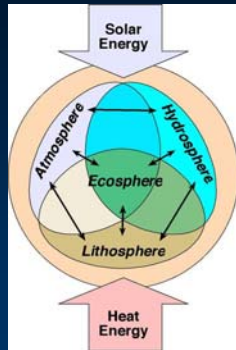


Ecosystem Roadmap

We wish to know:

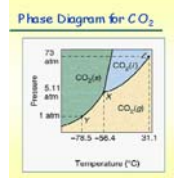
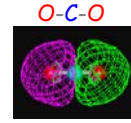
- **Where we are going?**
 - Tie together 3 previous sections of the class
 - Climate warming, acid rain, lost tropical rainforests
- **Why we should care?**
 - See Dave Allan's Roadmap lecture, *plus...*
- **How do we get there?**
 - Facts and concepts (and, dispelling "truth")



1. FACTS

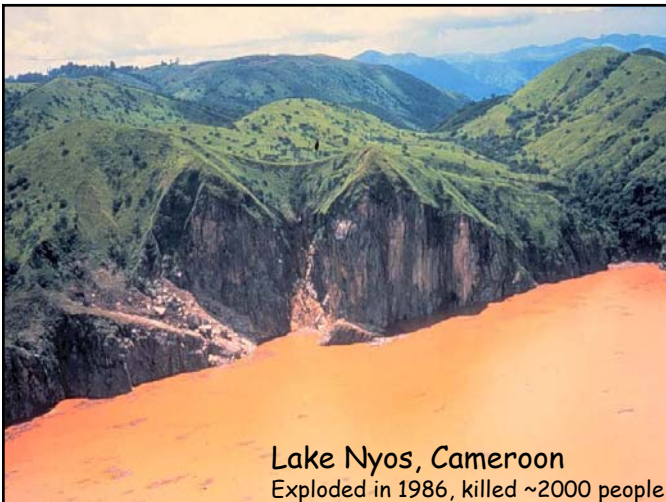
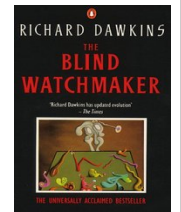
Physical constants of CO₂:

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

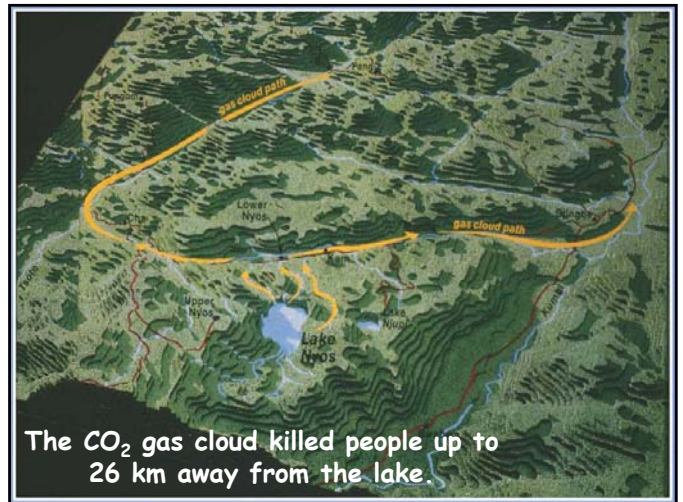


2. CONCEPTS

"Life is like a blind watchmaker"



Lake Nyos, Cameroon
Exploded in 1986, killed ~2000 people



1. Fact/Concept ratio Low = ?

Philosophy

2. Fact/Concept ratio High = ?

Engineering, Medicine

Scientific Concepts:

Negative/Positive Feedback - *Perry's Roadmap*

Standing Stock

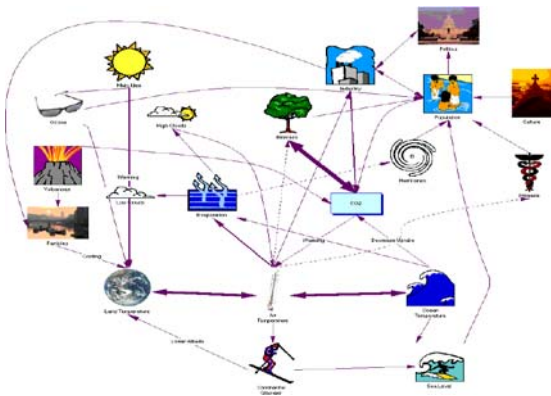
Mass Balance

Material Flux Rate

Residence Time

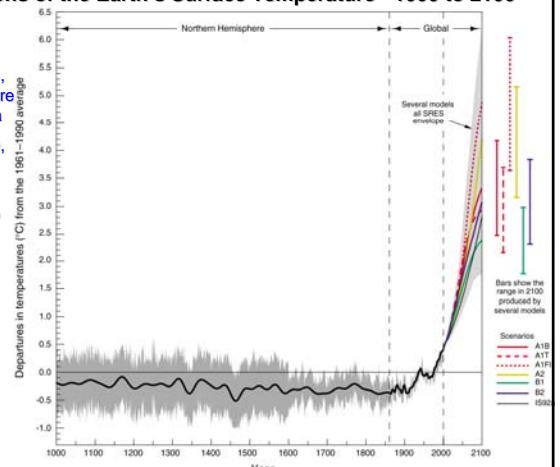
Understanding Complex Systems --

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".

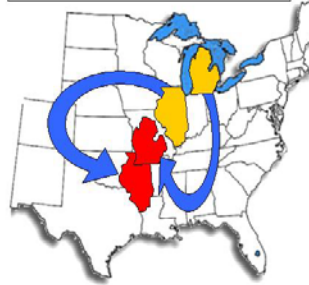
IPCC 2001

This has never happened before!



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

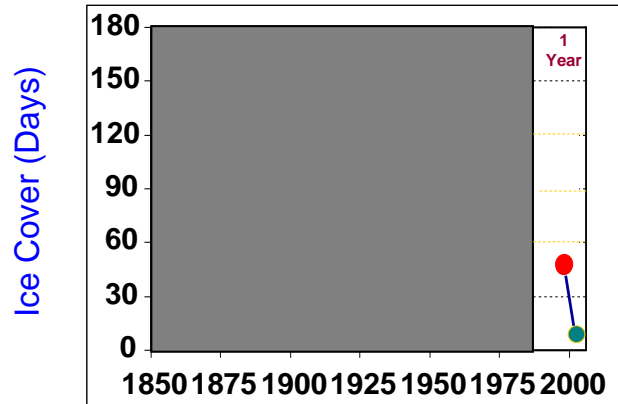
Changing IL and MI Winters (DJF)
By 2030 - no change By 2095



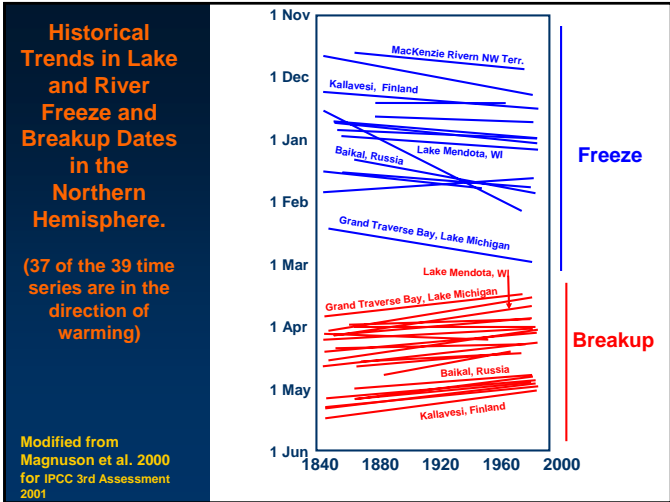
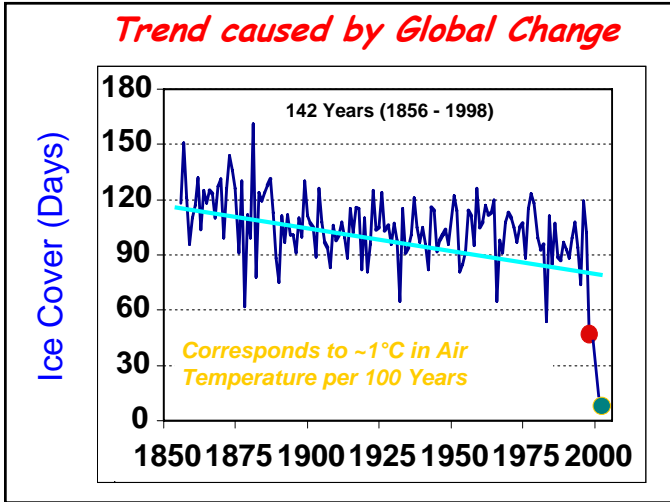
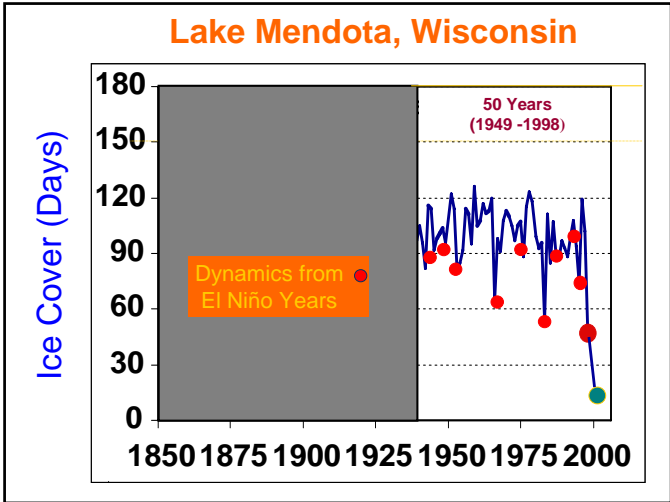
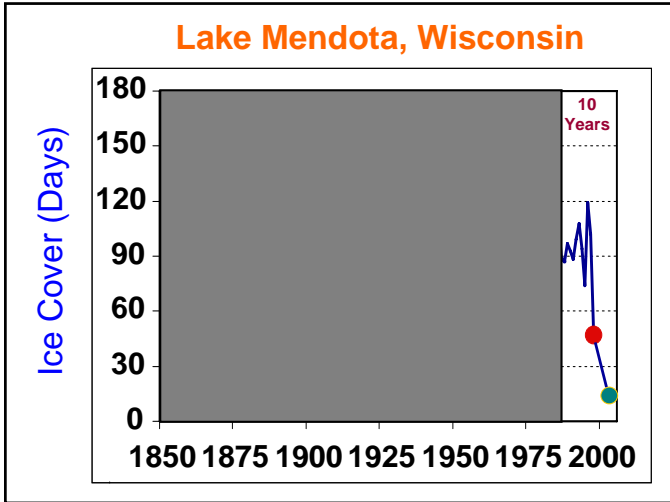
Changing IL and MI Summers (JJA)
By 2030 By 2095



Lake Mendota, Wisconsin



Manuscript, 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!

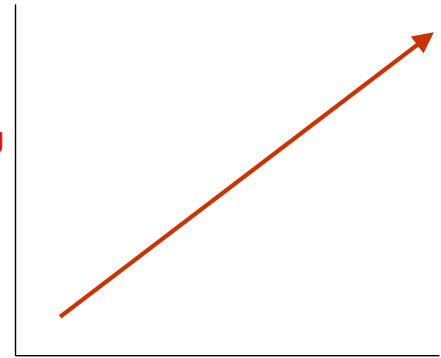
#1

Understand? Believe?

Air Conditioning Costs

0

Summer Temperatures



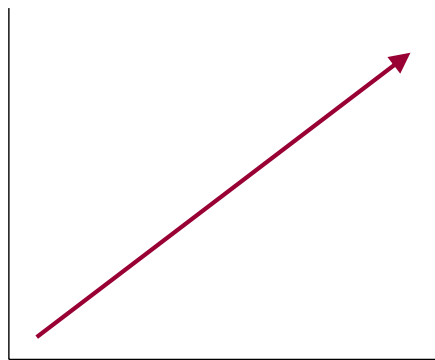
#2

Understand? Believe?

Earth's Surface Temperature

0

Number of Sun Spots



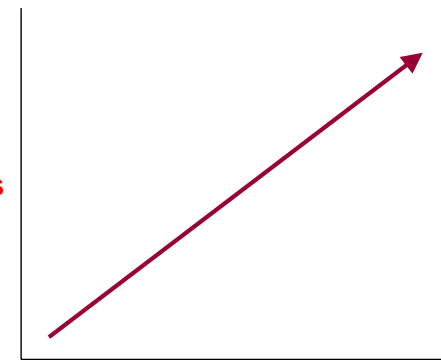
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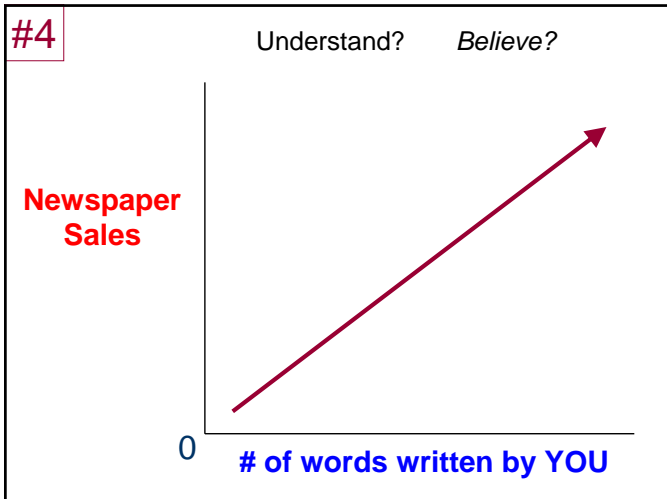
Understand? Believe?

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 CO₂ 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