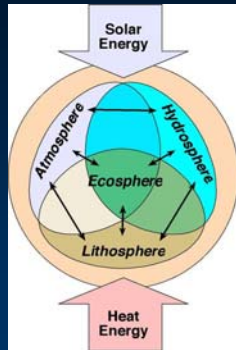


# Ecosystem Roadmap

We wish to know:

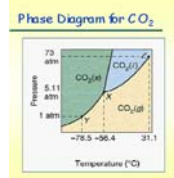
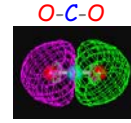
- **Where we are going?**
  - Tie together 3 previous sections of the class
  - Climate warming, acid rain, lost tropical rainforests
- **Why we should care?**
  - See Dave Allan's Roadmap lecture, *plus...*
- **How do we get there?**
  - Facts and concepts (and, dispelling "truth")



## 1. FACTS

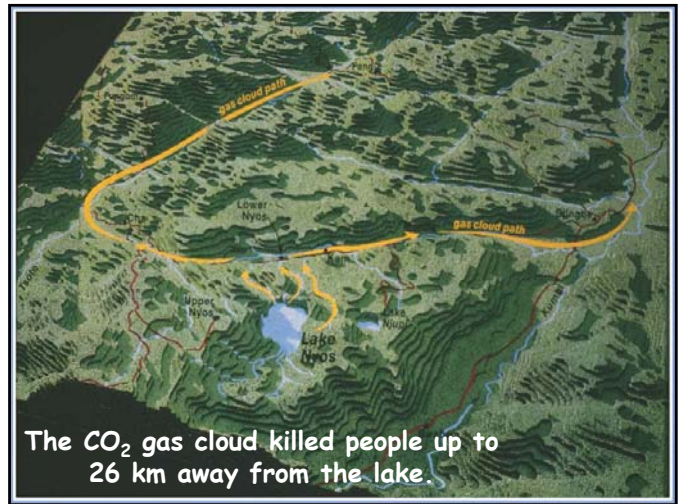
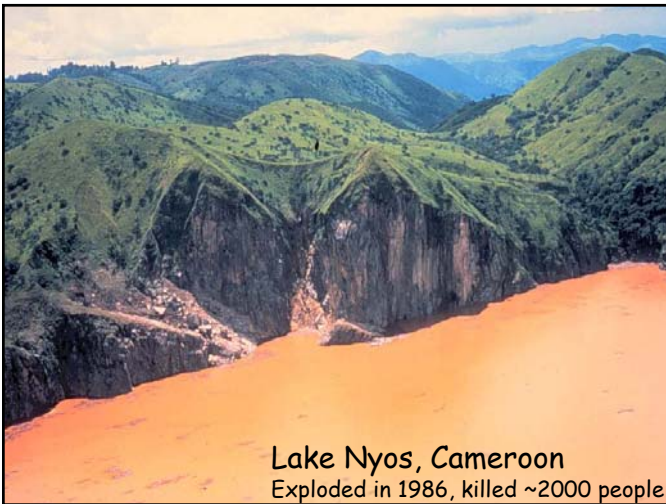
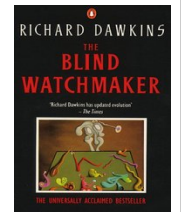
Physical constants of CO<sub>2</sub>:

| Mol. Weight | Density | mag. sus. | ref. index | Cp    | delta H |
|-------------|---------|-----------|------------|-------|---------|
| 44.01       | 1.799   | -21.0     | 1.663      | 29.14 | -110.5  |



## 2. CONCEPTS

"Life is like a blind watchmaker"



1. Fact/Concept ratio Low = ?

*Philosophy*

2. Fact/Concept ratio High = ?

*Engineering, Medicine*

### Scientific Concepts:

Negative/Positive Feedback - *Perry's Roadmap*

Standing Stock

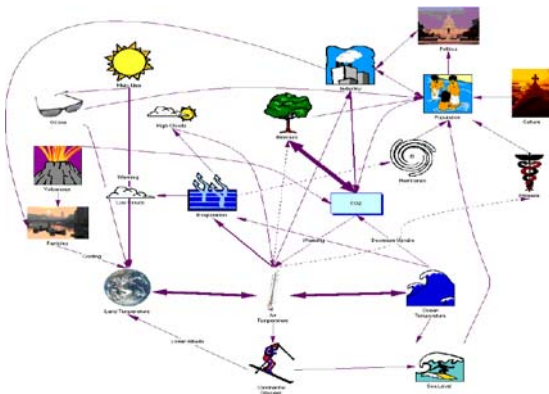
Mass Balance

Material Flux Rate

Residence Time

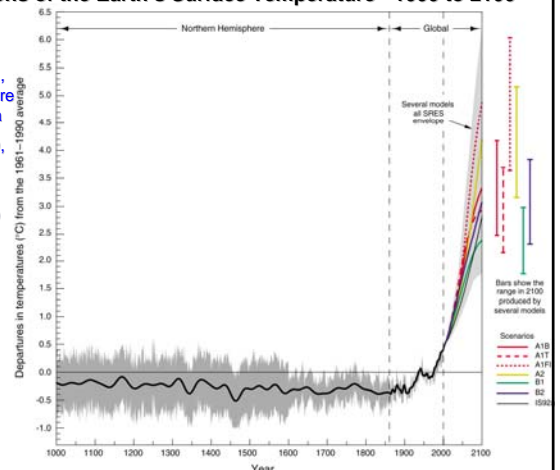
### Understanding Complex Systems --

*Use conceptual tools (and some facts...)*



### Variations of the Earth's Surface Temperature - 1000 to 2100

- 1000 to 1861, N. Hemisphere — proxy data
- 1861 to 2000, Global — instrumental
- 2000 to 2100 Global — model projections



- "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities"

- "...most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations".

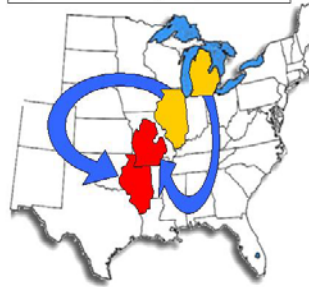
IPCC 2001

*This has never happened before!*

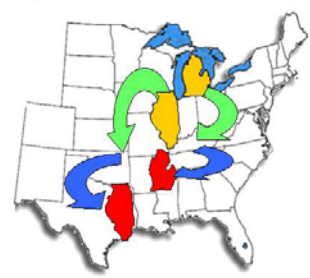


### Climate Warming will Impact the Future Weather we "Feel" in Michigan and Illinois

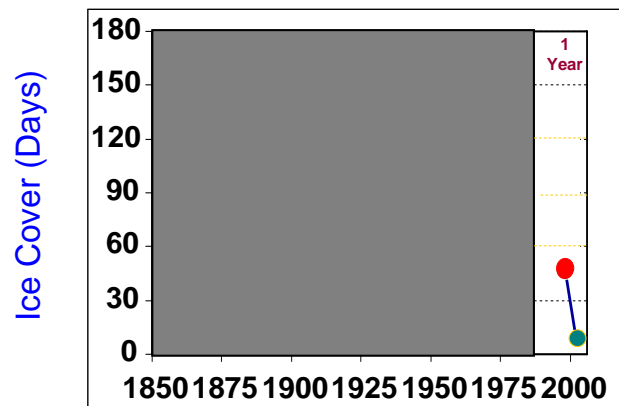
Changing IL and MI Winters (DJF)  
By 2030 - no change By 2095



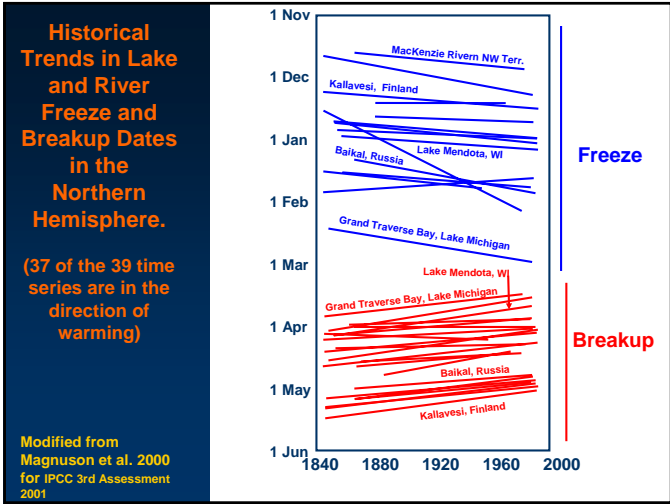
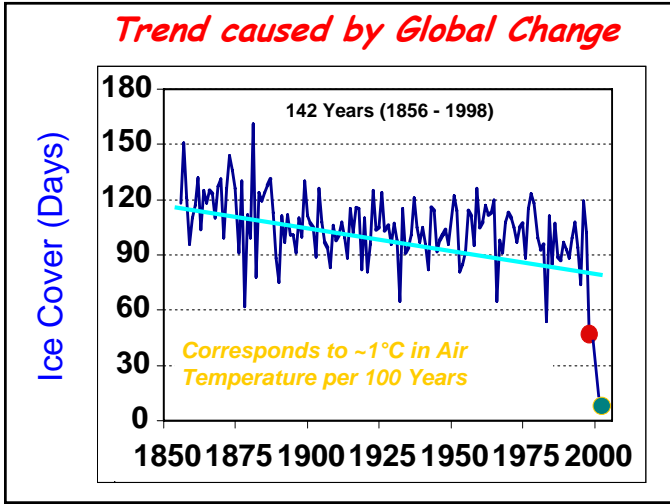
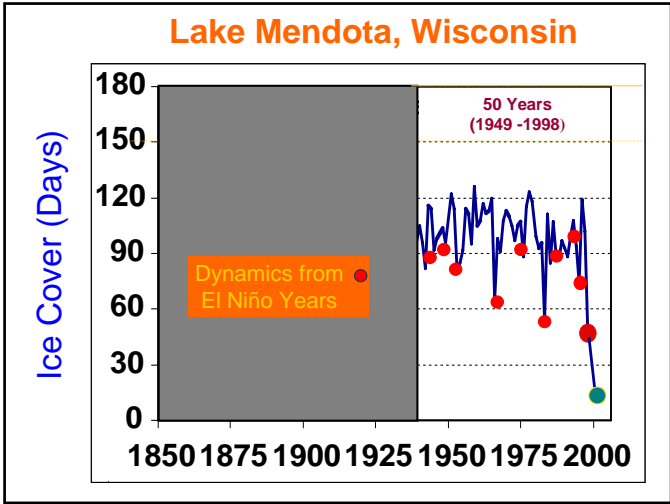
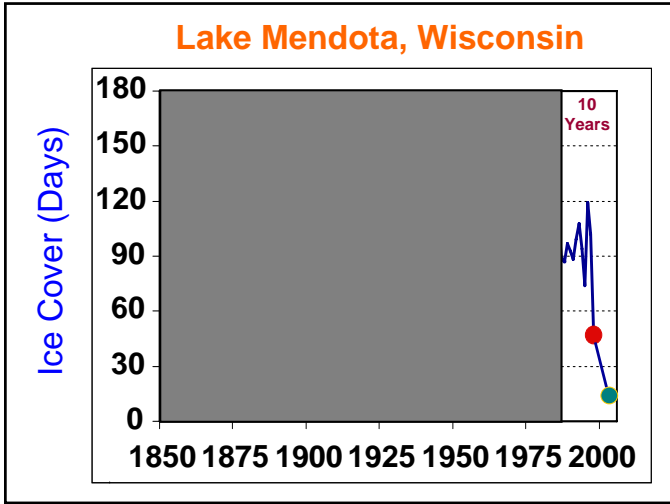
Changing IL and MI Summers (JJA)  
By 2030 By 2095



### Lake Mendota, Wisconsin



Mannuson, April 2001



## Climate Change

1. How do we know it's happening?

-- Easy, just look around

2. What do the skeptics say?

Lay-person's view -- *doubt and uncertainty*

Professional approach

-- *uncertainty and deception*



We don't care who made the watch, we just want to know how it works!

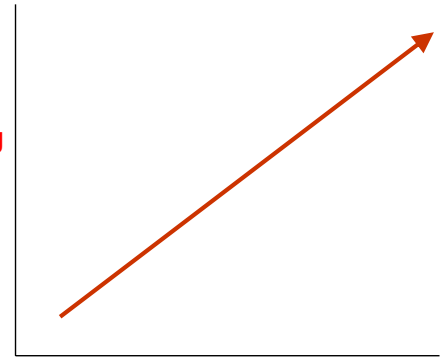
#1

Understand? Believe?

Air Conditioning Costs

0

Summer Temperatures



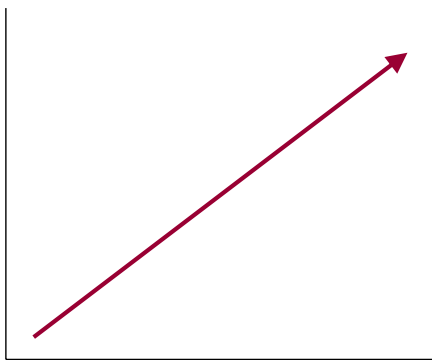
#2

Understand? Believe?

Earth's Surface Temperature

0

Number of Sun Spots



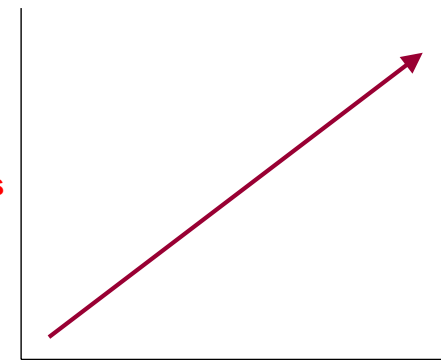
#3

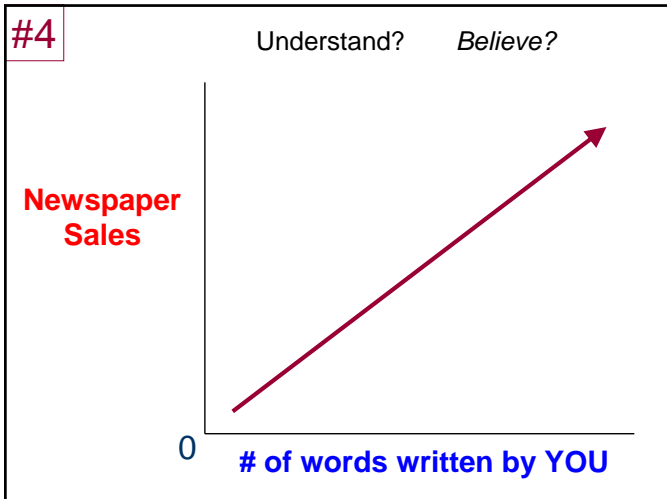
Understand? Believe?

Birth Rate in the Netherlands

0

Number of Stork Sightings





## How does it work?

1. Mechanism OK  
Size/Impact OK  
*(temperature & air conditioning costs)*
2. Mechanism OK  
Size/Impact too Small  
*(temperature & sun spots, # words written by YOU)*
3. Mechanism Bad  
*(birth rate & stork sightings)*  
*Hey, it's all BS! (Babies and Storks...)*

## The Political Uses of Uncertainty:

- All parties use uncertainty as rhetoric
  - Conservative: support for "high-proof" positions
    - *Uncertainty as a reason to wait*
  - Science: support for further research and political importance
    - *Uncertainty as a reason to continue*
  - Liberal: support for "frontier" positions
    - *Uncertainty as a reason to act*

We **must** learn how to apply Science (and its uncertainties) to Real Problems

## My Themes

- Global change on our planet can only be understood by combining "abiotic" and "biotic" components - must look at the whole Ecosystem
- A combination of facts and scientific concepts can help us understand even the most complicated problems
- Science is NOT hard (it might sound scary), and everyone can learn enough to make rational decisions about our world's future

## Possible Projects

- The "missing sink" - Where did all the dang CO<sub>2</sub> go?
- Microbes rule, Humans drool
- Does the rainforest really matter?
- The day the Earth turned brown and blue - The limits to food production
- Who's doing who? Climate skeptics and the use and misuse of Science
- Who needs more ice? Melting the Earth's glaciers (a.k.a. "Water World 2050", starring P. Samson as K. Costner...)
- WWF Climate slug-fest, 2005 - People vs. Nature
- The politics of uncertainty and the Scientific Platform
- Whatcha gonna do when the rain don't come - Shifts in the Global water cycle