

Assessment to Action...

Olivia LeDee, Ph.D.
ALC3184 - Climate Change Vulnerability Assessment
Lacrosse, WI
September 30-October 2, 2014

The Challenges...

- Mandates/Authority
- Funding
- Stakeholder Support
- Expertise/Confidence
- Response Time
- Durability
- Economic Impact

To illustrate...

2nd in the nation for angler participation (32%)

4th in the nation for angler expenditures (\$2.4b)

- \$1.4 billion: Equipment expenditures such as boats, vehicles, rods, reels, lines, etc.
- \$925 million: Trip-related expenditures such as food, lodging, transportation
- \$41 million: Other such as magazines, membership dues, leasing, etc.



Science and Decision-Making

“The predictive capacity of science holds great inherent appeal...”

- Reduce uncertainty
- “Rational”
- Less prone to stakeholder conflict

“We’re Set”

Sarewitz and Pielke, 1999

Optimal Decision-Making

Optimal: from set of competing options, one maximizes benefits/minimizes costs.

“what is likely to happen in the future”

Predict-Then-Act

Lempert and Schlesinger, 2000
Lempert et al. 2004

Prediction

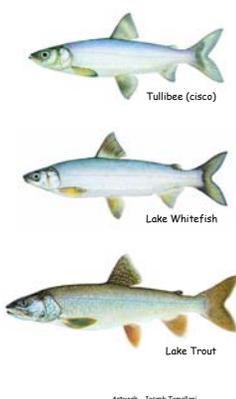
What is prediction?

- 1: hypothesis testing (if-then)
- 2: use of observational data + models to estimate the time, place, and characteristics of future events to meet a goal

Sarewitz and Pielke, 1999

Protecting coldwater fish from climate change:
Building resilience in deep lakes using a landscape approach

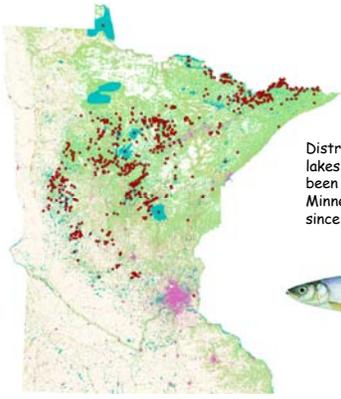
Peter Jacobson, Don Pereira,
Mike Duval - Minnesota DNR
Xing Fang - Auburn University
Heinz Stefan - University of Minnesota



Tullibee (cisco)
Lake Whitefish
Lake Trout

Artwork - Joseph Tomalleri



Distribution of 648 lakes where cisco have been sampled in Minnesota DNR surveys since 1946



Artwork courtesy of Joseph Tomalleri



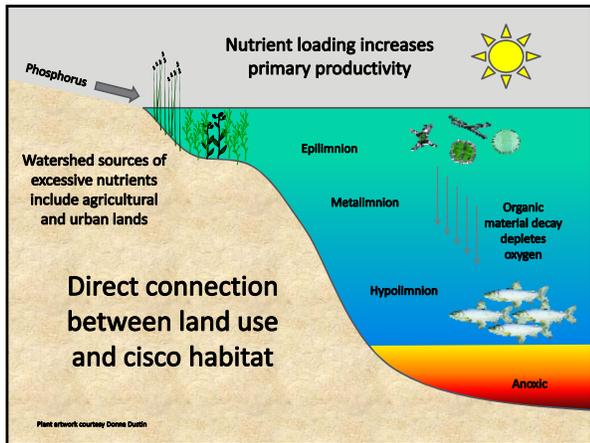
Step 1

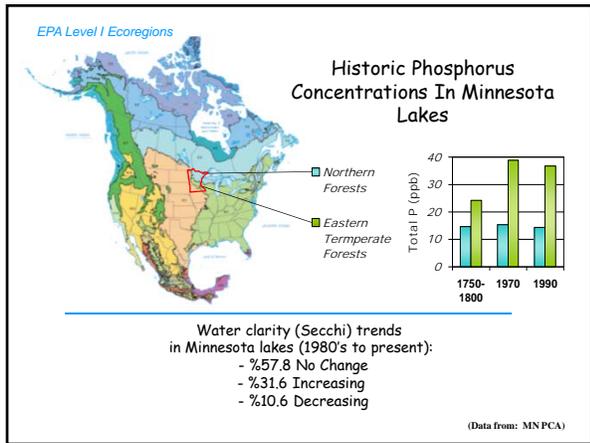
Are there changes in the system?

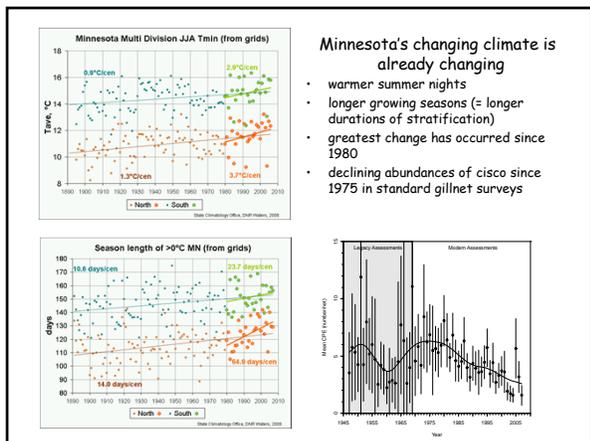


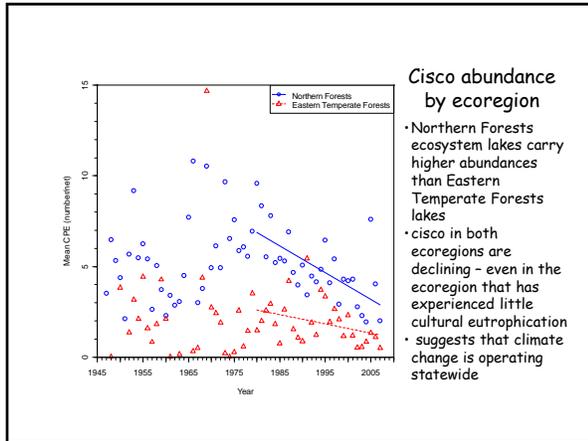
Step 2

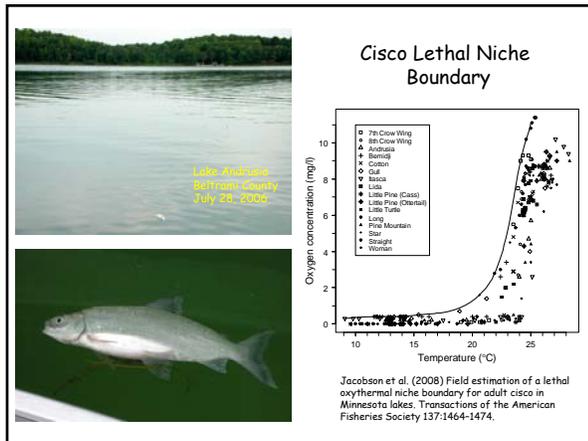
What is the cause?

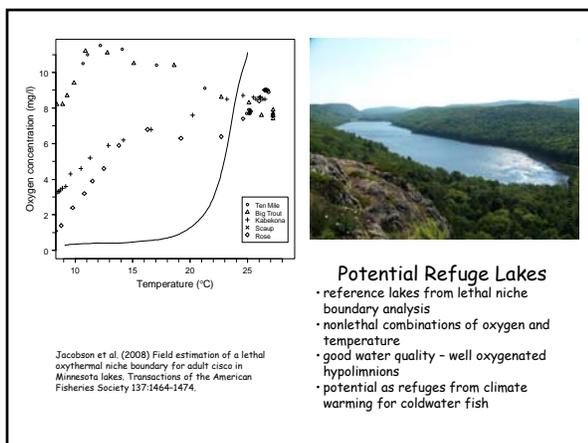






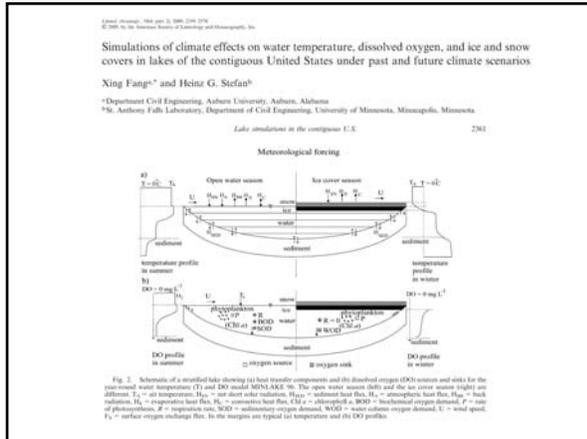




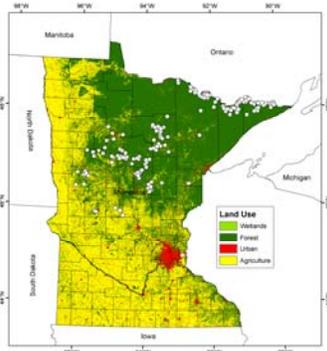


Step 3

Where might lake conditions stay below the lethal limit?



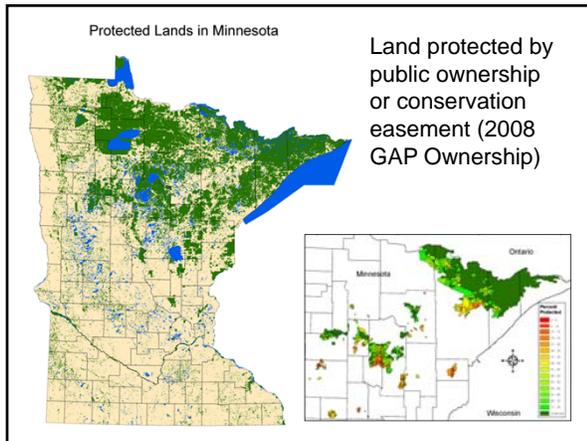
176 cisco refuge lakes identified by Fang and Stefan



Tier 1	most suitable
Tier 2	suitable
Tier 3	not likely

Step 4

We can't invest in all of this, so which ones are most important?



Prioritization:

- 1) threat (changes in land use)
- 2) investment efficiency (surface area per amount invested)

"To provide sufficient protection (75% public ownership or easement protected) for the 301 refuge lake catchments that have undisturbed watersheds (<25% disturbance) that are not yet protected in Minnesota would require US\$156 million to purchase conservation easements on 124,951 ha."

Jacobson et al. 2011

Step 5

How do we direct resources to protect these landscapes?

Clean Water Legacy Funding to protect forested watersheds of cisco refuge lakes

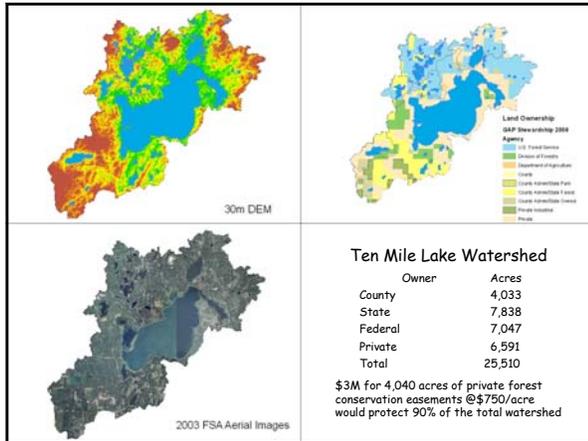


Minnesota Forests for the Future
Conserving Minnesota's working forest lands to meet the state's future recreation, economic, and ecological needs.

Minnesota Forest Legacy
Habitat, Jobs and Recreation for Future Generations

Private Forest Conservation Easements





Treasures of the Deep: protecting hypolimnetic oxygen in Minnesota lakes

- Hypolimnetic oxygen will be an increasingly valuable ecological resource in a climate warmed Minnesota
- Deep lakes with good water quality need extra protection
- Statewide significance
- High priority for shoreland and watershed protection
- Invest \$180 million to protect 300,000 acres (\$600/acre) of forest to protect watersheds of 176 coldwater refuge lakes.

Tullibee (cisco)

Lake Whitefish

Lake Trout

Artwork - Joseph Tomelleri

To Do...

1. Identify/align focal areas
2. Allocate resources and sustain effort
3. Get to the mechanism
4. Prioritize
5. Leverage resources

In the meantime...

Insight: general scientific knowledge about the future

“Scientific insight tells us that earthquakes are more likely to occur within 100km of fault zones; scientific predictions seek to tell us which fault zone, on what day, and to what extent”

Sarewitz and Pielke, 1999

Robust Decision-Making

Robust: options insensitive to future uncertainty

“what actions should we take, given that we cannot predict the future”

Assess-Risk-of-Policy

Lempert and Schlesinger, 2000
Lempert et al. 2004

Final Note

Engage leaders, stakeholders, and others early...
