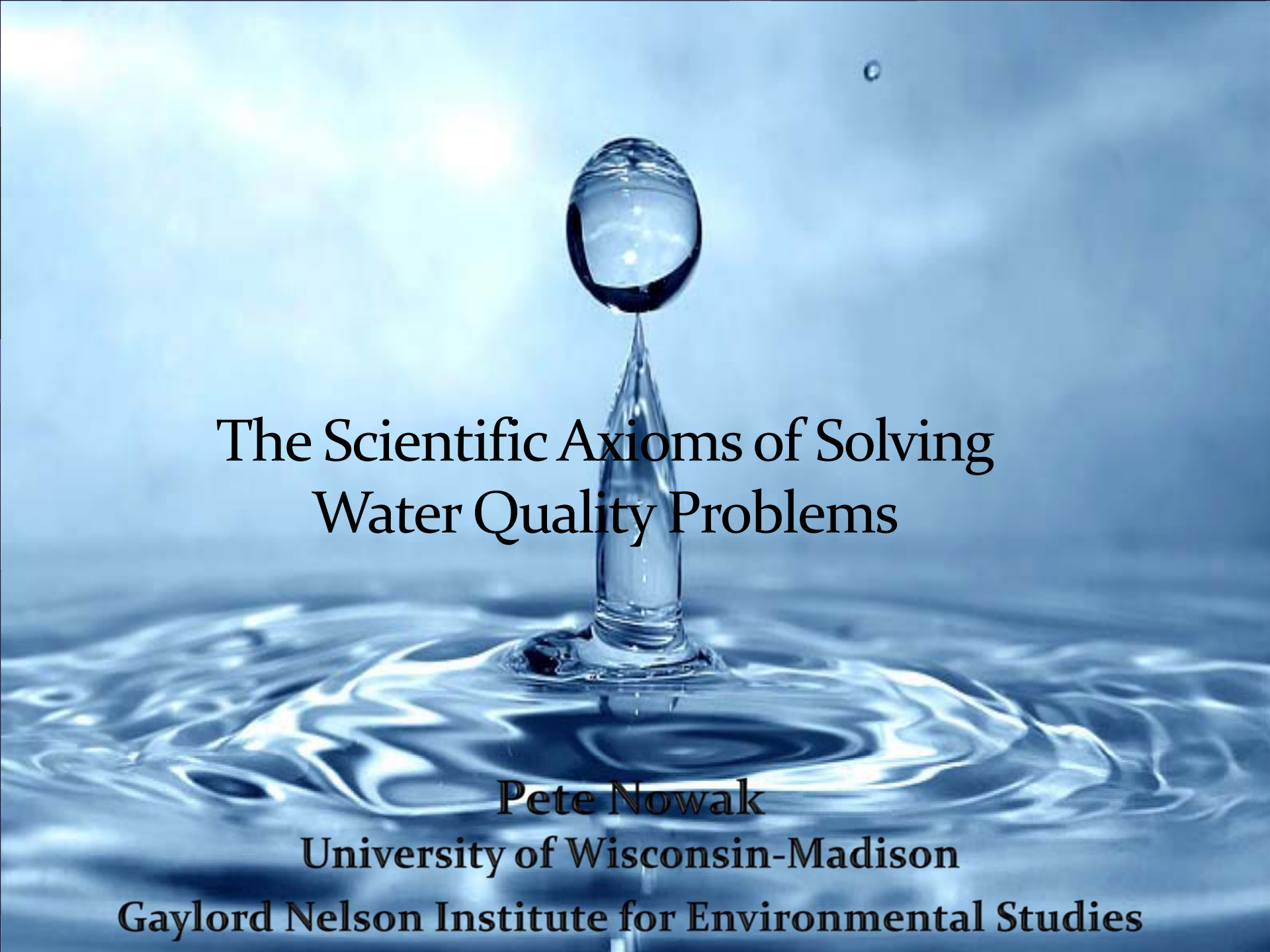

The Scientific Axioms of Solving Water Quality Problems

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Conference Function

You are charged with answering four questions relative to the agricultural activities in your jurisdictional area:

1. What nutrient load reductions are achievable?
2. How will these reductions be achieved?
3. What are the implementation schedule and corresponding milestones for this effort?
4. What is the value to each stakeholder of these reduction efforts?

Answering the Questions

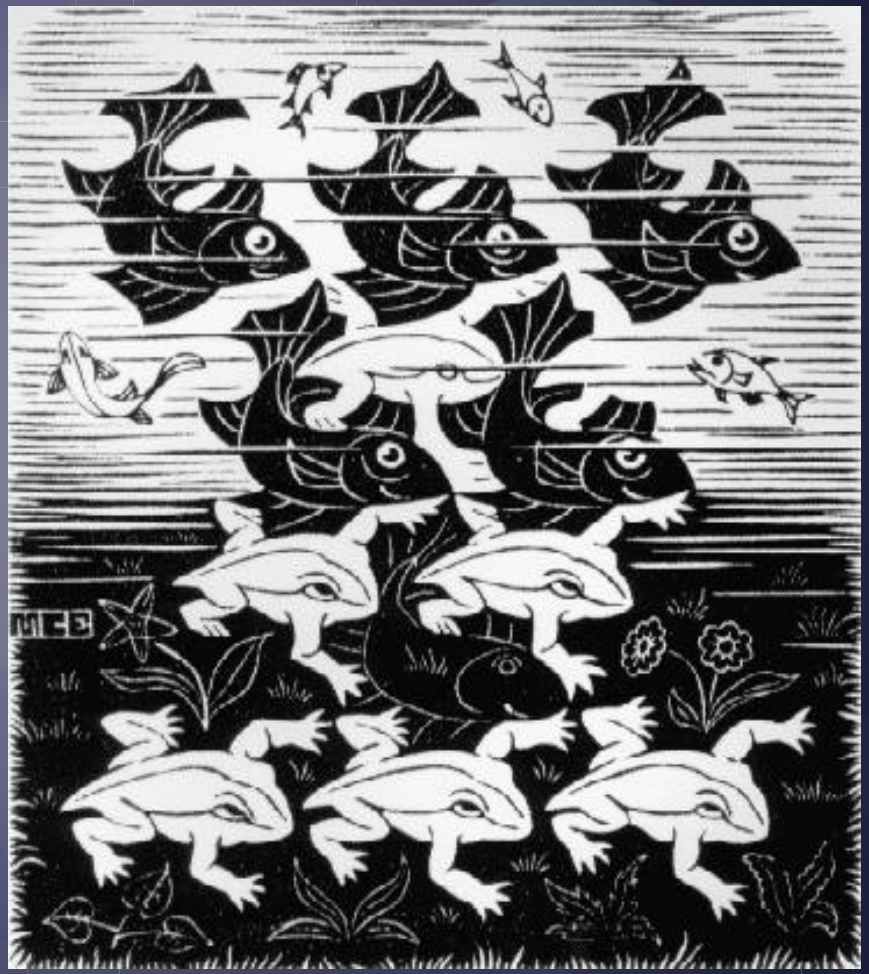
- There is no doubt that program managers can generate answers to all four of these questions; standard templates, protocols, and administrative as well as scientific procedures are readily available.

An Opportunity

- These questions can be approached as either another aspect of program management, or as an opportunity to explore novel approaches to solving water quality problems

A Transformative Approach

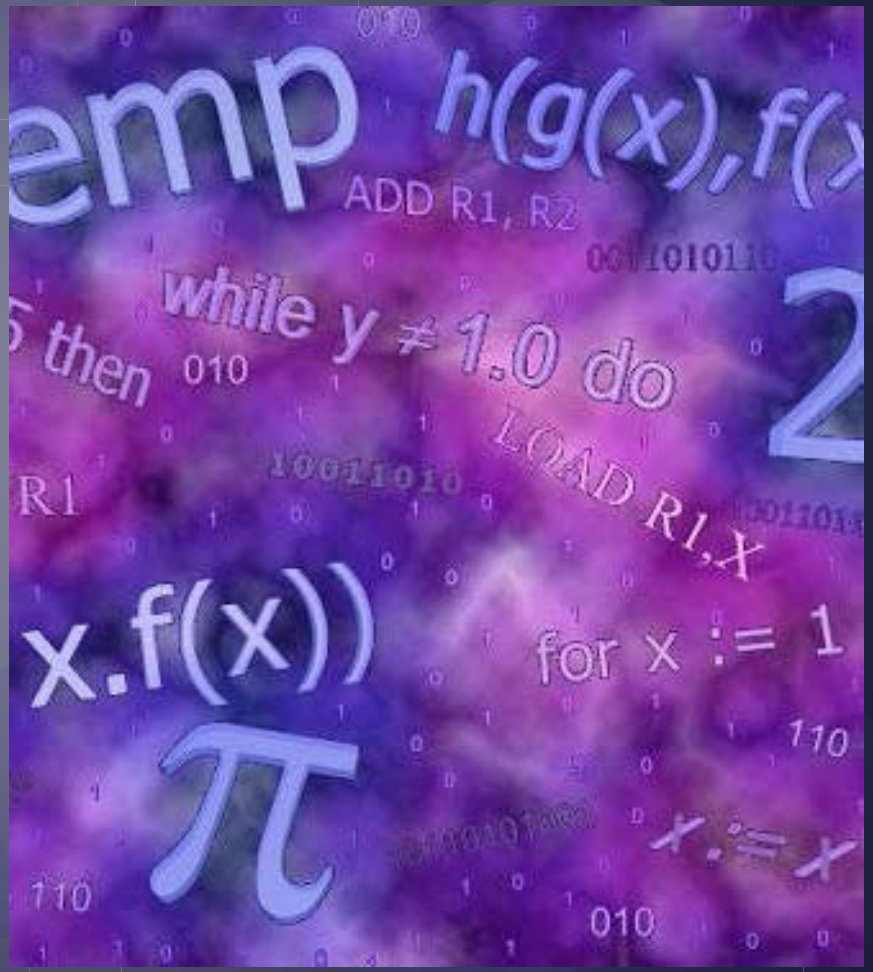
I am going to suggest that we approach these four questions with imagination, creativity, innovation, and a sense for adventure.[1]



1. *The Conservation Journey*. 2011. J. Soil & Water Conservation. 66:3; 61A-64A.

Transformative

- Activities with the capacity to revolutionize approaches to long-standing challenges, create new analytical protocols, cause paradigm shifts, support discovery, and lead to radically new programs and implementation strategies.



My Goal

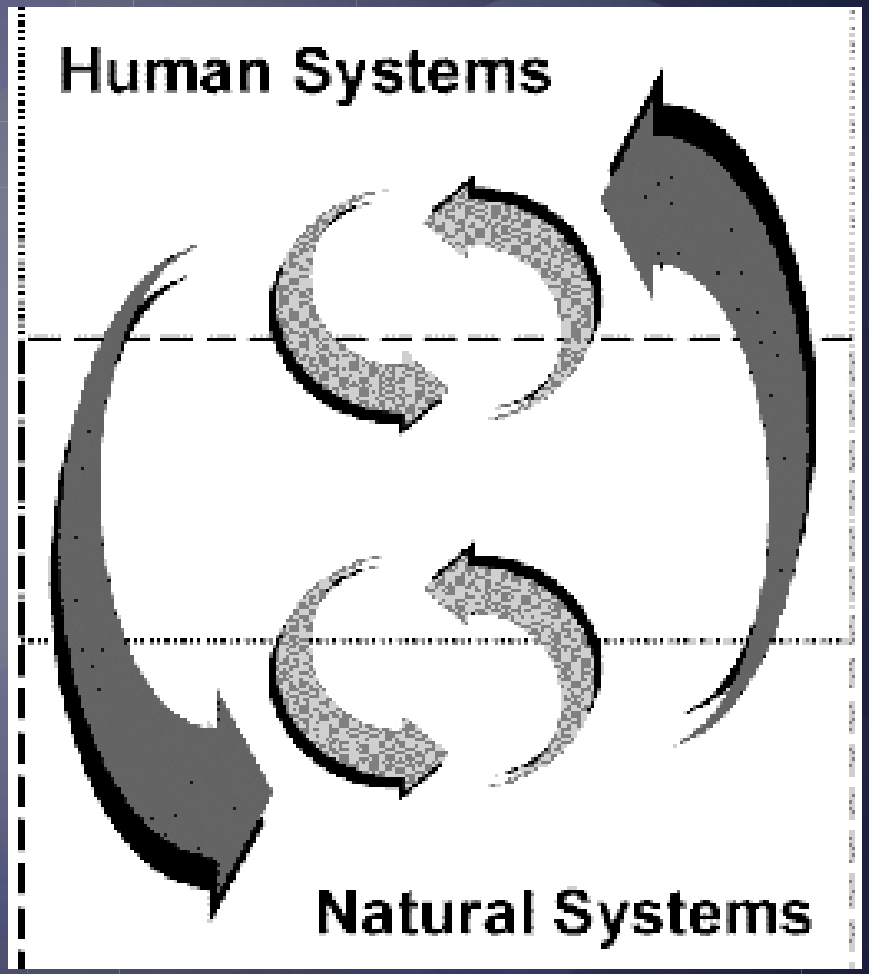
- My goal is not to tell you how to engage in transformation, but to try and motivate you to consider this approach while providing you with scientific insights to guide the process.

Definitions

- Science - systematic study of the causes of degradation and viability of remediation.
- Axiom - a statement or proposition that is regarded as being established, accepted, or self-evidently true.
- Coupled Human and Natural Systems – an analytical framework based on the interaction between socioeconomic and biophysical systems.

Coupled Human and Natural Systems

- The NSF has spent tens of millions on this topic, but the water quality community continues to treat these as parallel or even independent of each other.



Axioms - Coupled Human and Natural Systems

1. Size Matters
2. Legacies and Lags
3. Disproportionality
4. Surprises

Size Matters

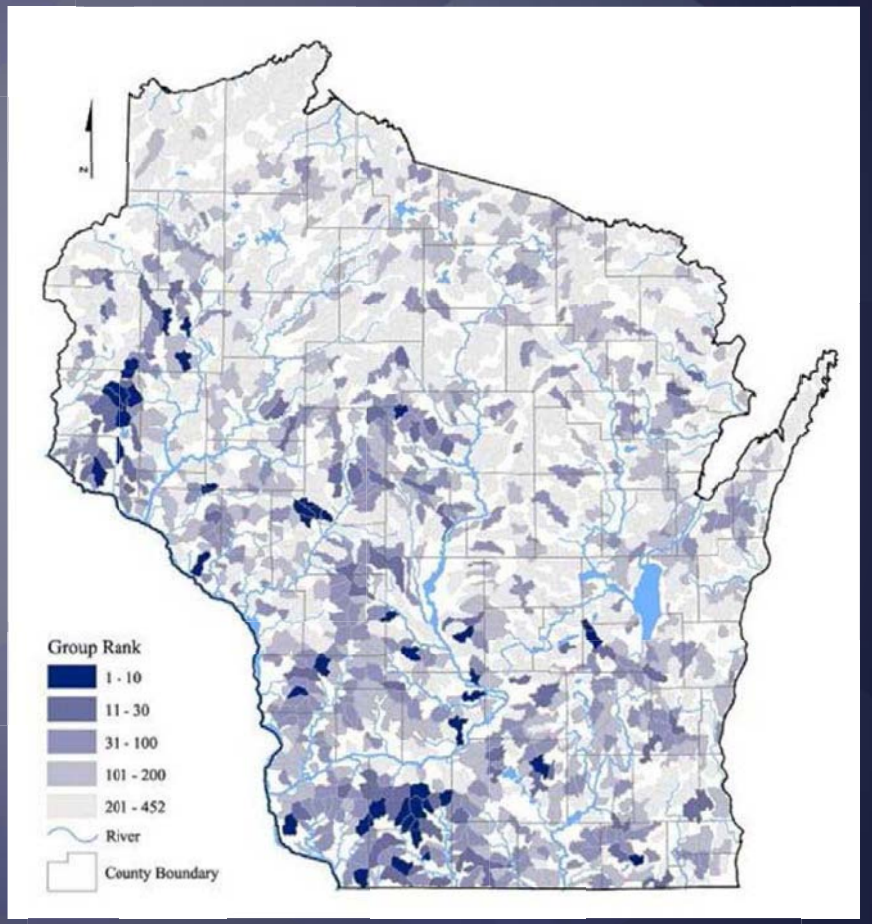
- Small watersheds are better suited for efforts to solve problems based on monitoring.
- Large watersheds are better suited for program management efforts based on modeling.

Size Matters

- The watershed size should also be selected so that it is congruent with the social structures and processes that will be integral to the remedial effort.

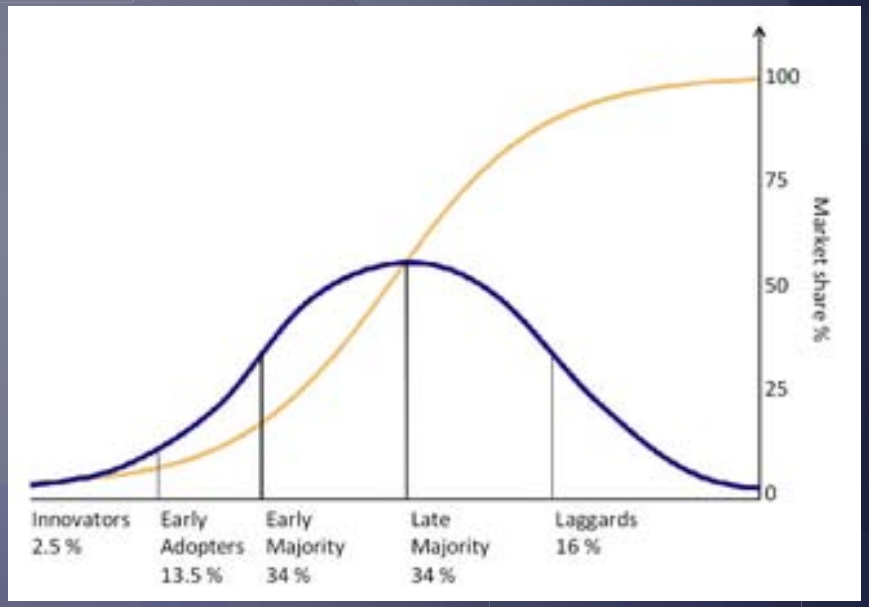
Size Matters

- Not all small watersheds are the same.
- Models or assessments can be used to rank small watersheds on different criteria.
- The focus will depend on priorities, both local and national.



Legacies and Lags

- P buildup or step-flow through the watershed.
- Use of remedial practices.



Legacies and Lags

- Past experiences with government programs and recommendations.
- A delay in building trust in groups behind remedial effort.

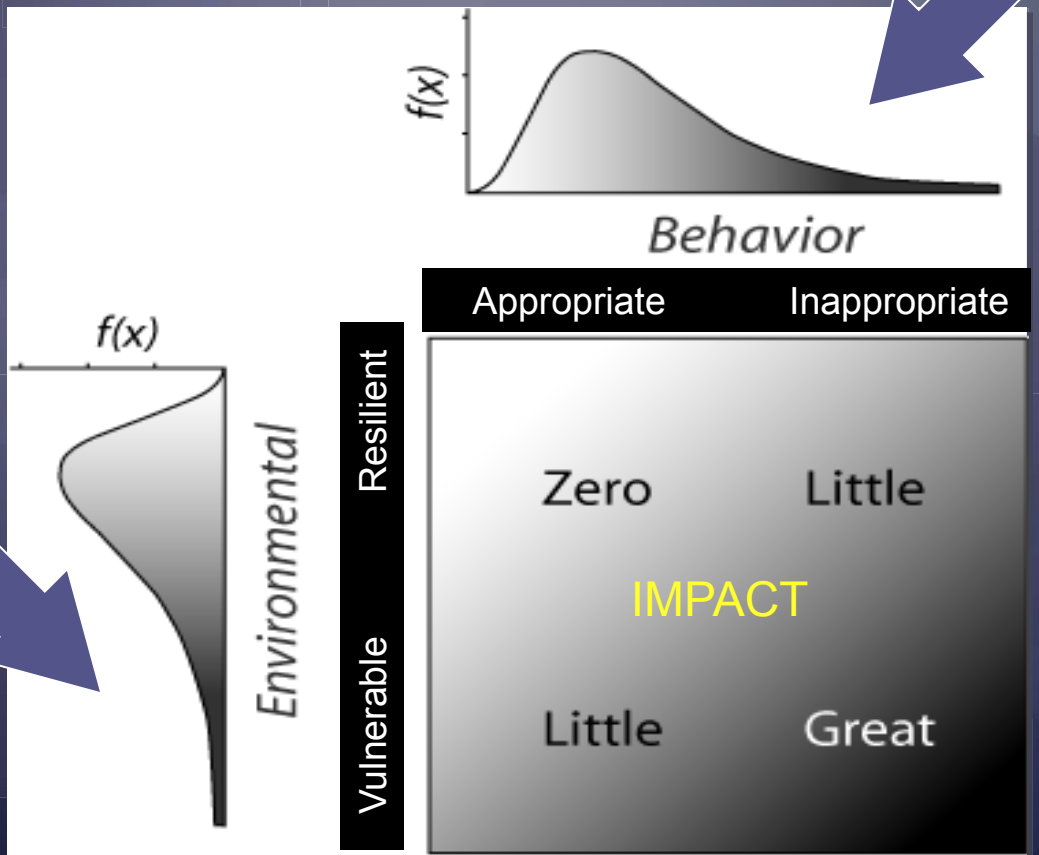
Disproportionality

- A small proportion of all human behaviors account for a large proportion of environmental degradation.
- Inappropriate behaviors are not the same as "bad actors" in policy analysis.

Disproportionality: The "Tail" that Wags the Watershed

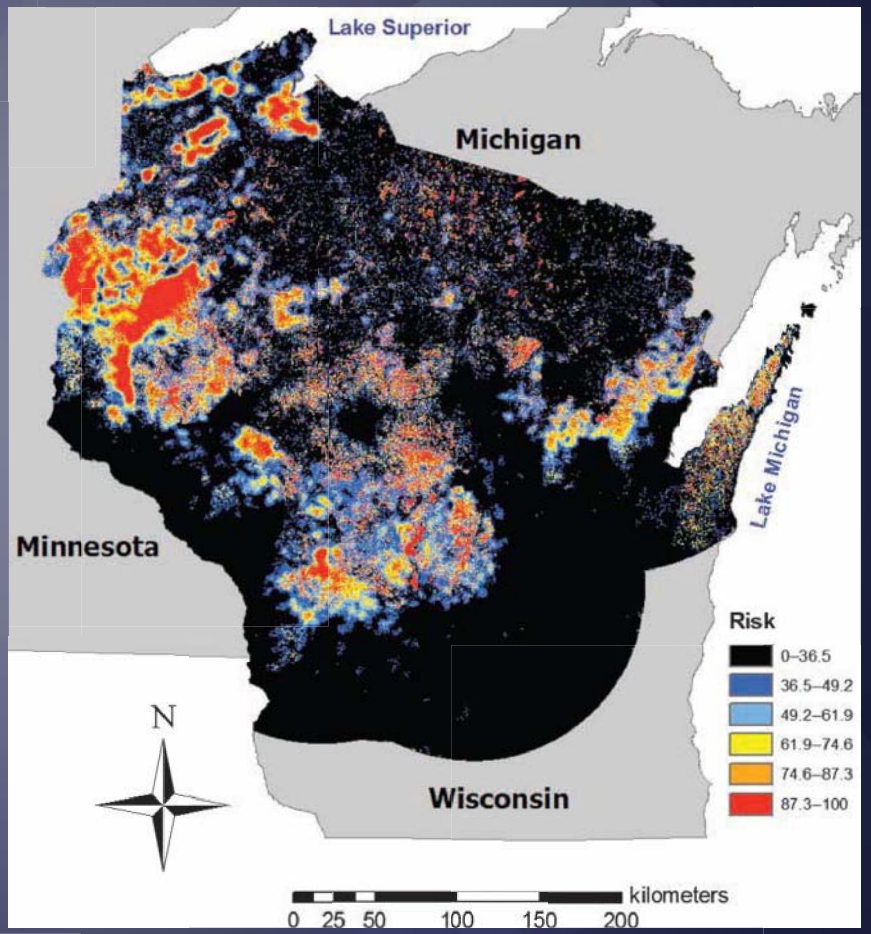
Social Science

Biophysical Science



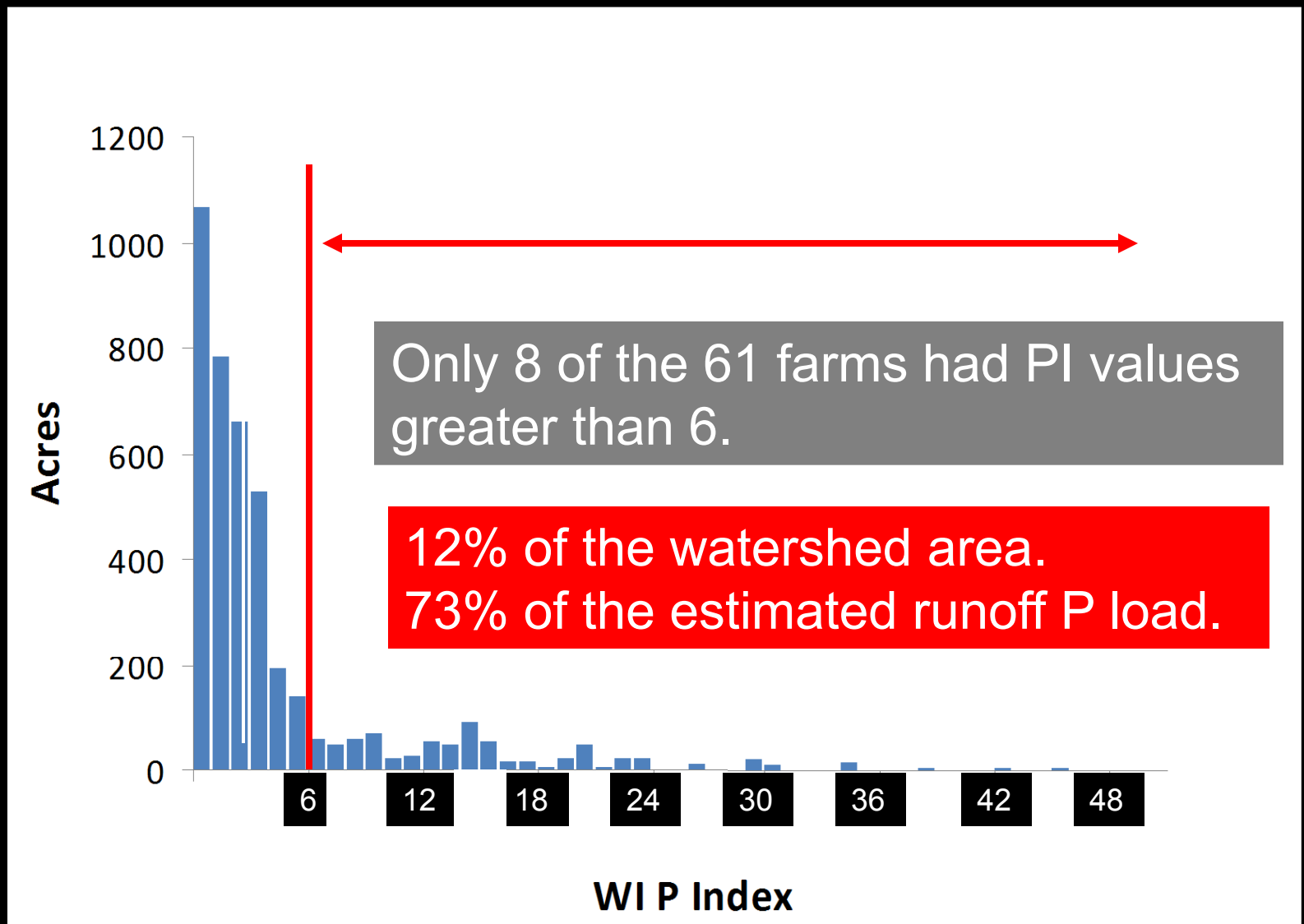
Another Recent Example

- The interaction of humans with nature often creates patterns of disproportionality.
- Understanding these patterns allows you to manage them.

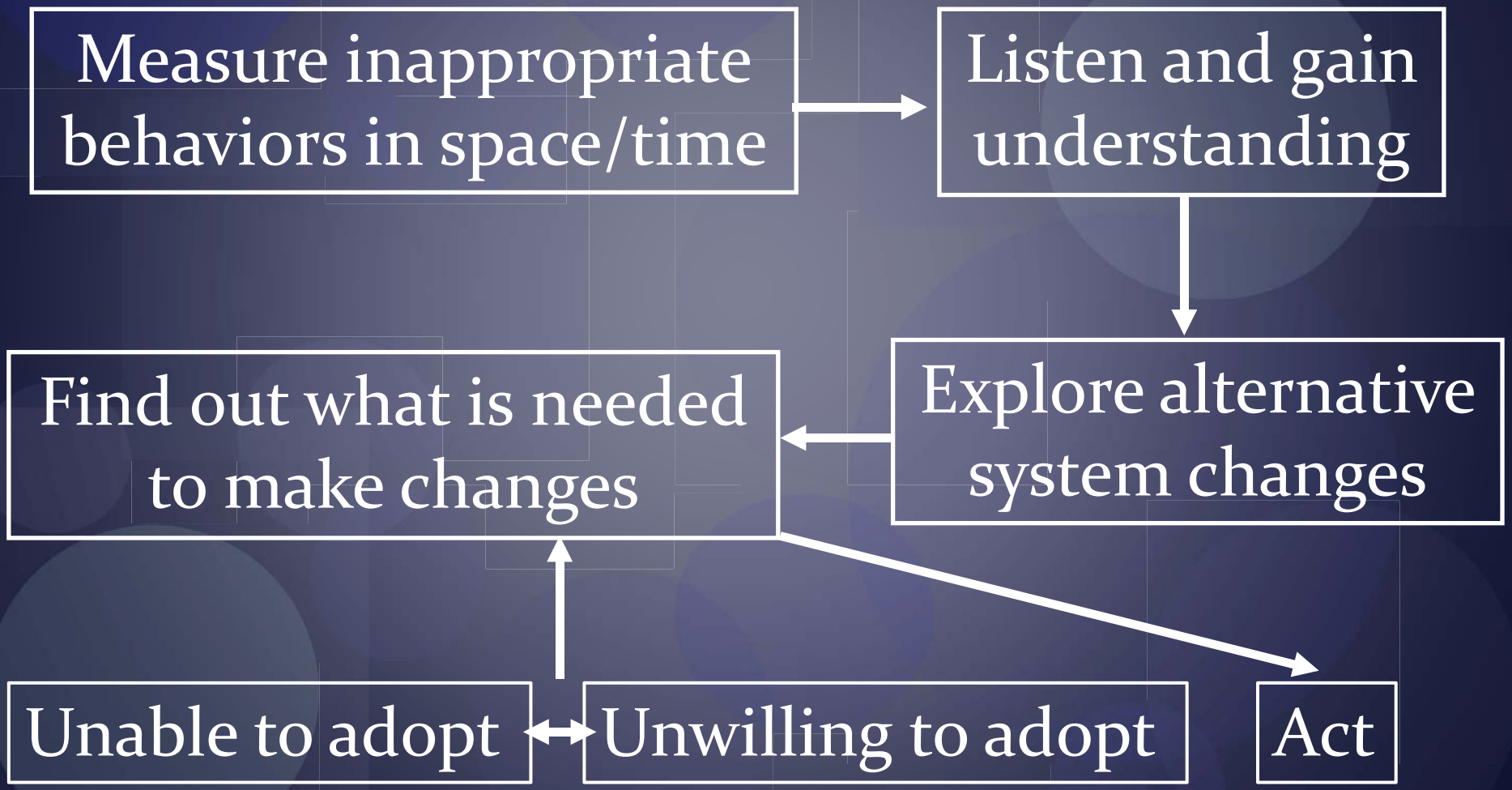


Treves et al., 2011. Bioscience Vol. 61 No. 6. p455.

A Watershed Example



Addressing Disproportionality

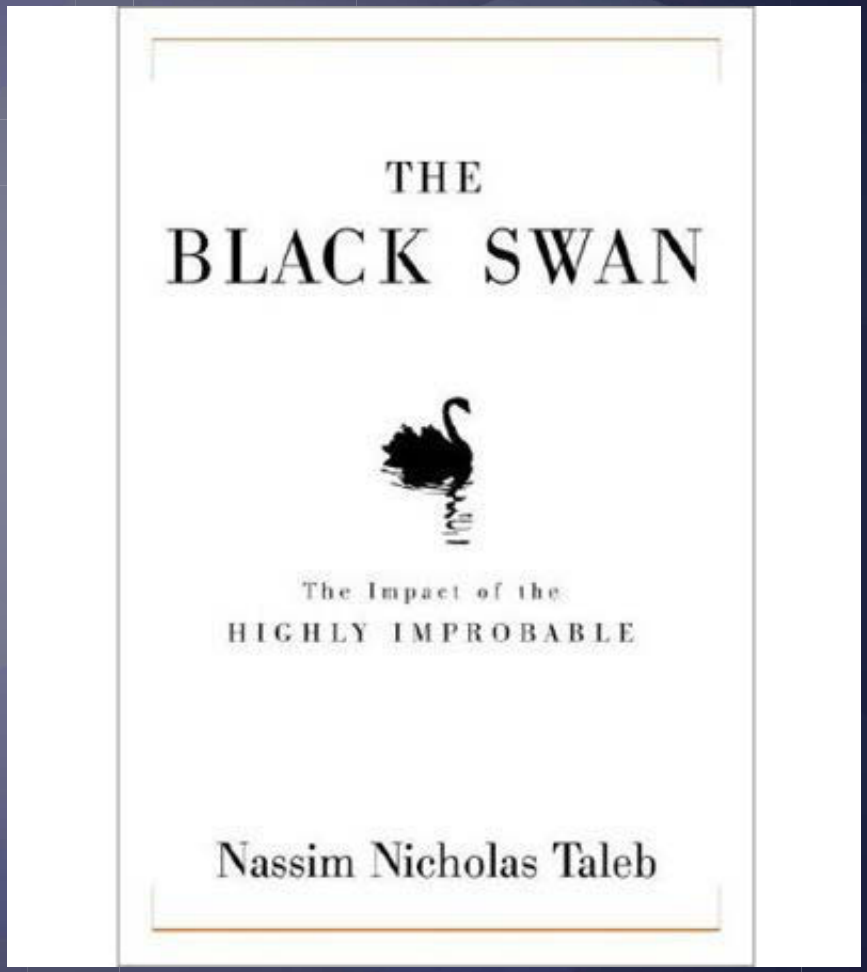


Surprises

- The conservation efforts of today will not be the same in the near future.
- We will be surprised.
- Remember, it is the exceptional (the “tail”) that drives ecological, market, and social systems.

Surprises

- While one cannot know the unknowns, it is possible to respond to surprises through adaptive management.
- Contingencies to respond to surprises is part of adaptive management.



Back to Your Questions

1. What nutrient load reductions are achievable?
   Reductions that result in significant improvements to water quality parameters in high-priority watersheds.
2. How will these reductions be achieved?
   By employing coupled human and natural system axioms to target disproportionality.
3. Timeline – *you know best*
4. Value to stakeholders– *you know best*

Some Concluding Messages

- While it relatively easy to focus on human **or** natural systems, solutions will be found in the integration of the two.
- To simplify, if you want to solve problems, then focus on disproportionality within small, high-priority watersheds.
- There are no bad actors only inappropriate behaviors in vulnerable locations or times.
- Consider “bottom-up” remedial efforts when addressing these inappropriate behaviors.

A Final Thought to Keep in Mind

- We have achieved excellence in describing or characterizing water quality problems, but are mediocre, at best, when it comes to describing successes in this arena due to the lack of experience with solving problems.

Transformation Based on Successes

Thank You