

Understanding relationships between lakes and people: Insights from the North Temperate Lakes Long-Term Ecological Research Program

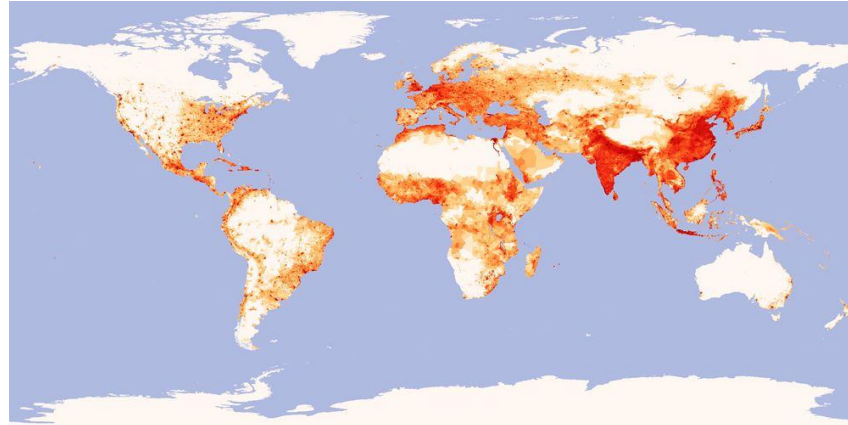
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How much monitoring is needed in a long-term laboratory?

- My charge:
 - Major insights from a long-term research program
 - Perspectives on monitoring, detecting human impacts

How much monitoring is needed in a long-term laboratory?



Global population distribution

Perspectives on monitoring, detecting human impacts



Perspectives on monitoring, detecting environmental change

Welcome to
**North Temperate Lakes
Long Term Ecological Research**

LTER



<http://lter.limnology.wisc.edu>



North Temperate Lakes LTER

How do climate, social-ecological interactions, land use and cover, and ecological processes act in concert to shape the past, present, and future of lake districts?

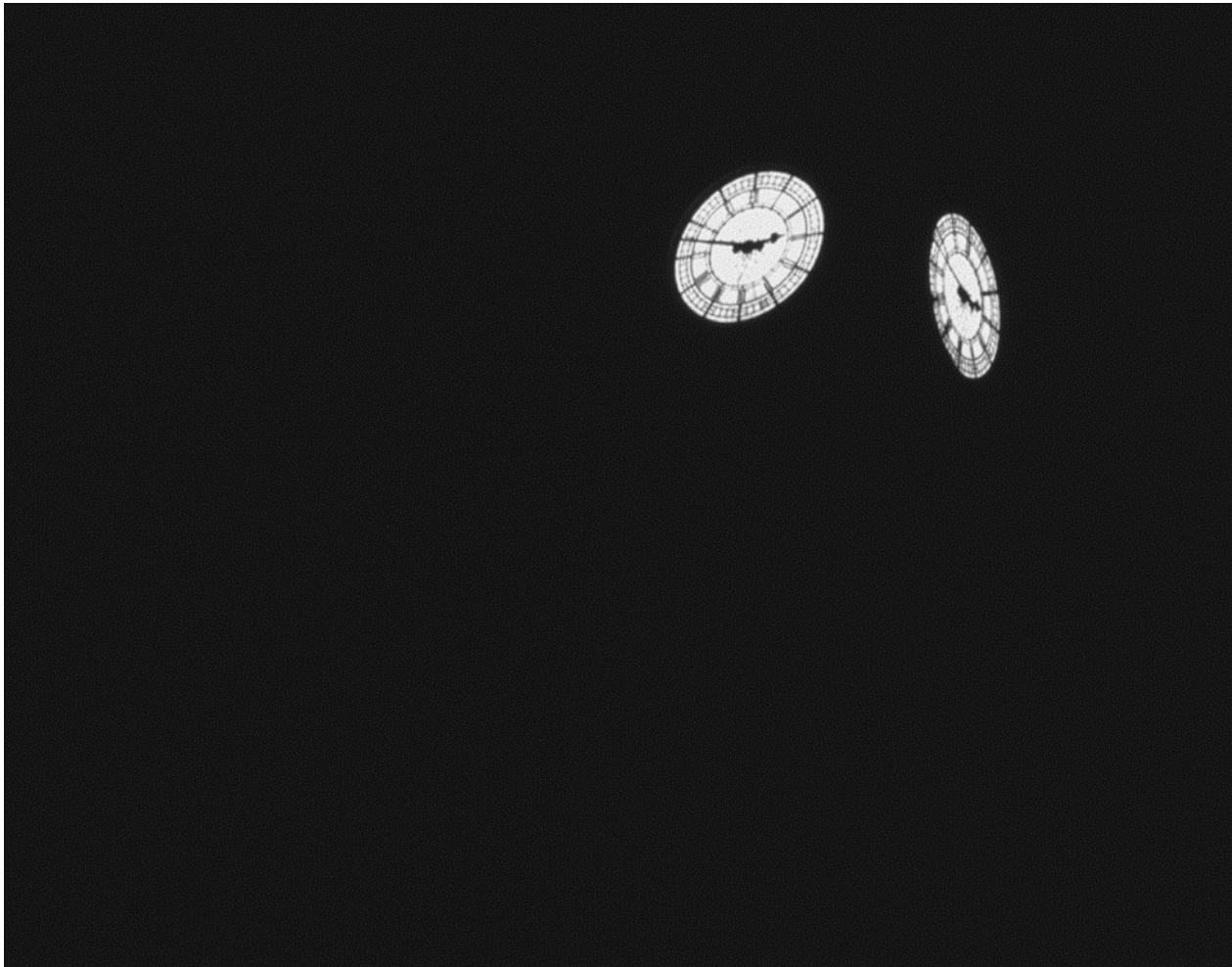
- **Long-term measurements**
 - Physical, chemical, biological, social variables
- Comparative studies
- Whole-ecosystem experiments
- Modeling and synthesis

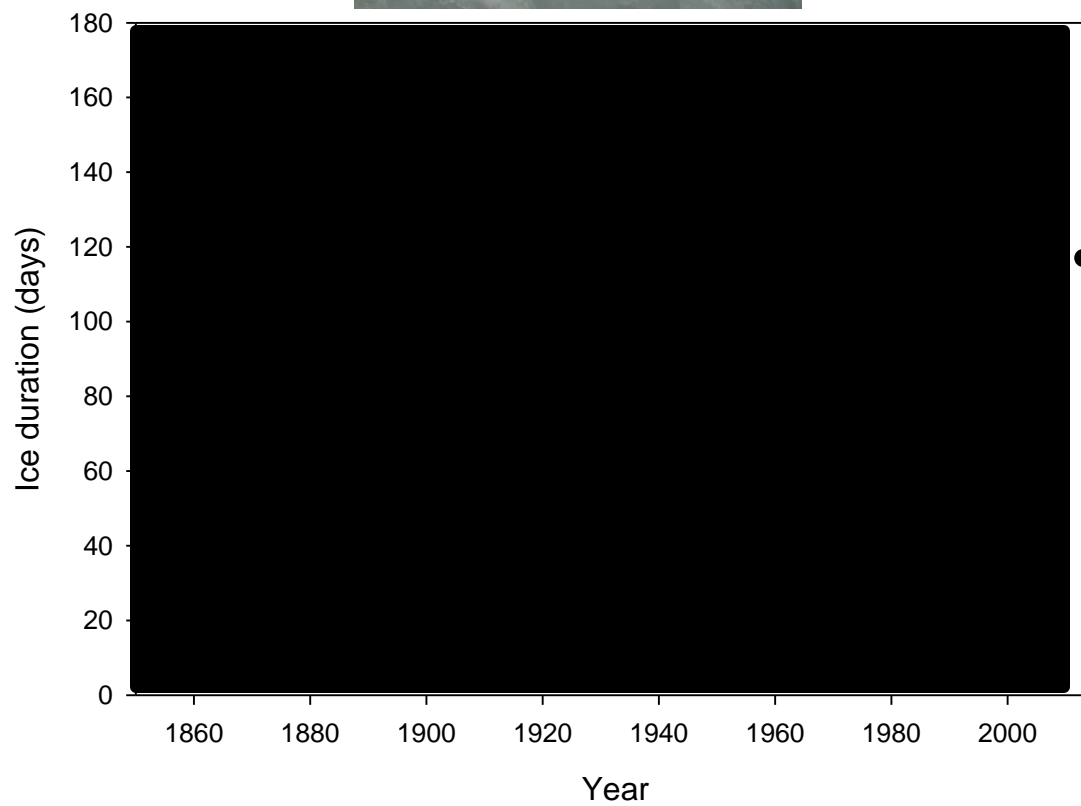
Motives for starting the U.S. LTER program, 1981→

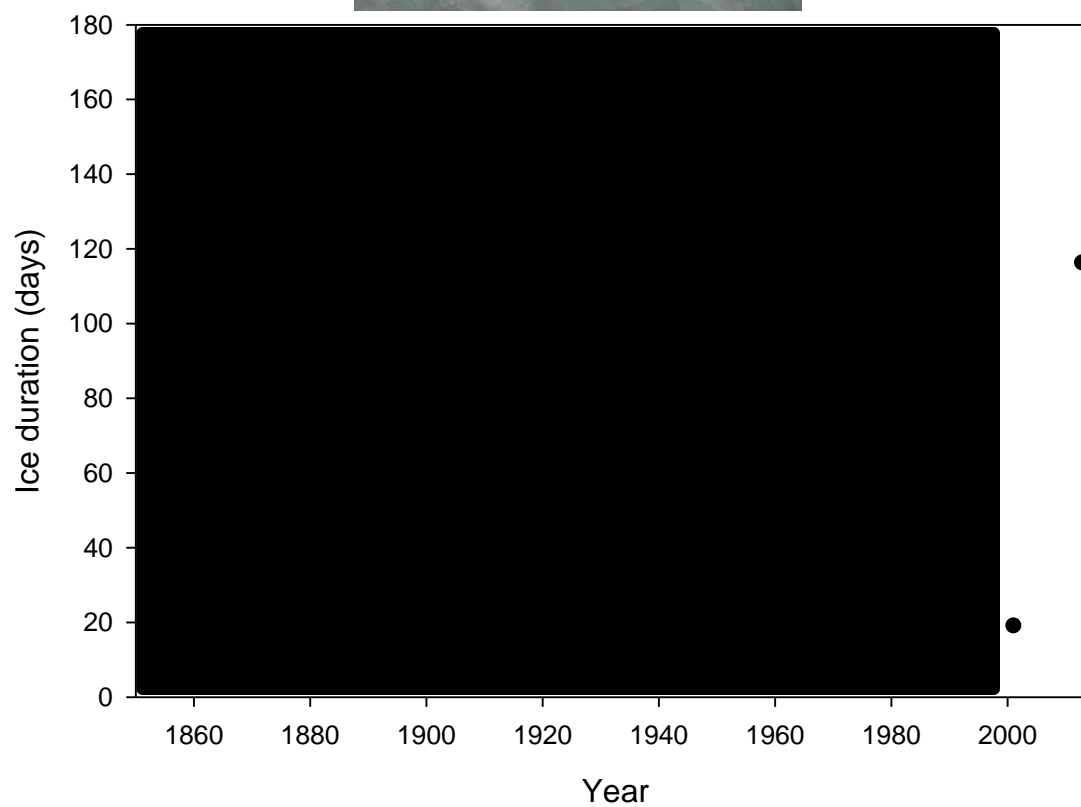
- Capture phenomena at scales >3 yrs
- Detect long-term trends/changes that may be under way (cycles vs. directional change)
- Provide a context for short-term work
- Be more comprehensive in variables being measured
- Ongoing habitat degradation

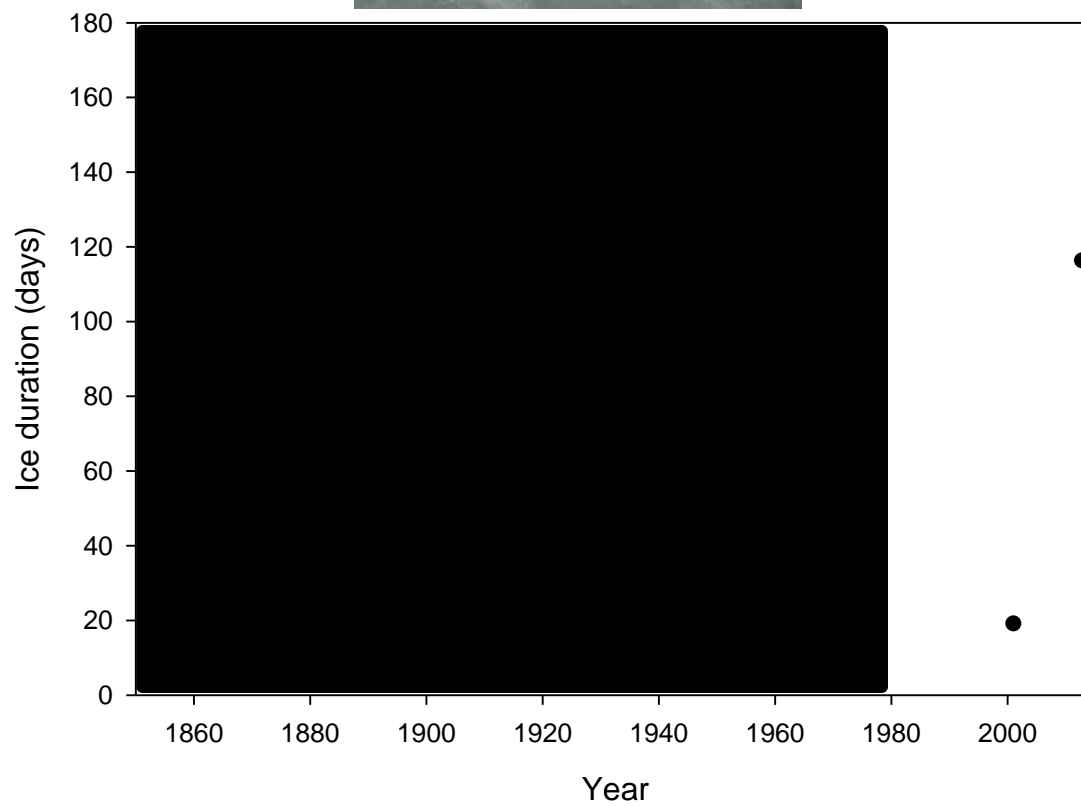
The invisible present

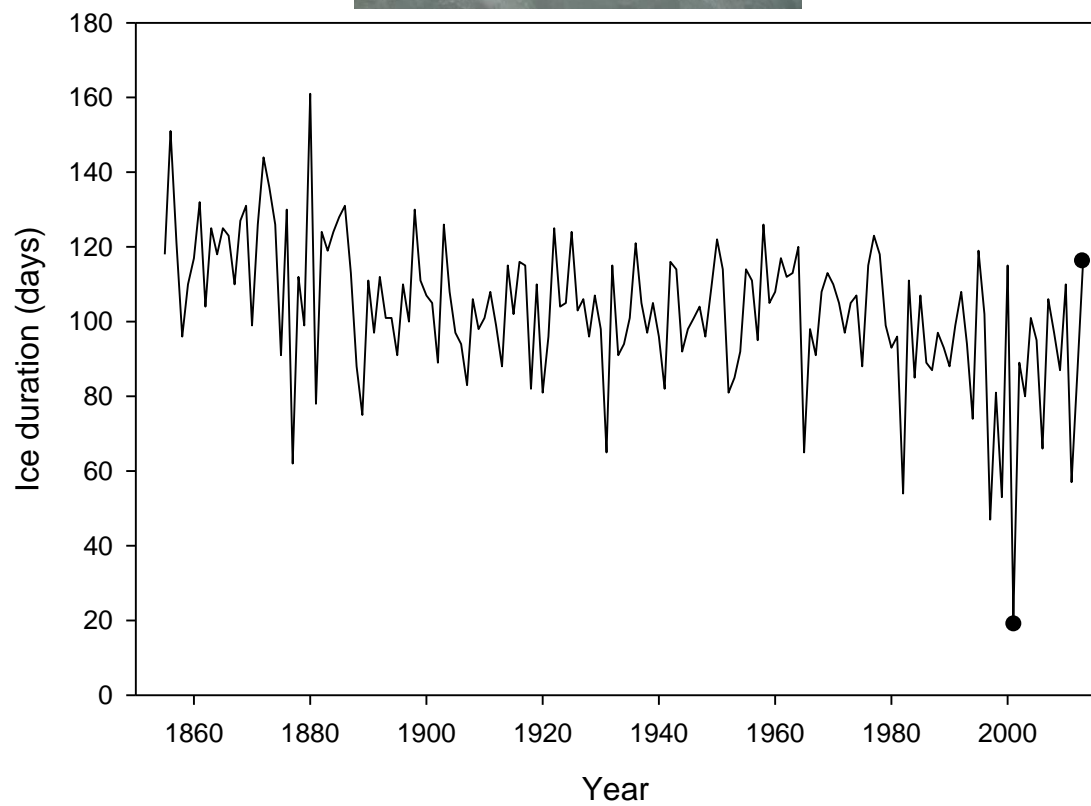
John Magnuson











The Invisible Present

John Magnuson

“Because we are unable directly to sense slow changes and because we are even more limited in our abilities to interpret their cause-and-effect relations, processes acting over decades are hidden and reside in what I call ‘the invisible present’.”

“In the absence of long term research, serious misjudgments can occur in attempts to manage the environment.”

1-3 years

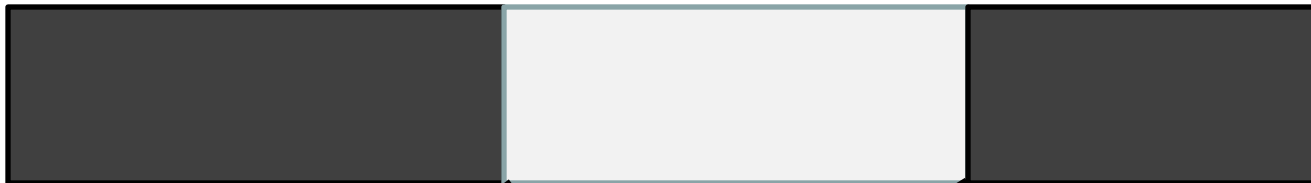


Time



500 Years

50-100 years

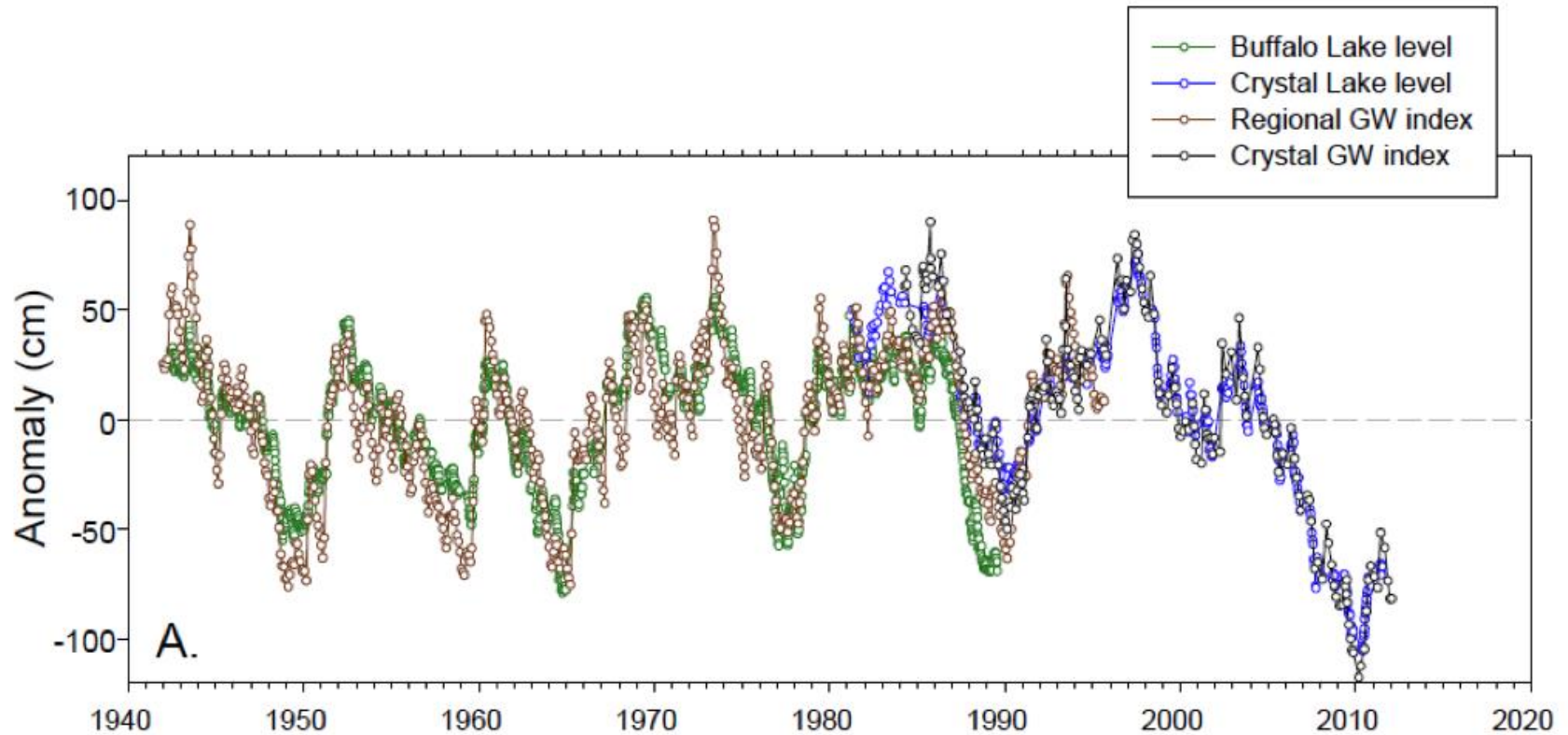


Time



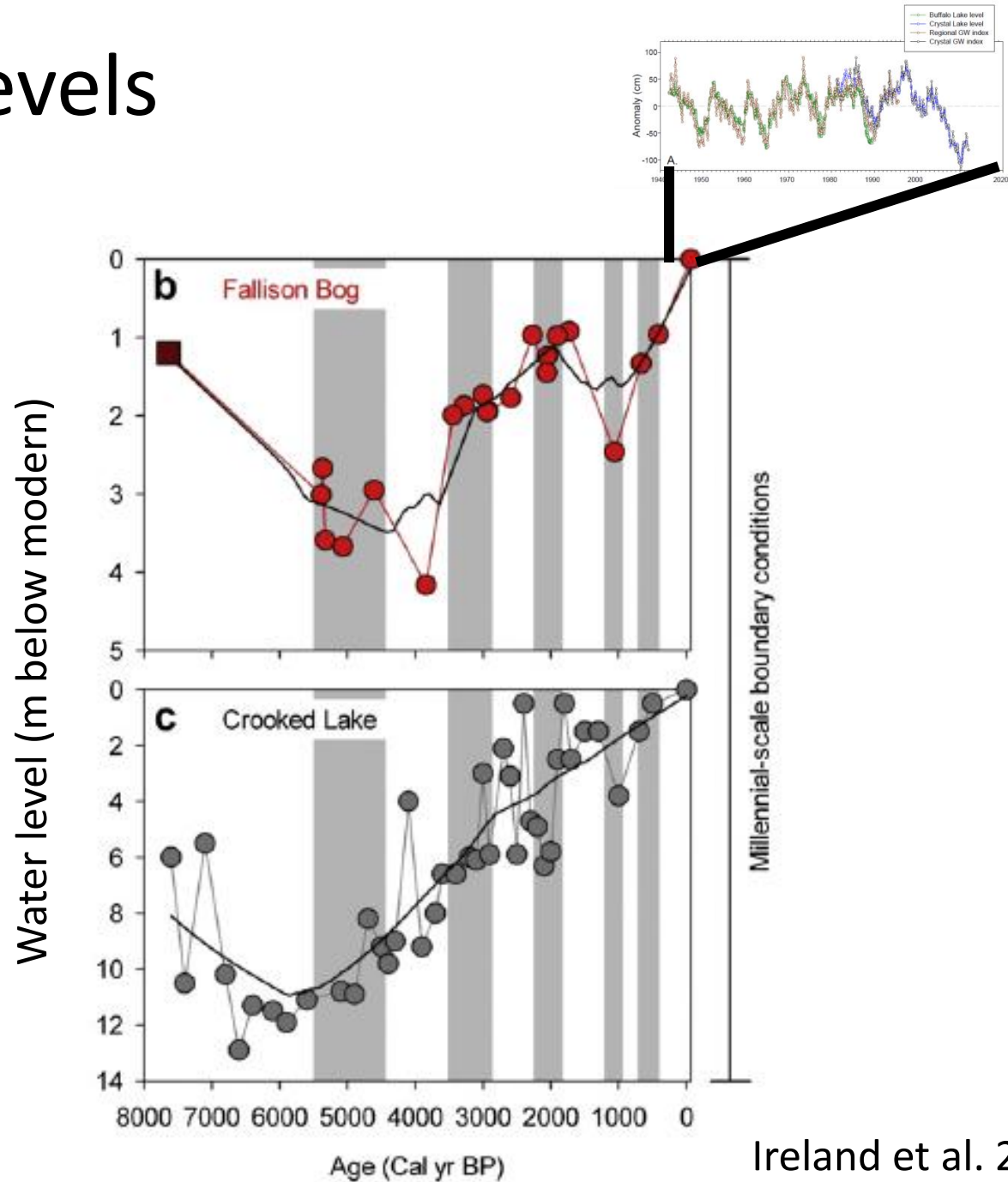
10,000 Years

Lake levels



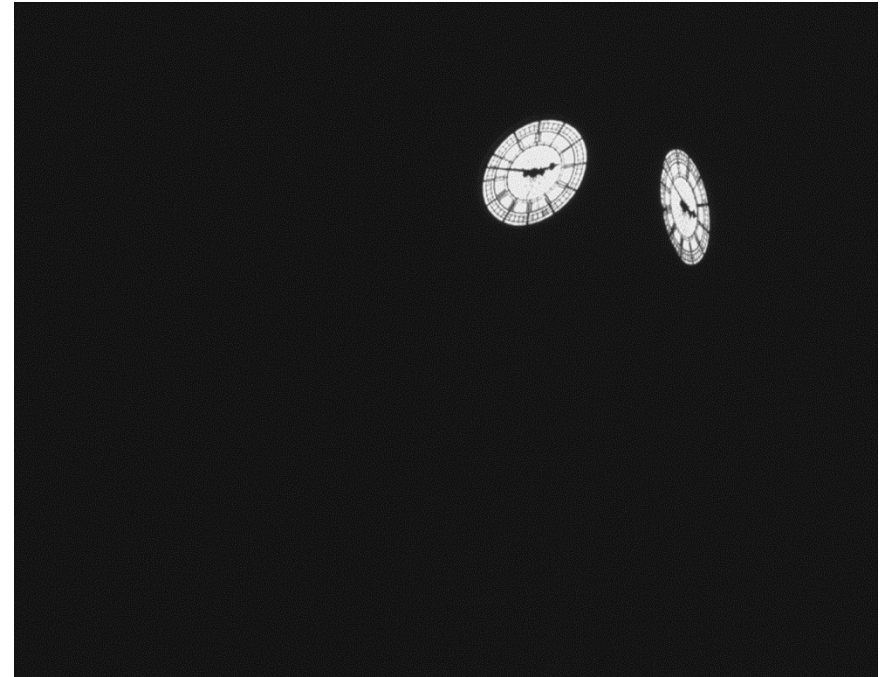
Watras et al.2014

Lake levels

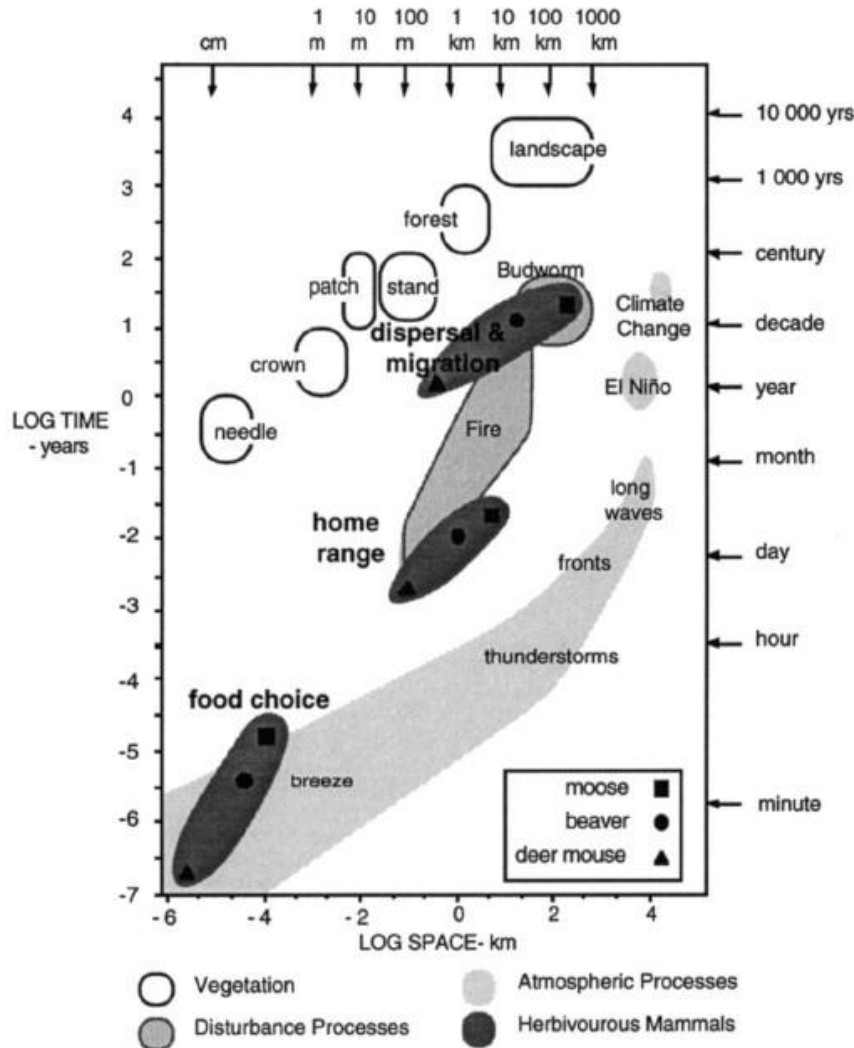


The Invisible Present

- Long term data are essential for understanding slow changes
- But there are other, slower changes going on over longer time scales



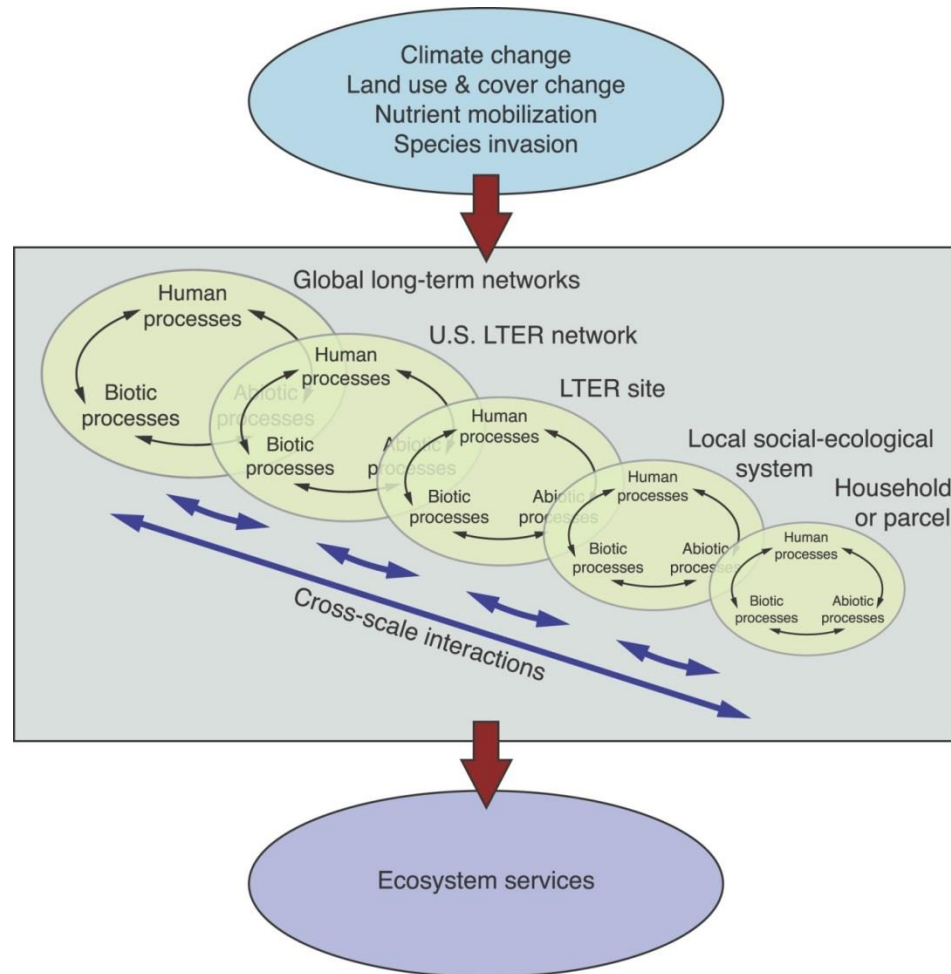
Slower processes often occur over larger areas



Time and space scales
of the boreal forest

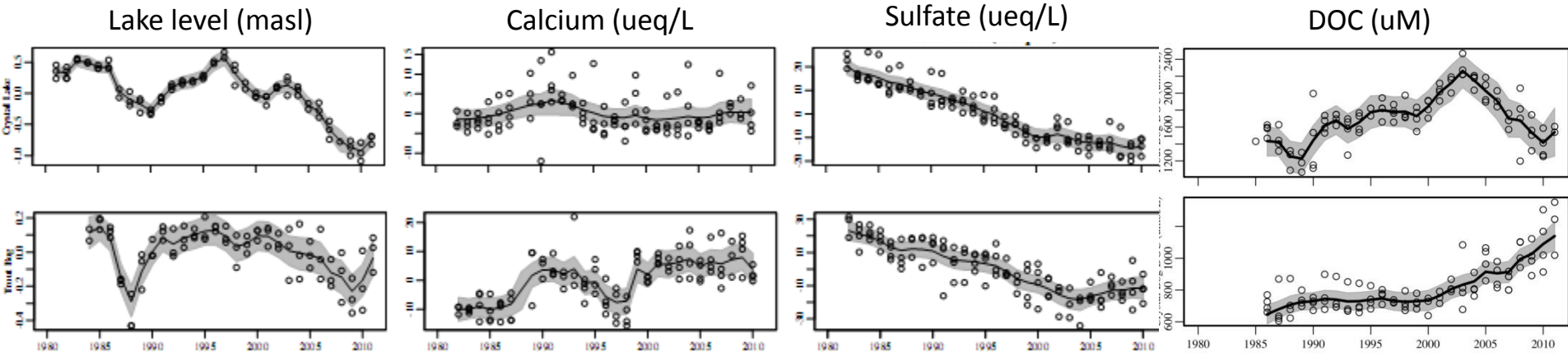
Gunderson & Holling (2002)

Changes in any one place reflect multiple interacting drivers acting at multiple time scales



NTL-LTER conceptual framework

Everything is changing all the time



Lake levels and chemistry in adjacent lakes

Challenges

- Detecting effects of any one process (e.g., regional human impacts) can be difficult...
- But not impossible, and long-term measurements are essential for providing critical insights

REPORTS

Long-Term Effects of Acid Rain: Response and Recovery of a Forest Ecosystem

G. E. Likens,* C. T. Driscoll, D. C. Buso

Identifying variables prone to extremes

Long-term data can be used to:

- Identify 'record-setting' variables
- Characterize disturbance regimes

Use Long-term data to look forward

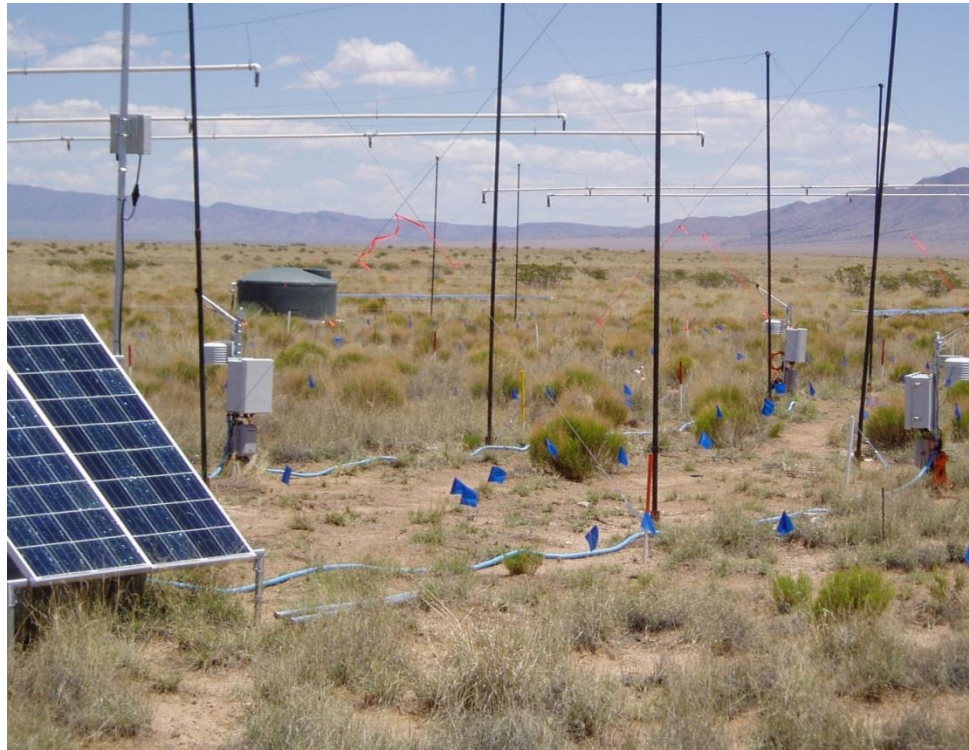
- Data can be used to consider outcomes of different scenarios of the future
 - Identify vulnerabilities, inform management actions

Comparing Climate Change and Species Invasions as Drivers of Coldwater Fish Population Extirpations

Sapna Sharma^{1*}, M. Jake Vander Zanden¹, John J. Magnuson¹, John Lyons²

Opportunities

Explosion in capacity to measure, analyze environmental change.



*A critical challenge: managing, the data and making it available

- Change is constant, and is a product of multiple interacting drivers that occur at multiple spatial and temporal scales
- Detecting effects of any one driver requires context
 - Collections of long-term data
- And- long-term datasets are potent tools for identifying sensitive variables, exploring future scenarios of change



Happy Birthday!



Thank you / Merci / Danke