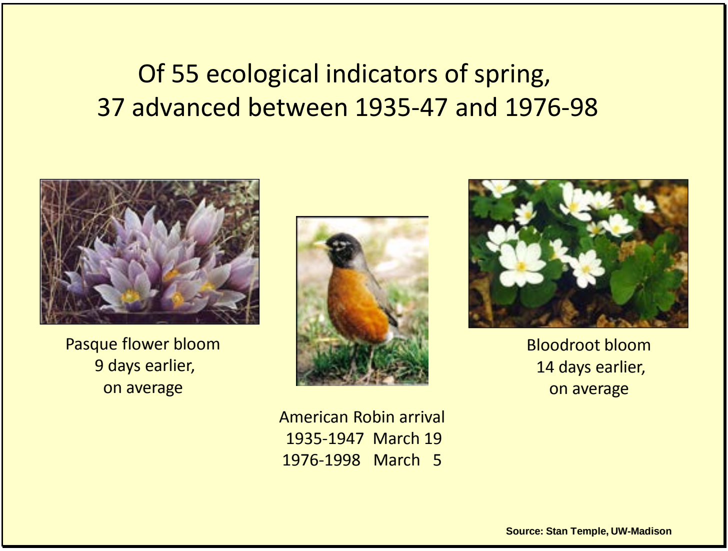


- Plants and animals also respond to temperature
- Regional ecological impacts are consistent with a warming climate

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**Climate Impact:**

# Wildlife

**Winners:**

- Short generation times
- Wide distributions
- Move easily across landscape
- General habitat requirements
- Not sensitive to human activity

**Losers:**

- Long generation times
- Narrow distributions
- Poor dispersal ability
- Special habitat requirements
- Sensitive to human activity


- Most species thought of as generalists or invasive will adapt and prosper
- Species that depend on specific habitat conditions will suffer

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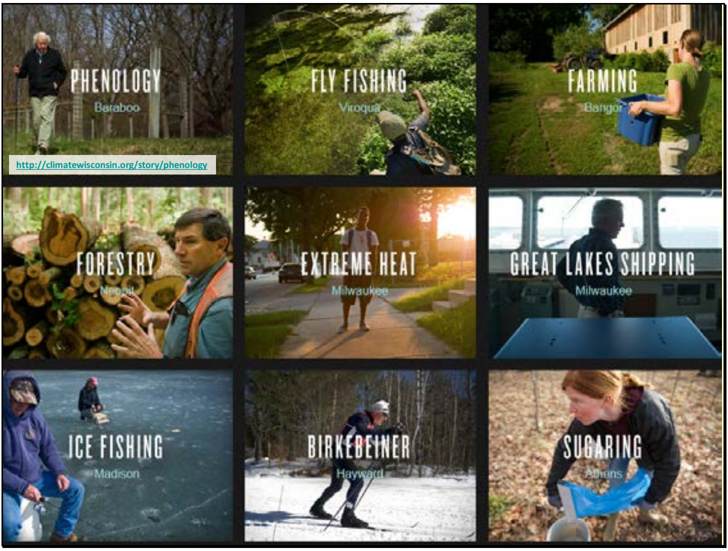


Play *Phenology* (click on url)
Source: http://climatewisconsin.org/story/phenology

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**Part 5**

Climate projections and impacts

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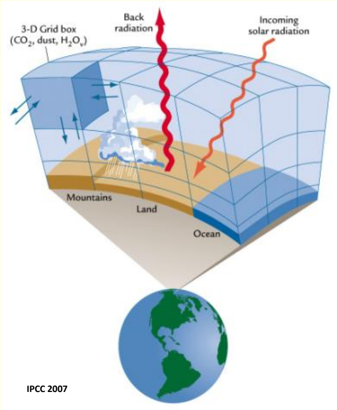
## Using climate models
## to understand how the future might unfold




General Circulation Models (GCMs) simulate the effects of incoming and outgoing thermal radiation on global climate, and include:

- Atmosphere
- Clouds
- Oceans
- Topography
- Rainfall
- Radiant heat

- Earth's climate system is complex, and all interrelated elements of it cannot be resolved to provide exact predictions
- Mathematical modeling provides approximations of physical process, and insight into future conditions

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A few thoughts on climate projections

- Climate modeling seeks to understand climate processes, how human activities are altering the climate system, and to project future conditions
- No single GCM is “right” - the differences between models reflect the complexity of the climate system
- All model projections become more uncertain further into the future

***What humans adapt to is the variability of <u>weather</u>***

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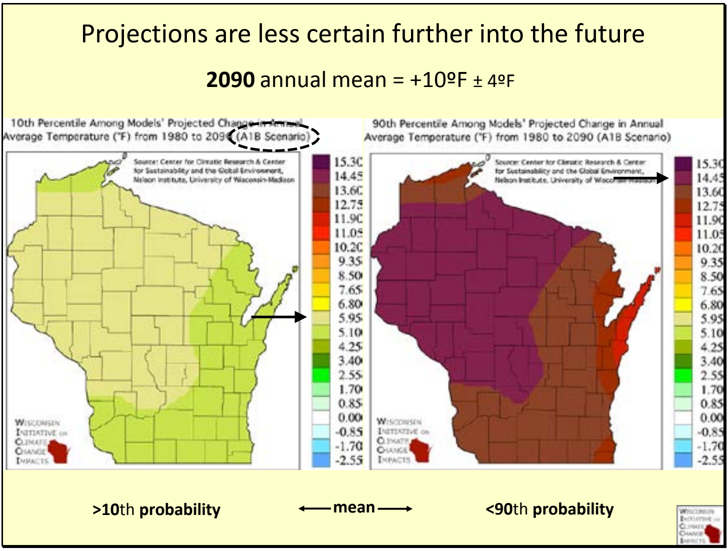
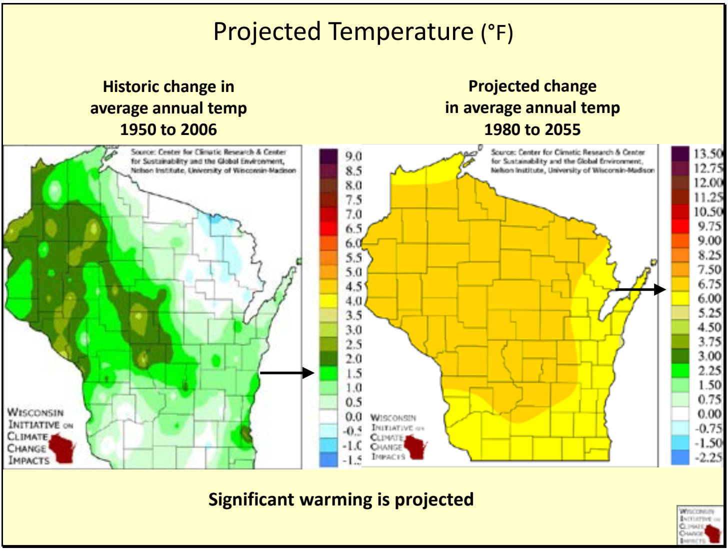


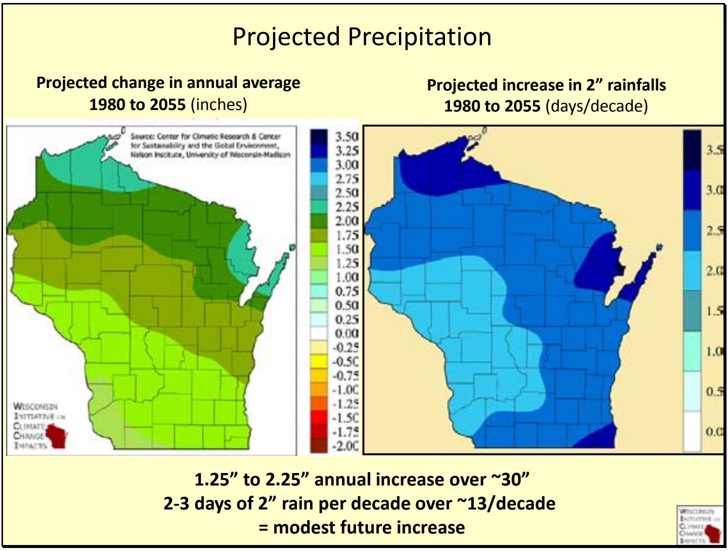

- Relate to previous slide
- A1B CO2 emission scenario:
  - Rapid economic growth
  - A global population that reaches 9 billion in 2050 and then gradually declines
  - The quick spread of new and efficient technology
  - A convergent world - income and way of life converge between regions
  - Extensive social and cultural interactions worldwide.
  - A balanced emphasis on all energy sources
- Note that nobody is planning for 2090

Slide 55



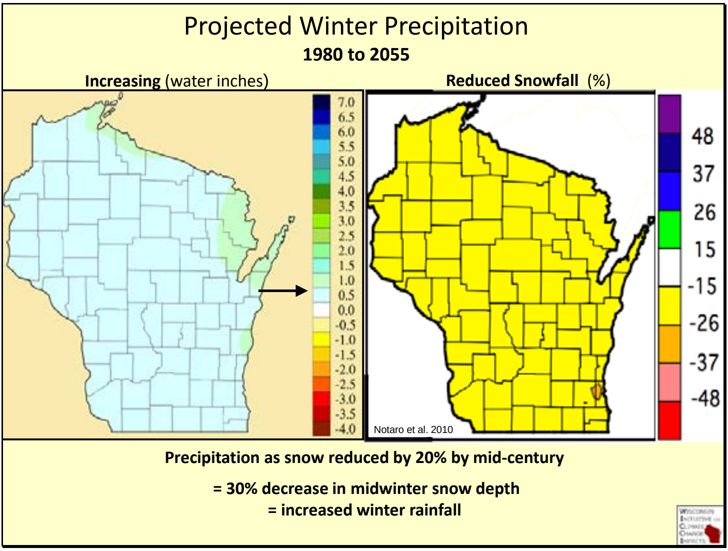

- Explain why 1950 was used as historic baseline: Beginning of reliable and extensive weather records for WI
- Explain debiasing (1980 -2008) for projections: Climate models begin with twenty years of historic data

Slide 56

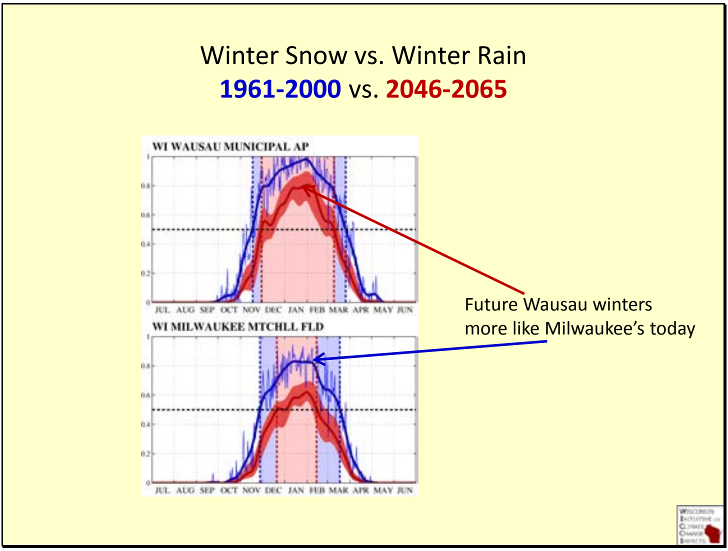



- Note broad spatial resolution compared to historical
- Projections for precip necessarily more uncertain than for temp
- Historic annual precip ~30" (1895-2007, WI State Climatologist)
- 2"-24hr rainfall frequency ~13/decade (Midwest Climate Center - Bulletin 71)

Slide 57




- Change in seasonality of rainfall more certain than change in the amount of precipitation.




- Snow vs. rain plot for Wausau and for Milwaukee.
- The thick blue curve indicates the probability that precipitation will be in the form of snow instead of rain (11 day running mean applied to make it smoother).
- The thick red line is the probability under 2046-2065 conditions. The broad range of red indicates the 10th and 90th percentiles.
- By 2046-2065 climate, Wausau looks like Milwaukee for 1961-2000.

Source: Dan Vimont

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**Climate Impact:**

## Groundwater flooding from increased recharge

This Spring Green subdivision has been razed, with FEMA reimbursement.

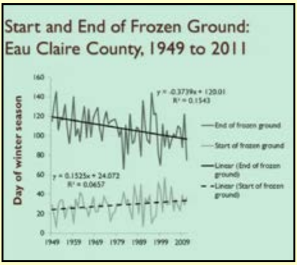
The community has built a diversion channel to carry water from future flooding.

- Groundwater flooding occurs when recharge exceeds drainage and the water table rises above the surface.
- Impacts primarily upon rural development and agriculture.
- Photos from Spring Green, where FEMA paid out for groundwater flood damage for the first time
- Diversion channel runs north to south, crossing US Hwy 14

Slide 60

**Climate Impact:**
Less Frost

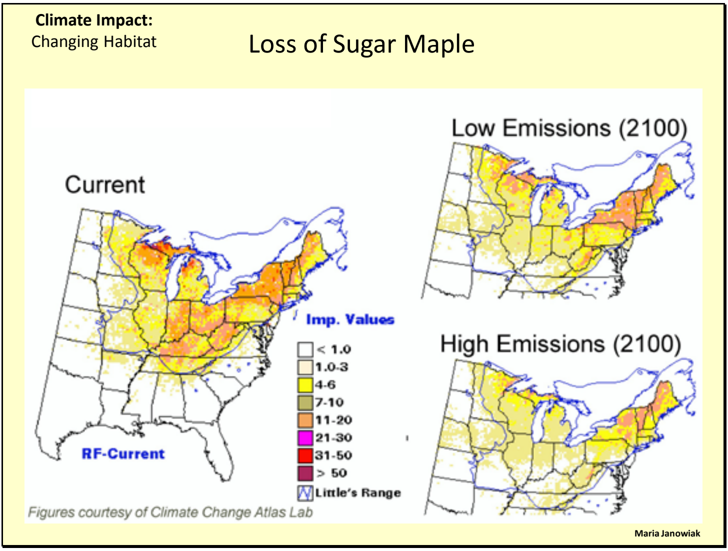
# Forestry




**Shorter periods of frozen ground**
**= limits to the logging season**

- Relate Eau Claire County figure to previous ice-off slide
- Winter road hauling may be affected
- Increasing forest disturbance from summer harvesting?

Slide 61




While sugar maple will still exist over a wide range, it will become uncommon. (Imp. Values = Importance Value )

- Maple syrup industry will suffer.

Note: Importance values rank species within a site based upon three criteria:

1) how commonly a species occurs across the entire forest;
2) the total number of individuals of the species;
3) the total amount of forest area occupied by the species.

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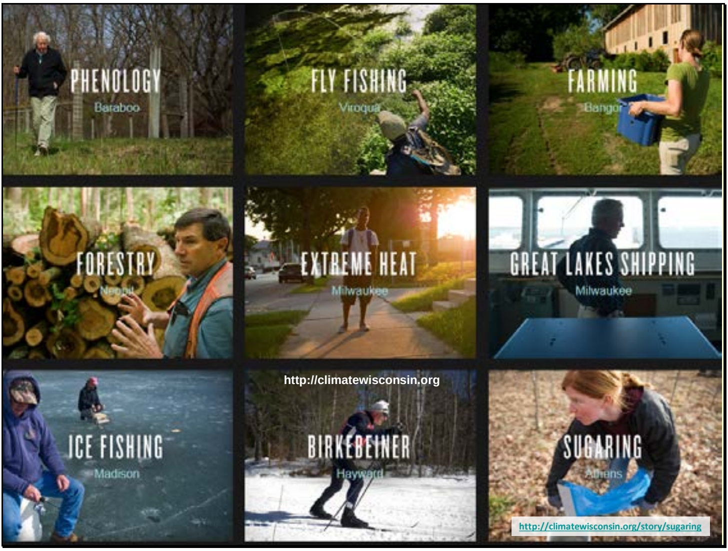


Play *Sugaring* (click on url)
Source: http://climatewisconsin.org/story/sugaring

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## Summary of Wisconsin's projected climate

- More frequent hot days
- Significant increase in heat waves
- Warmer nighttime and winter temperatures
- Moderate increase in frequency and intensity of precipitation
- Significant increase in rain during winter
- Impact on short term variability (weather) not understood

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**Discussion:**

Have you personally observed climate change?

What are the implications for communities?

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**Part 6**

Responses to climate change

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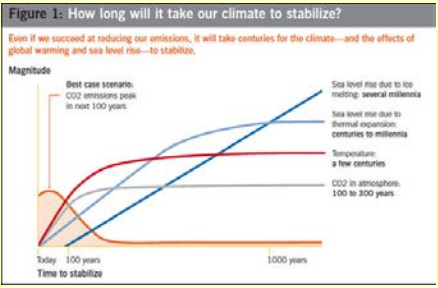
Responding to climate change:
a combined approach is needed




American Planning Association

**Mitigation:**
Necessary to avoid *dangerous* climate change

**Adaptation:**
Climate change is occurring; Adaptation needed to minimize impacts

- Atmospheric $CO_2$ and resulting warming trend will continue into future.
- In response need to work on both mitigation and adaptation.
- Mitigation to flatten the trajectory line to at least horizontal, maybe even downward, to prevent catastrophic warming.
- Adaptation is essential because we need to learn to live with the impacts.

Source:
http://www.planning.org/planning/2012/jan/waterwarriorsside2.htm

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## Mitigation: Reducing $CO_2$

- Energy Efficiency & Conservation
- Renewables: Solar, Hydro, Wind, Tides
- Carbon sequestration
- Nuclear Power
- Geo-Engineering

- There are a wide variety of mitigation strategies
- Many will require national consensus to move forward

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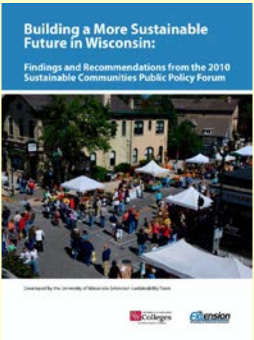
## Examples: UWEx role in mitigation (sustainability)




http://www3.uwsuper.edu/sustainability/Energy_Climate_Change.htm

Increase the amount of renewable energy generated in the state.

Develop local renewable energy and energy efficiency programs.

Update local ordinances to encourage energy conservation.

- Local programs can assist motivated individuals and businesses
- Sustainability is a useful concept for encouraging mitigation

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## Developing Climate Ready Communities

Climate Awareness

Vulnerability Assessment :

- Extreme heat
- Drought
- Heavy rainfall
- Warm winters
- Windstorms

Adaptation Capacity:

- Planning
- Resiliency

***Communities should be prepared for today’s rare weather extremes, they will become more common.***

- Community development and planning should acknowledge climate change

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## Case Study: Shawano County


Jay Moynihan

Understanding the potential areas of risk and opportunity posed by climate change

Understanding what climate change strategy is in the business context

Creating a *Rapid Climate Change Strategy* for business

- Businesses can be both economically and physically vulnerable to climate impacts
Source:
Jay Moynihan
Shawano County UW-Extension
(715) 526-6136
<jay.moynihan@ces.uwex.edu>
http://shawano.uwex.edu/community-development/
Blog: http://adaptationfactory.blogspot.com/

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## Challenges of Climate Adaptation

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

**e.g. civil infrastructure, natural resource management, hydropower**

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

**What margin of safety is affordable?**

**Place-based activities** – Can natural resource based economies and culture be relocated?

**We can't move the corn belt onto the Canadian shield**

***Win-Win strategies can hinge on climate change acceptance***

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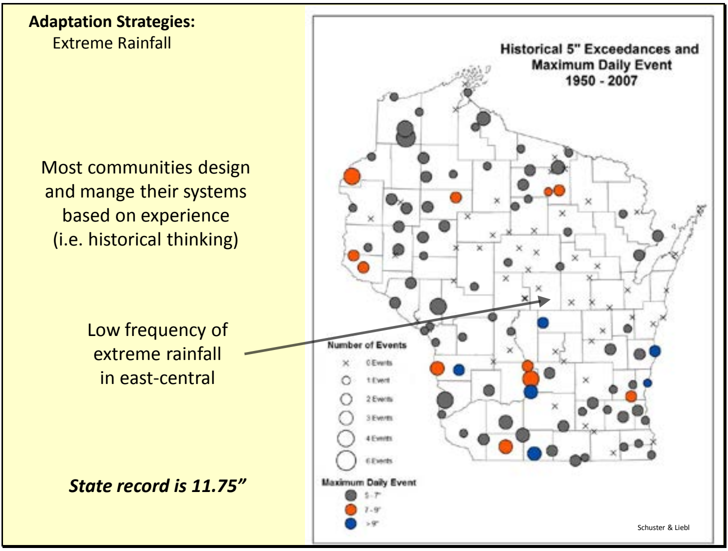


- Many Wisconsin communities have never experienced extreme rainfall.
- Communities in northeast WI are concerned about experiencing a 4”’ rainfall.
- Is it a statistical artifact or climate related? (unknown)

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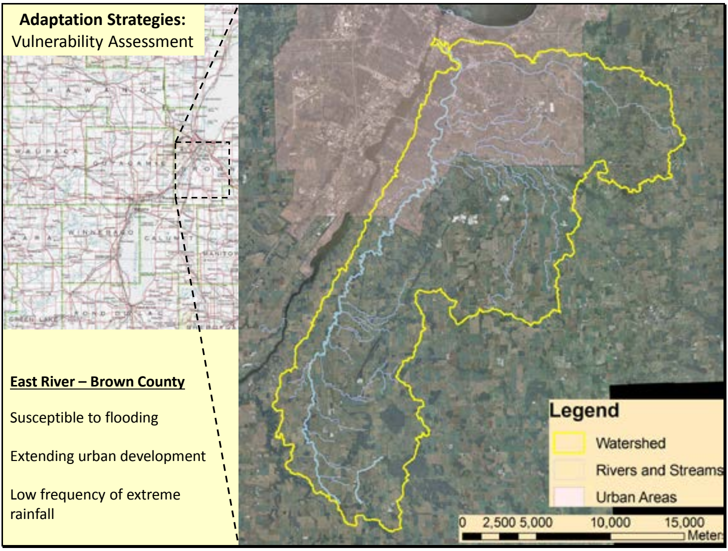


- Note steep slopes and "ladder" shape of watershed = high vulnerability to intense rainfall moving south to north

- Drainage in City of GB impeded by high Fox R and/or Green Bay elevations

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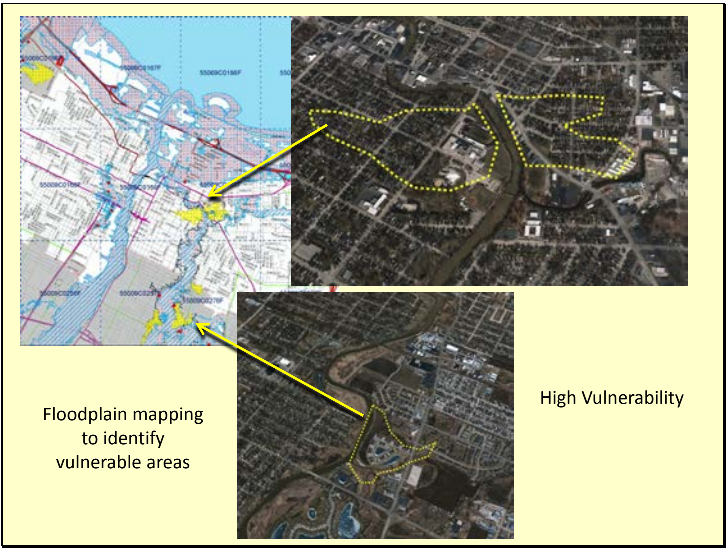


- 500-year flood elevations shown
- 2011 Resources for the Future study identified flood vulnerable areas
- High density residential downtown, low density multi-famliy upstream

## East River - Costs of flood vulnerability

| | *10-year flood* | *50-year flood* | *100-year flood* | *500-year flood* |
|---|---|---|---|---|
| Total building, content, and inventory loss (million 2010 $) | 55.88 | 80.11 | 95.62 | 123.78 |
| Business interruption loss[1] (million 2010 $) | 1.05 | 1.19 | 1.31 | 1.50 |
| Moderately damaged[2] buildings | 122 | 261 | 317 | 434 |
| Truckloads of debris generated (25 tons/truck) | 74 | 110 | 129 | 172 |

Source: RFF 2011

<u>Adaptation recommendations</u>

- Limit development to low-hazard structures
- Assess emergency warning and response capacity
- Anticipate removal of flood damaged structures
- Evaluate up-gradient flow control opportunities

- All require extensive community planning
Source: Kousky, C., S. Olmstead, M. Walls, A. Stern, M. Macauley, *The Role of Land Use in Adaptation to Increased Precipitation and Flooding: A Case Study in Wisconsin's Lower Fox River Basin*, November 2011, Resources for the Future

## Relevance of Climate Change to UW-Extension Programming

- Current weather extremes are consistent with the risk posed by climate projections.
- Communities that are prepared for today's weather extremes will be better adapted to future conditions.
- Extension's audiences are community members who are receptive to this point of view.

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## WICCI Adaptive Assessment Report

**Changes:**

- Climate Trends in Wisconsin
- Understanding Adaptation

**Impacts:**

- Water Resources
- Natural Habitat and Biodiversity
- Agriculture and the Soil Resource
- Coastal Resources
- People and their Environment

**Actions:**

- Implementing Adaptation
- Moving Forward


**www.wicci.wisc.edu**

- Working group reports provide specific impacts and adaptation strategies

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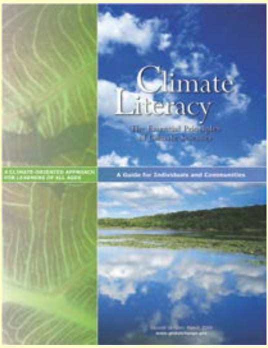
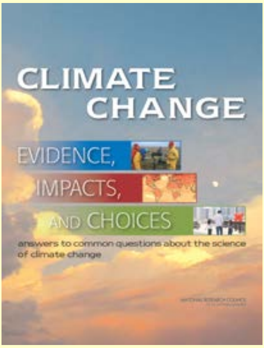
Other resources:




https://fyi.uwex.edu/climate/

Sources:

- http://www.cpo.noaa.gov/education/pdfs/ClimateLiteracyPoster-8_5x11_Final4-11.pdf
- http://nas-sites.org/americasclimatechoices/files/2012/06/19014_cvtx_R1.pdf

**Discussion:**

Integrating climate into UW-extension programs

***What is the most important "take-home" message for your office?***