A watershed approach to the future of lakes and waterways

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UNIVERSITY OF WISCONSIN MADISON
Water Sustainability and Climate
In the Yahara Watershed

NSF

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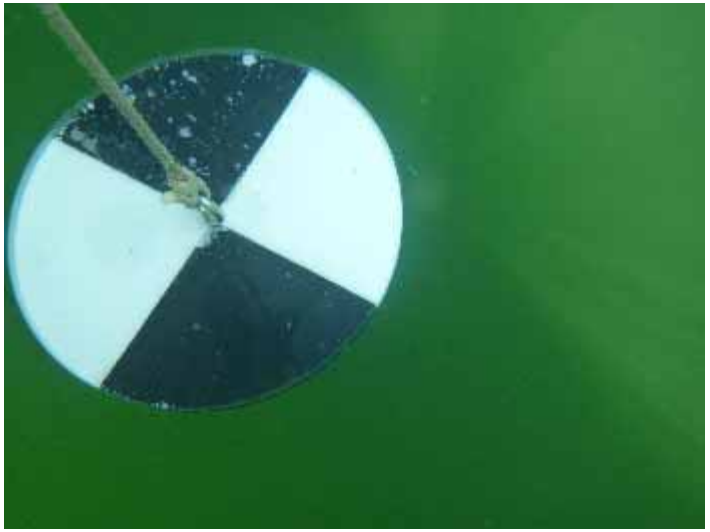
What does water quality mean?



What does water quality mean?

"The health of our waters is the principle measure of how we live on the land."

– Luna Leopold

WATERSHED = Area that contributes water to a common point or body of water

Traditional in-lake/near-lake approach

CHEMICAL TREATMENT OF MILFOIL

The Spokesman Review

REMOVAL OF MILFOIL BY HAND

The Northwoods River News

SHORELAND RESTORATION

WLWCA

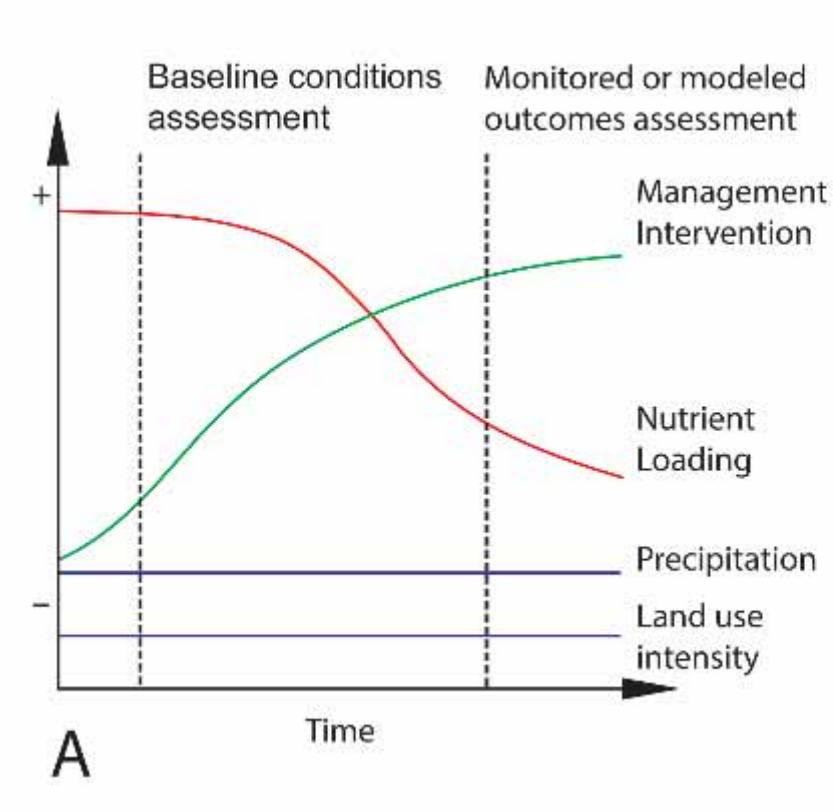
PREVENTION OF AIS INVASION

WDNR

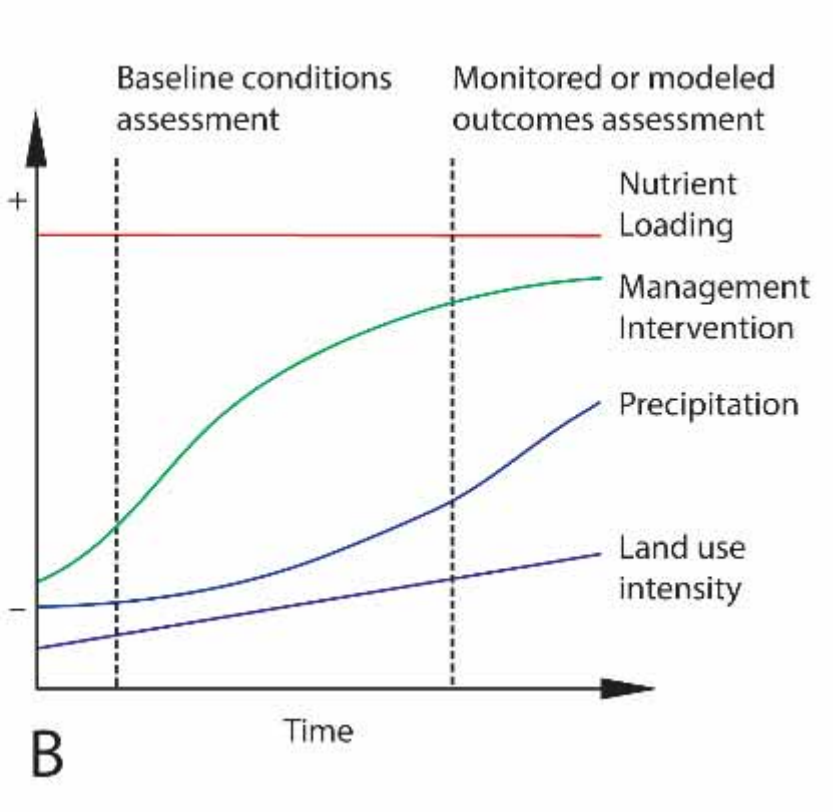
- Varying levels of success
- Often treating symptoms, not causes

Varying success, little progress

ASSUMED

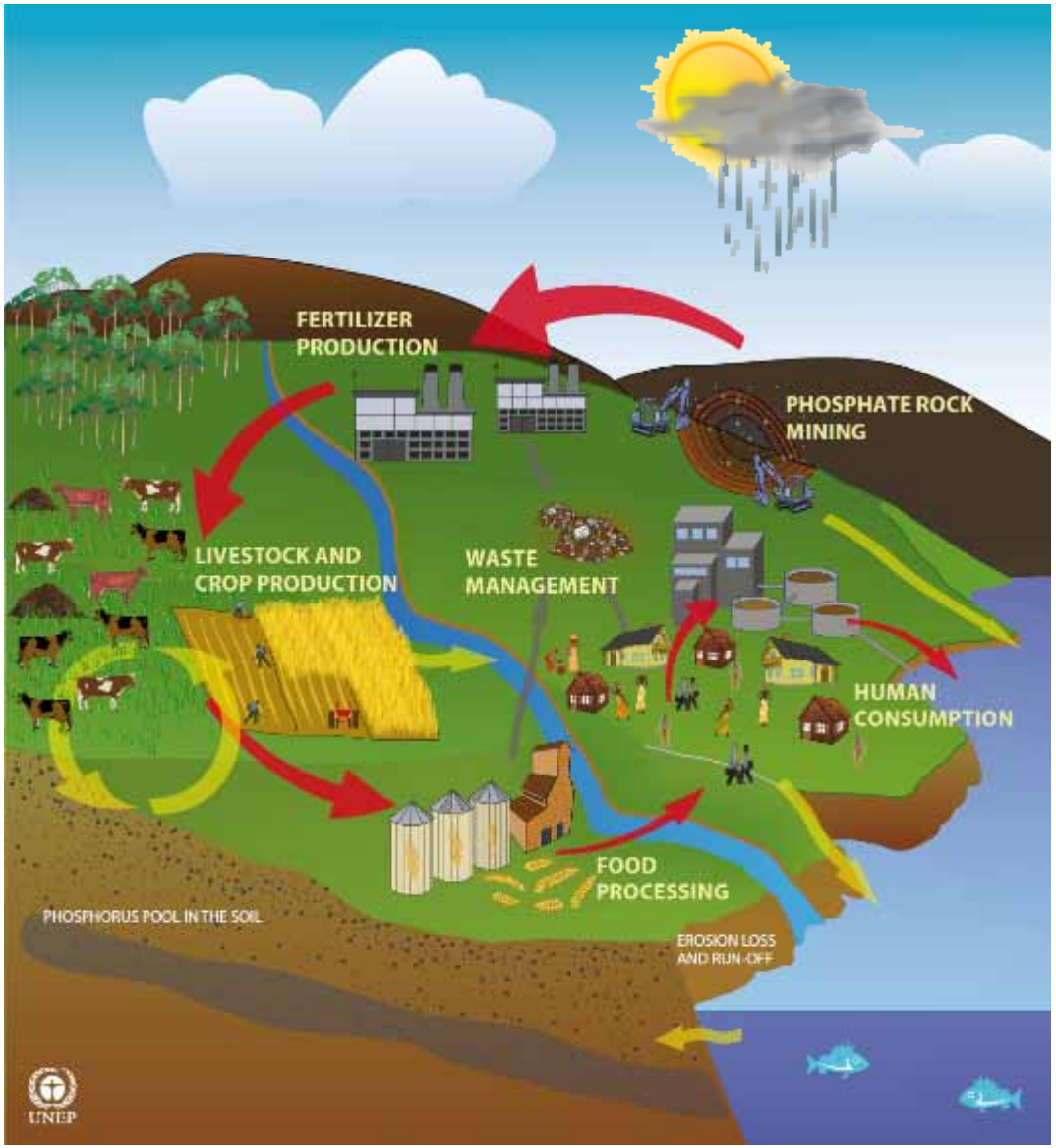


REALITY



from Gillon et al. 2016

Watershed approach = holistic approach



- Watersheds are complex systems that change according to internal and external drivers
- Watersheds produce multiple benefits for society

Challenges of holistic approach

- High uncertainty, drivers of change
  - Many drivers are obscure
- Internal drivers
  - Farm economics/family situation
  - Urban development pressures
- External drivers
  - Demand for food products, bioenergy
    - Price of milk, corn, dietary trends
    - State and federal policy
  - Climate change
    - Increasing frequency of heavy rainfall

These challenges span generations

Major Changes in the Yahara Watershed
1800-present

Lake health from a watershed scope: Our soil phosphorus legacy

Challenges of holistic approach

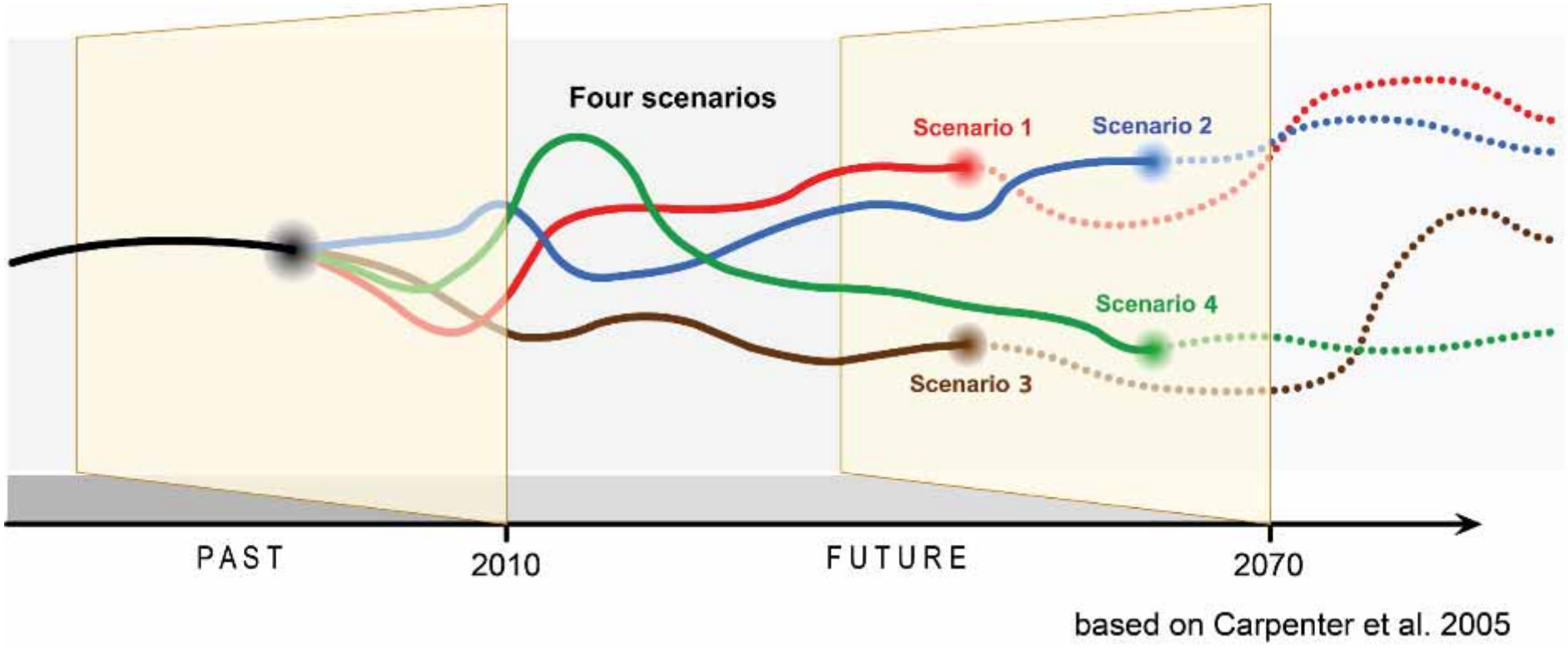
- Public engagement and decision making
- Starting conversations with unfamiliar groups can be a barrier
  - Especially if “blaming” is implied
- Loss of direct control over decisions
  - Hard enough getting lakeshore owners to agree on a plan…try a whole watershed


We expect a lot from our watersheds.
Crop production
Climate regulation
Flood regulation
Aesthetics
Water quality
Recreation
Groundwater supply

Can we have clean lakes and ice cream, too?

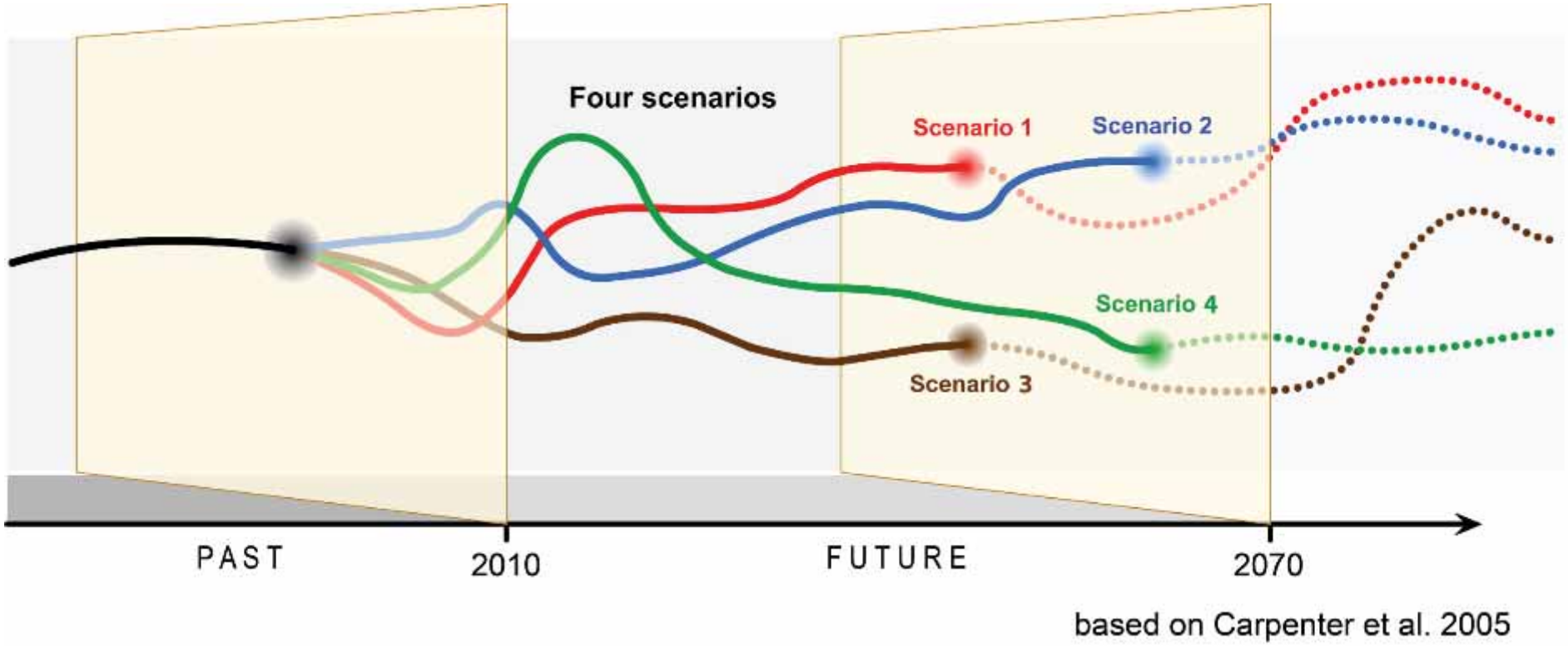
Scenarios and a watershed approach

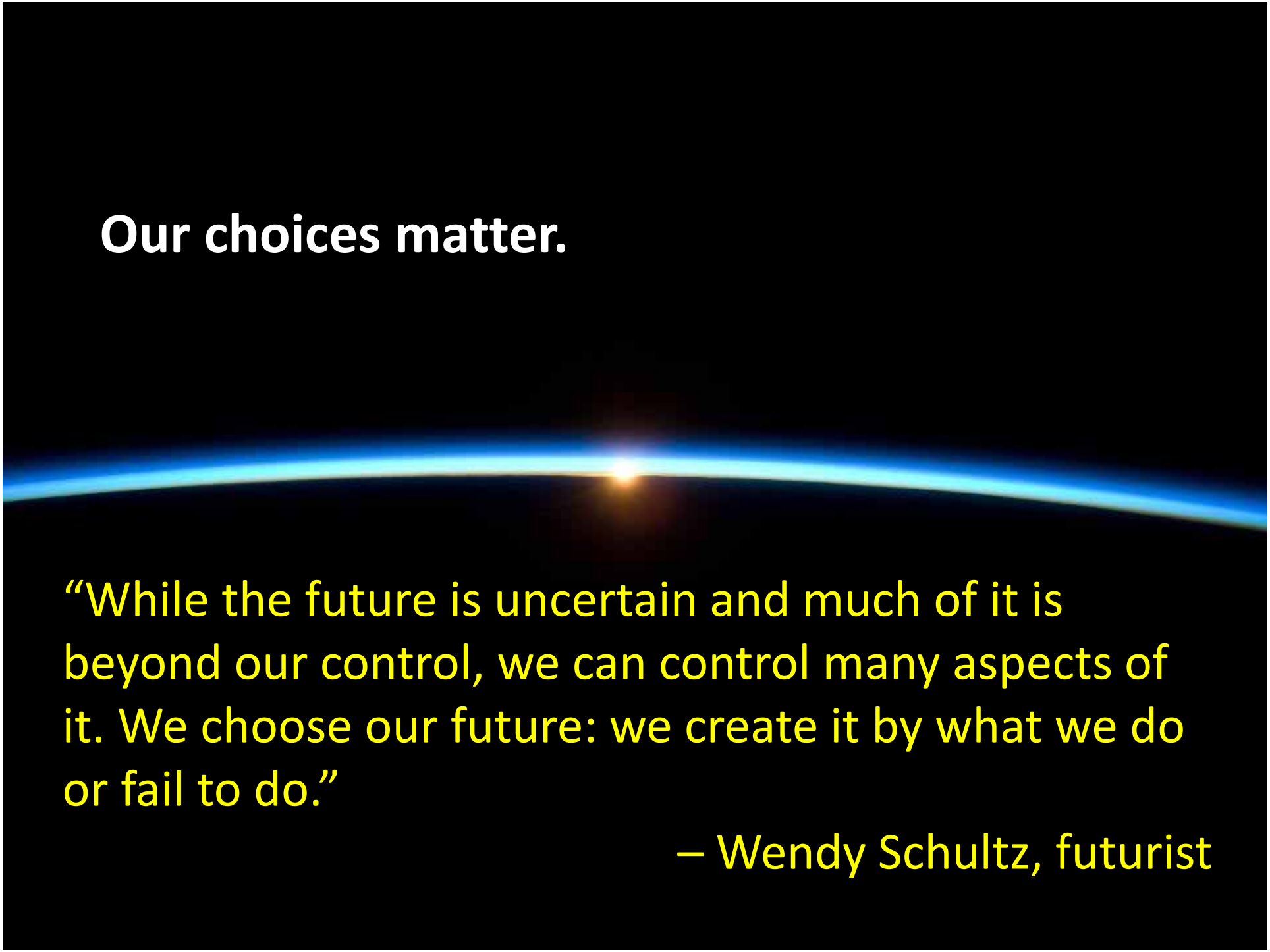
- Provocative, plausible stories about the future with contrasting social and environmental conditions.
- Explore questions of “What if?”

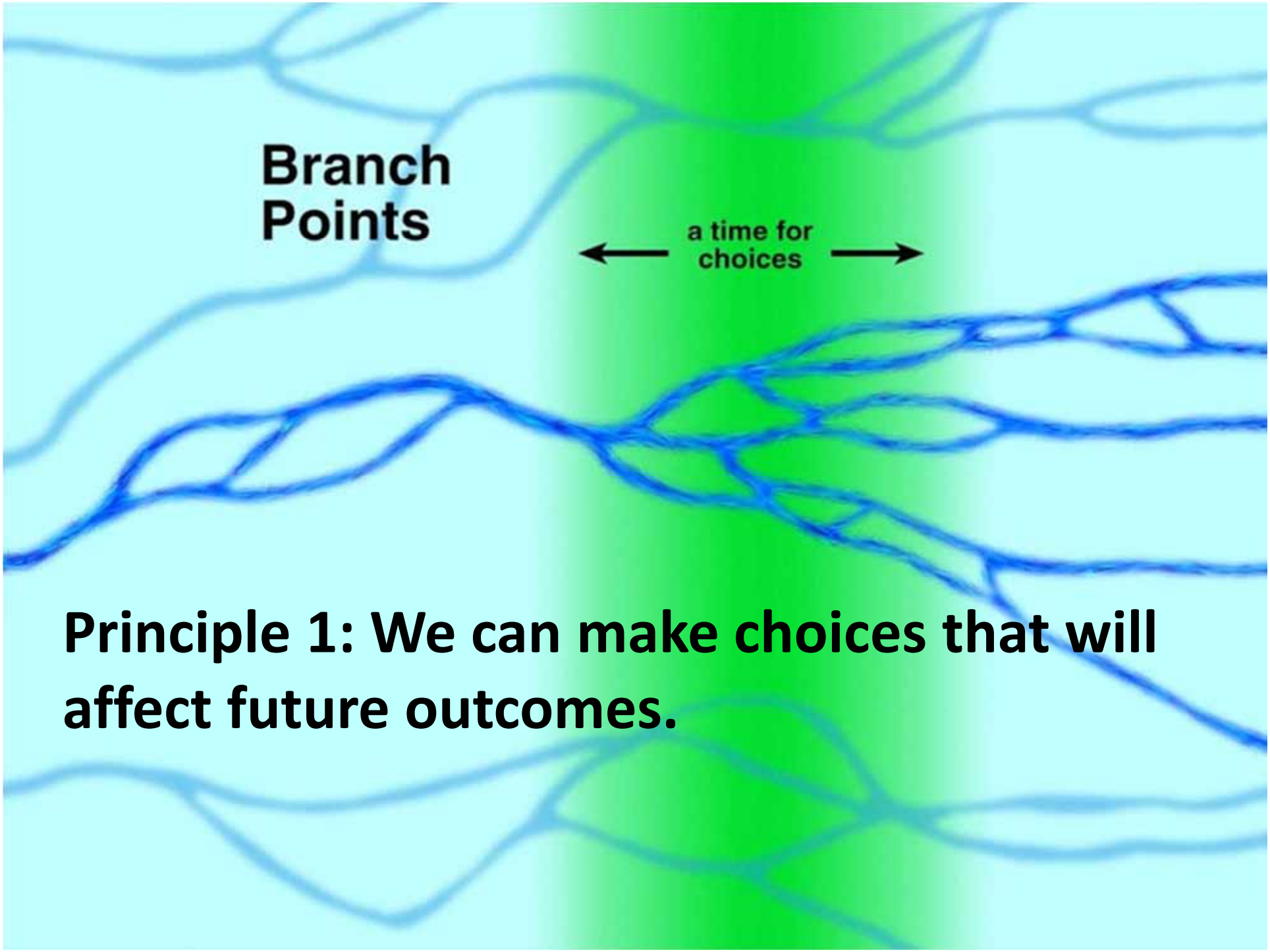


Scenarios help us consider changes and choices

- They facilitate multi-scale, long-term thinking.
- They help us learn ways to address change and build resilience.

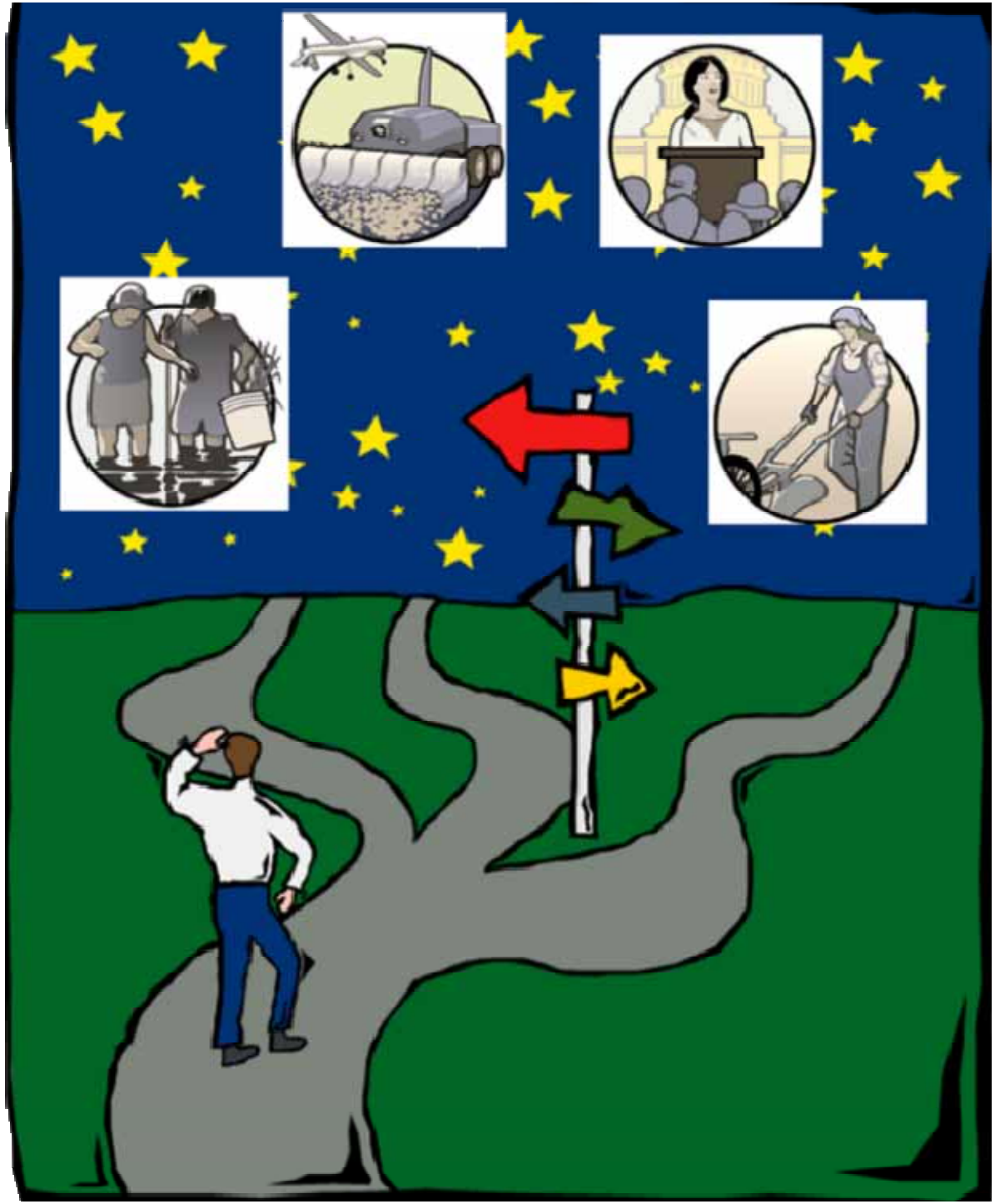



Our choices matter.
“While the future is uncertain and much of it is beyond our control, we can control many aspects of it. We choose our future: we create it by what we do or fail to do.”
– Wendy Schultz, futurist

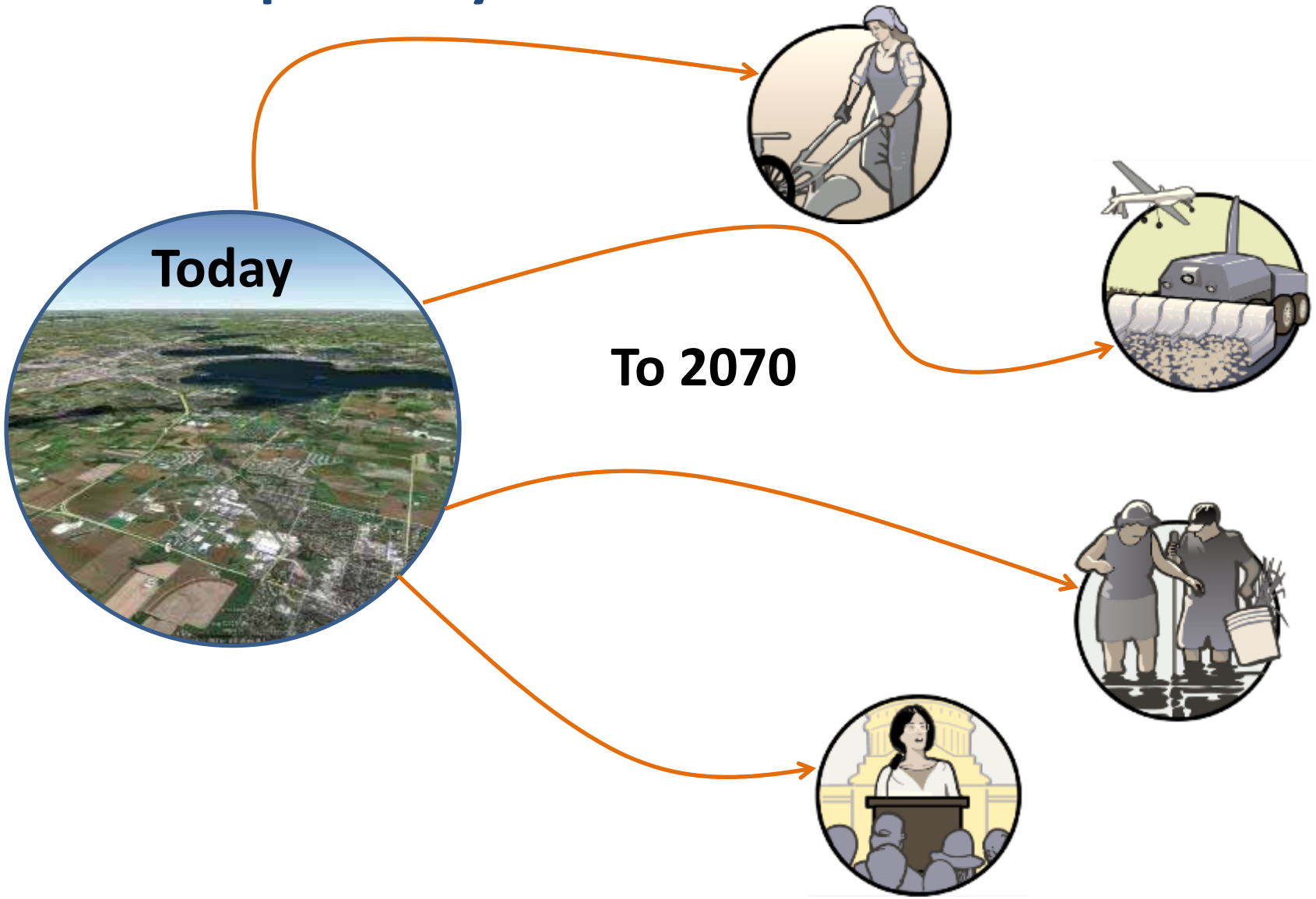


Principle 1: We can make choices that will affect future outcomes.

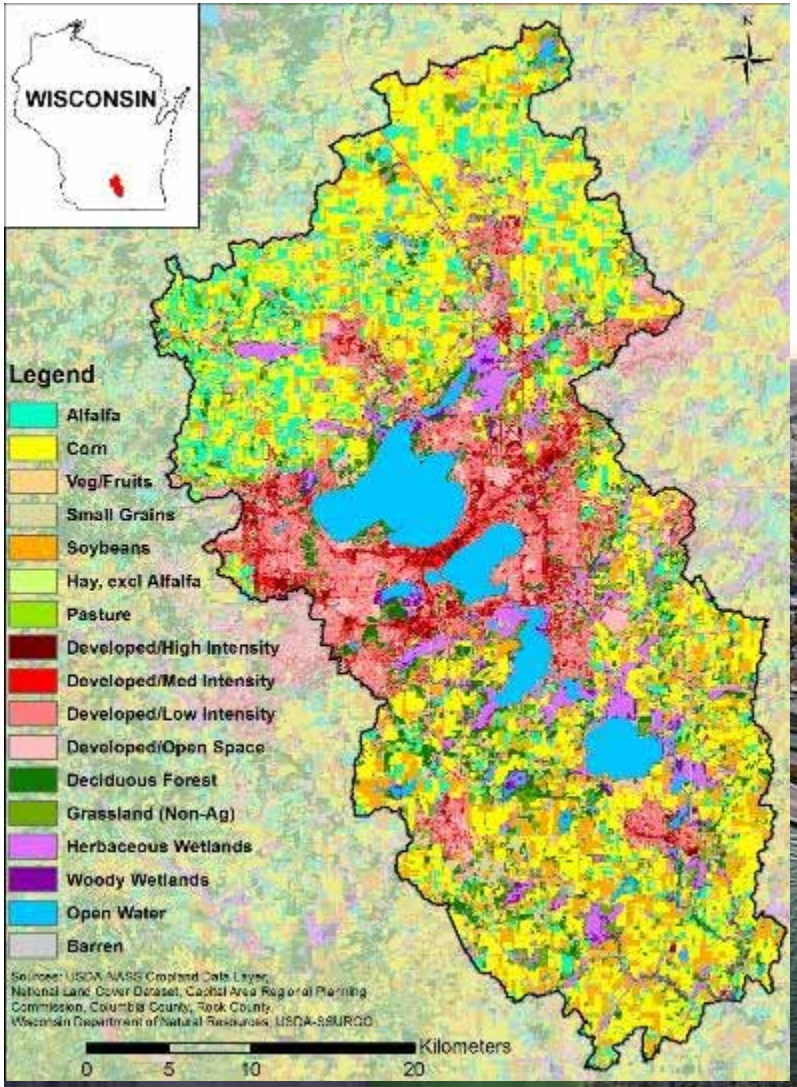
Principle 2:
We can consider the different pathways that might result from those choices.



Principle 3: We can anticipate the consequences of those pathways.



Yahara River Watershed

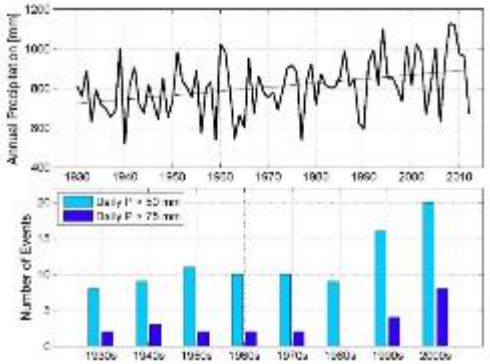


Long-term changes and challenges affecting water

- Intensification of dairy agriculture

- Increasing demand for biofuels

- Urban development
- Changes in climate
  - Increase in annual precipitation
  - More frequent heavy rainfall events



Real-life watershed approach: Yahara WINS

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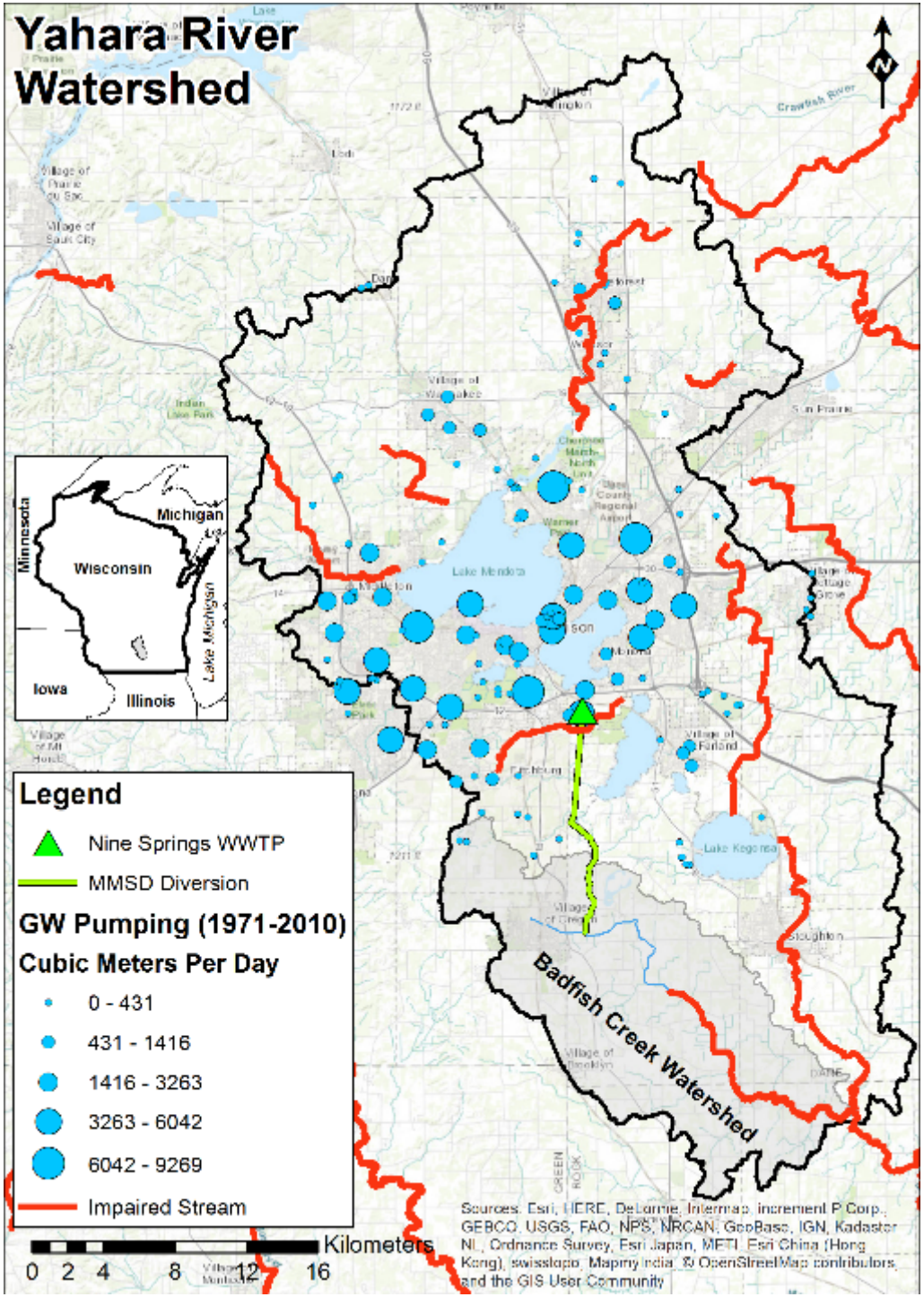
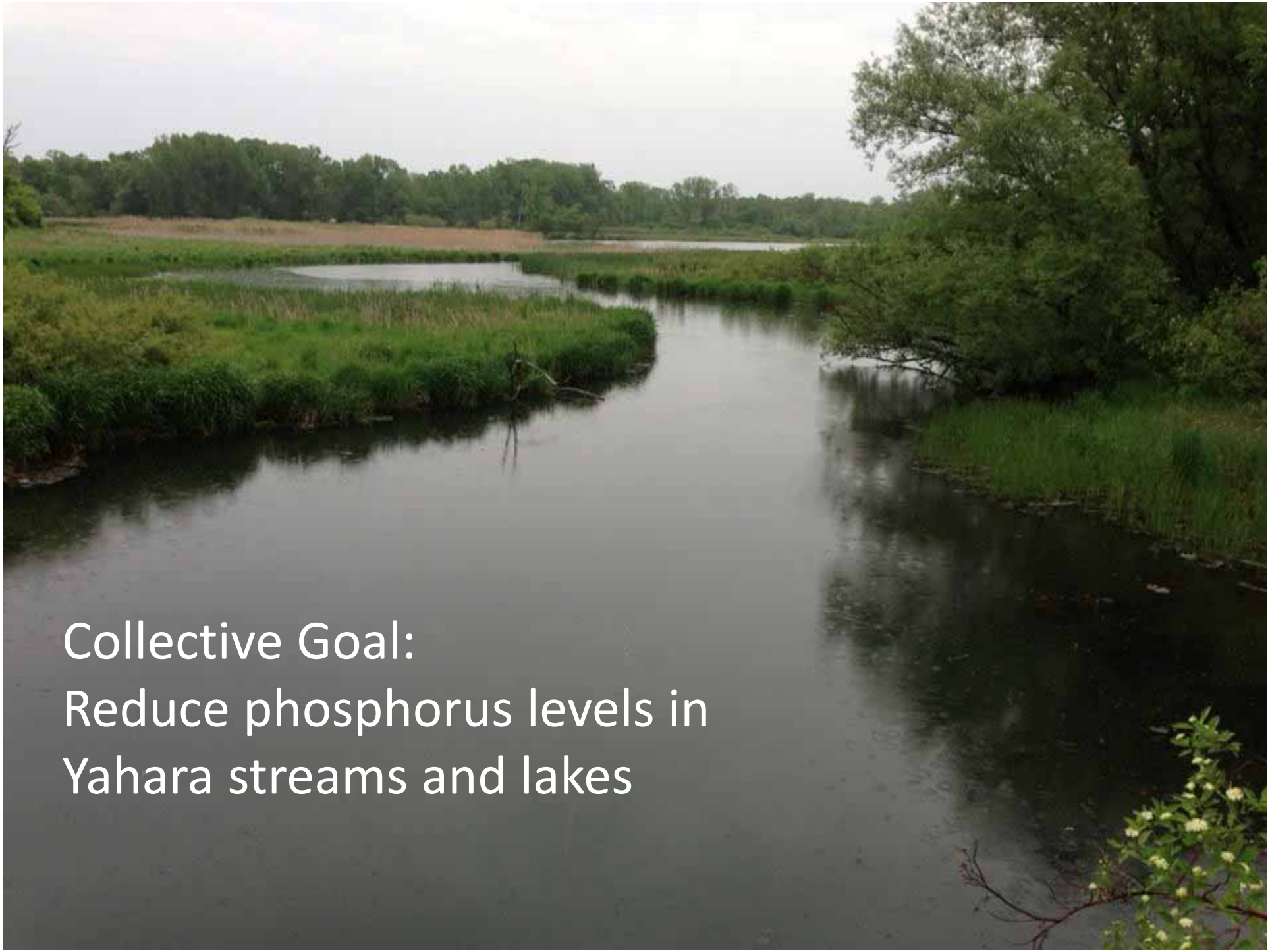


Watershed approach to reducing P

- Regulatory driver
- Point sources and municipalities carry burden
- Allowed to work with largest source of P
  - Agricultural runoff


Collective Goal:
Reduce phosphorus levels in
Yahara streams and lakes

First step : Engagement

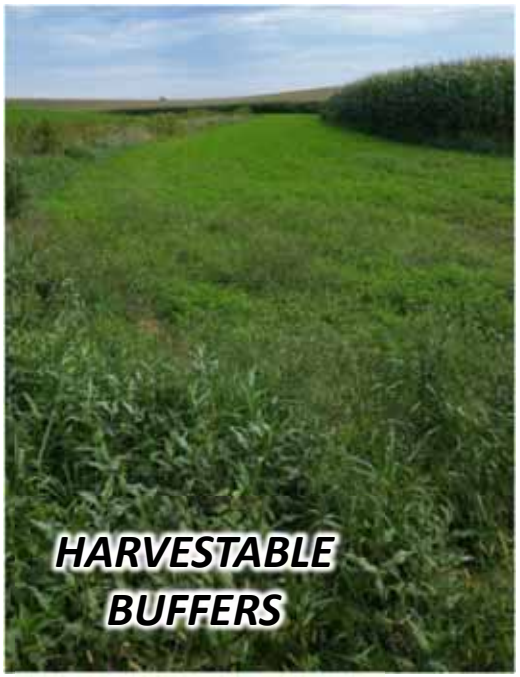
- Engaging with unfamiliar groups of people
- Developing mutual respect for broad goals
  - Beyond water quality (food production, etc.)
- Honest discussion of potentially conflicting goals and biophysical limitations of the watershed*

Second step : Implementation

- Conservation practices
  - cover cropping, grassed waterways
- Nutrient management
  - manure management

Yahara Pride Farms

Yahara Pride Farms



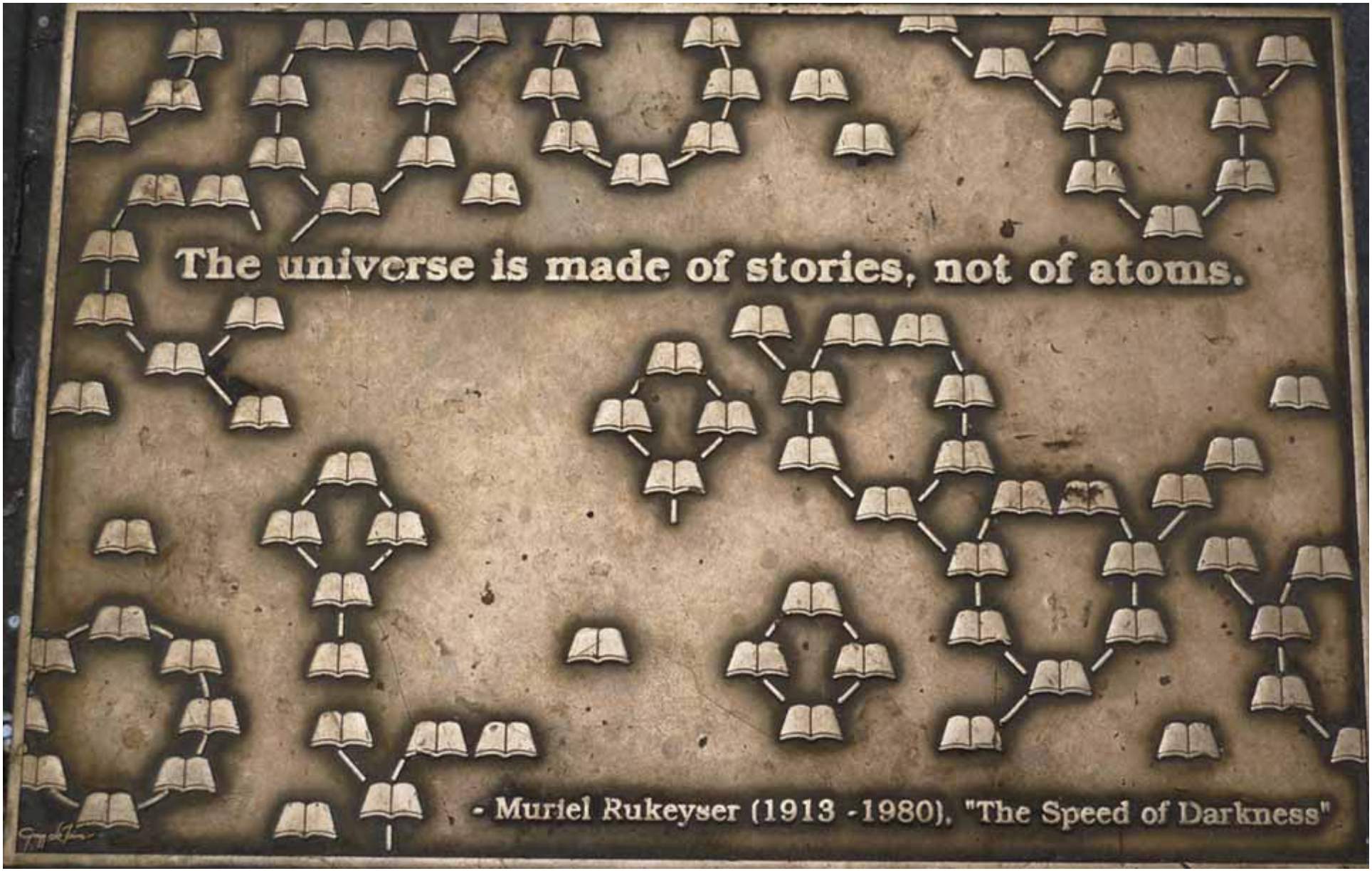
Yahara WINS

What about future changes in other drivers?

- Current implementation and evaluation strategies do not explicitly account for…
  - Land-use/land-cover change
  - Climate change
- The next step – long-term thinking and shifting baselines

YAHARA2070

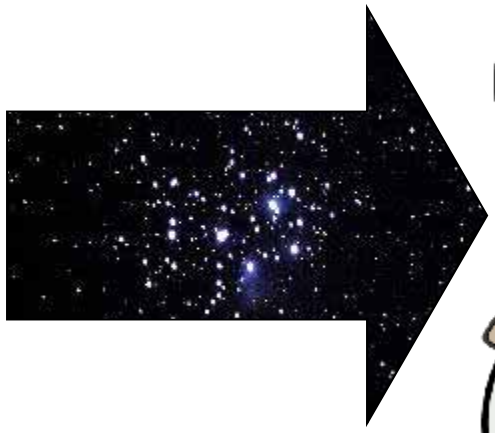
How can we build water sustainability and climate resilience *now* for *future* generations?


The universe is made of stories, not of atoms.
- Muriel Rukeyser (1913 -1980), "The Speed of Darkness"

We sampled perspectives from the Yahara Watershed through interviews and workshops,

clustered them into themes,

and condensed them into a few stories.

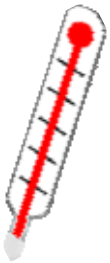


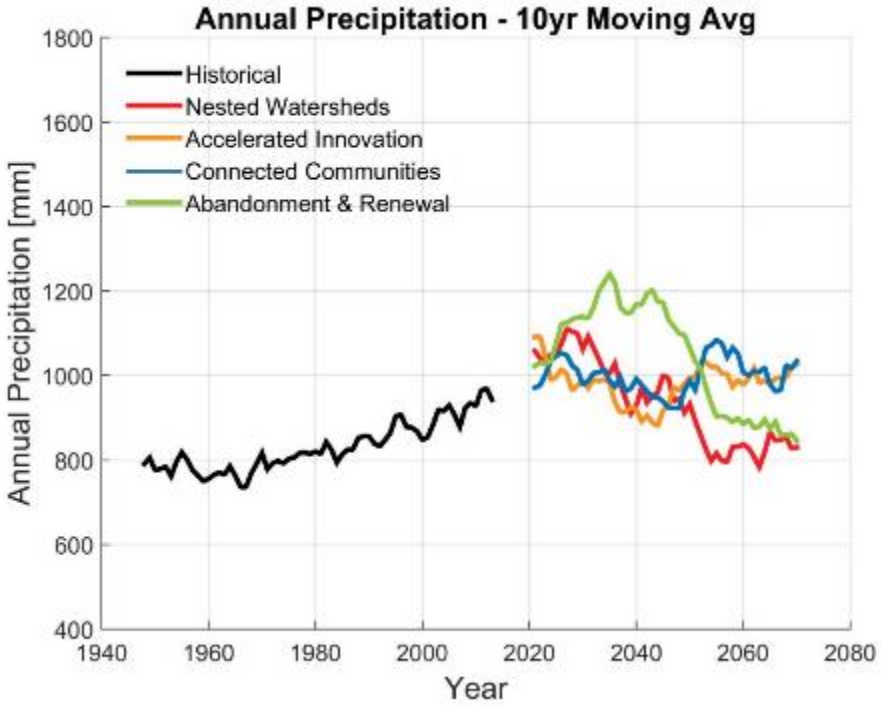
The stories

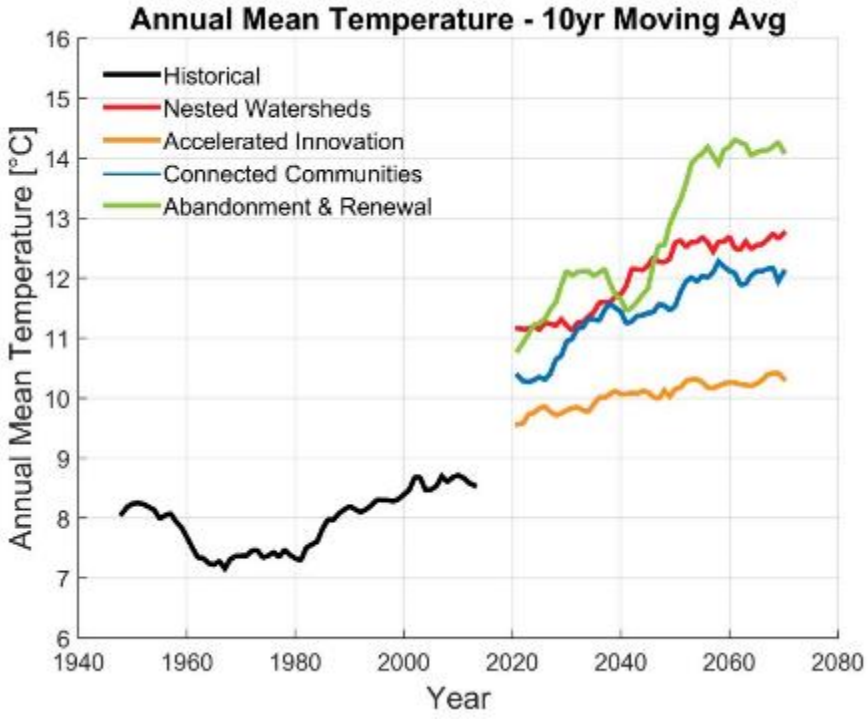
Name:	Nested Watersheds	Abandonment & Renewal	Accelerated Innovation	Connected Communities
Dynamics:	Adaptation	Transformation	Adaptation	Transformation
Key Factor in Change:	Government	Inaction	Technology	Values
Nutshell:	Government intervention maintains nature's benefits	Disaster decreases population, leads to reorganization	Massive growth in technology businesses, including green tech	Global shift in values toward sustainability

Each based on a different set of human choices and biophysical events

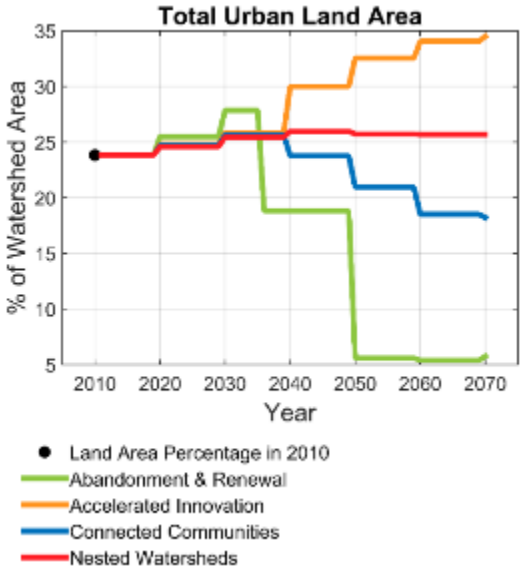
The “Atoms” = Climate Changes

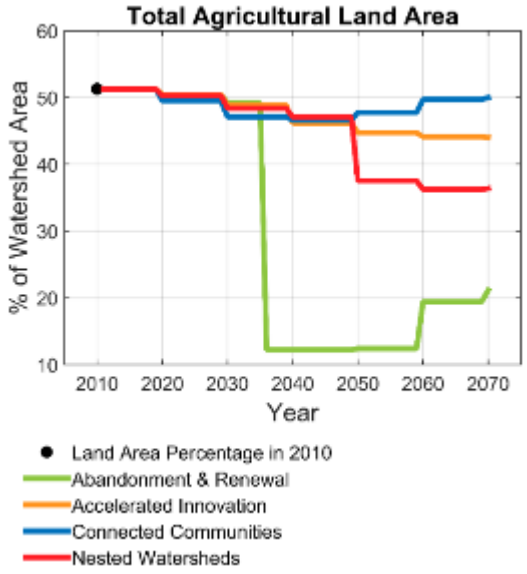




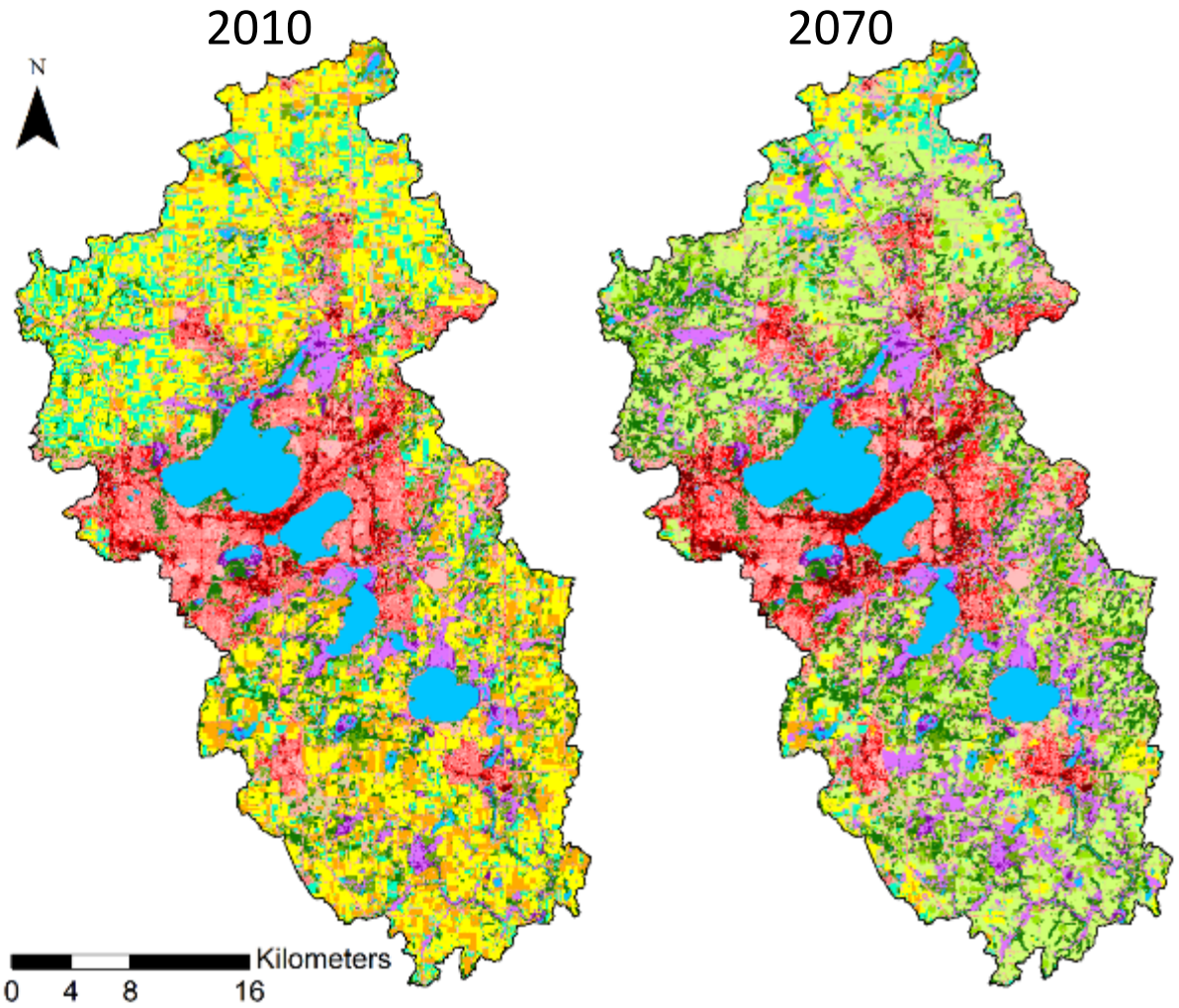


The “Atoms” = Landscape Changes



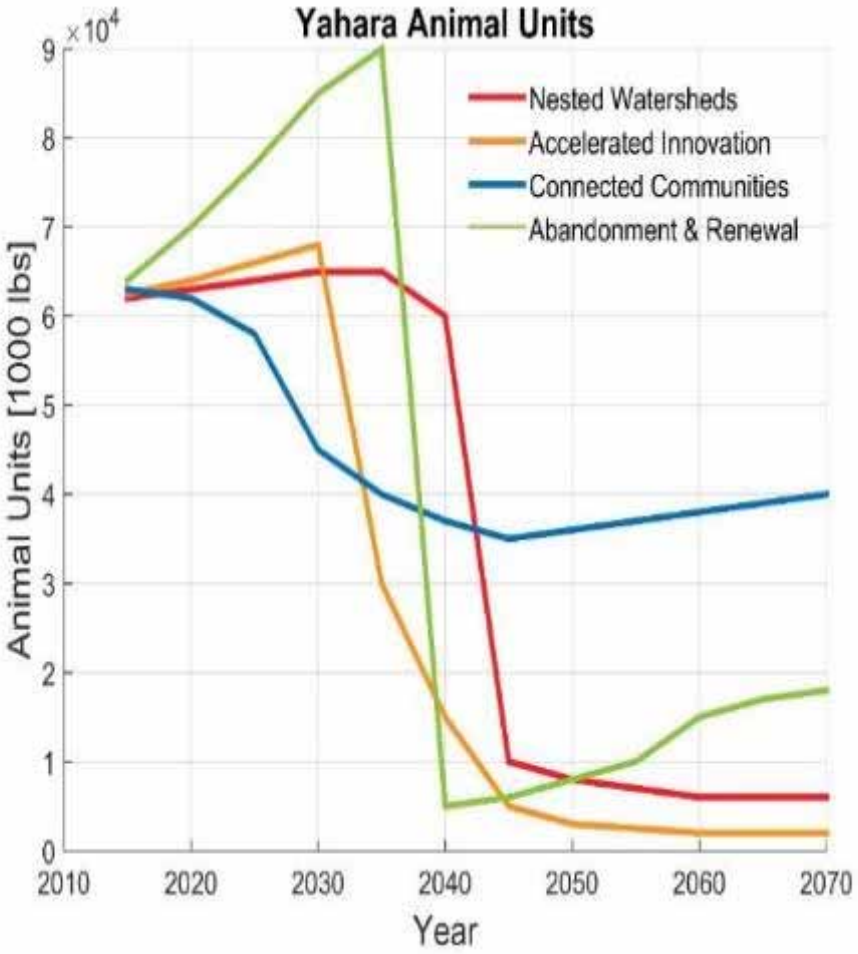


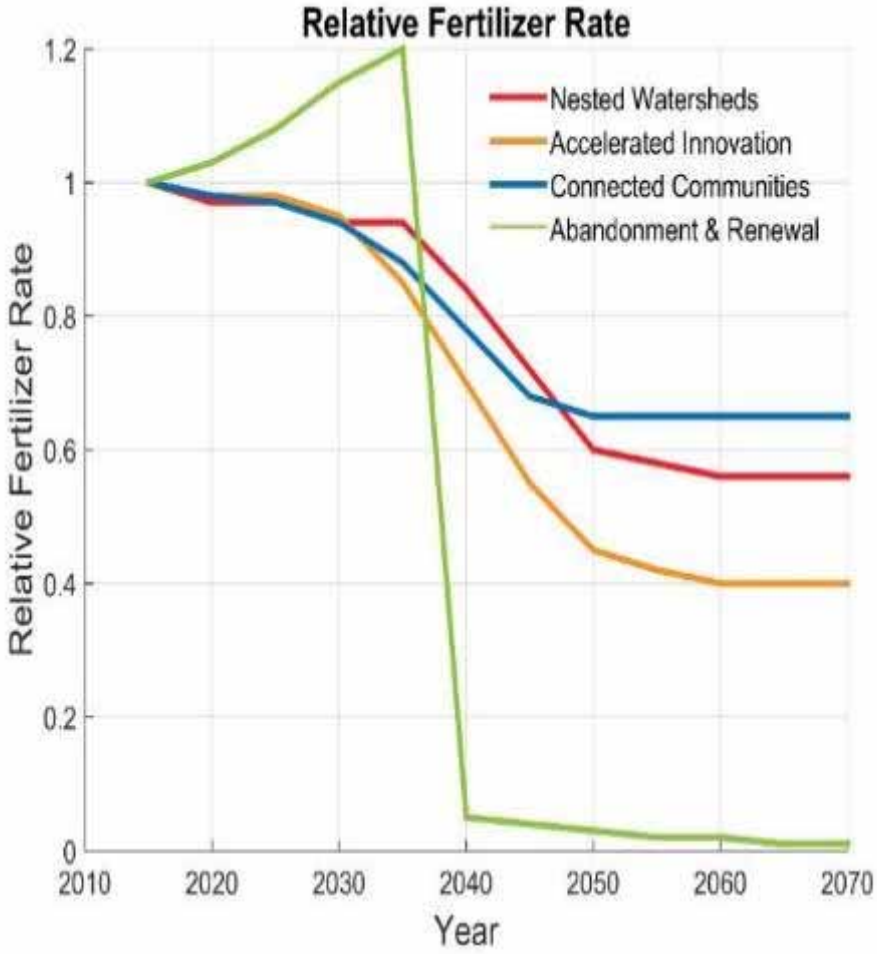
Nested Watersheds



The “Atoms” = Nutrient Management Changes

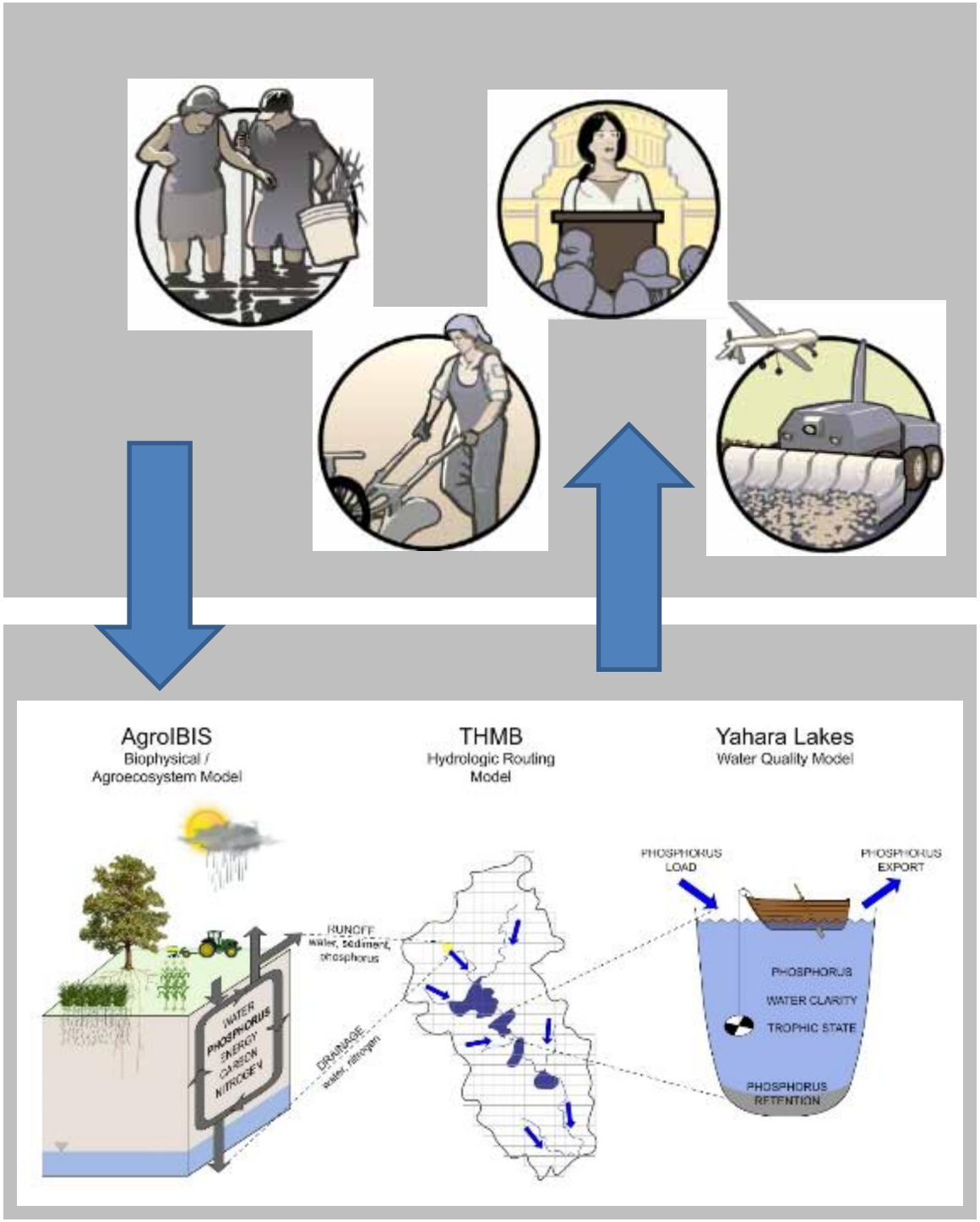
- Diet drives animal numbers (impacts manure inputs)
- Policies/values drive fertilizer rates



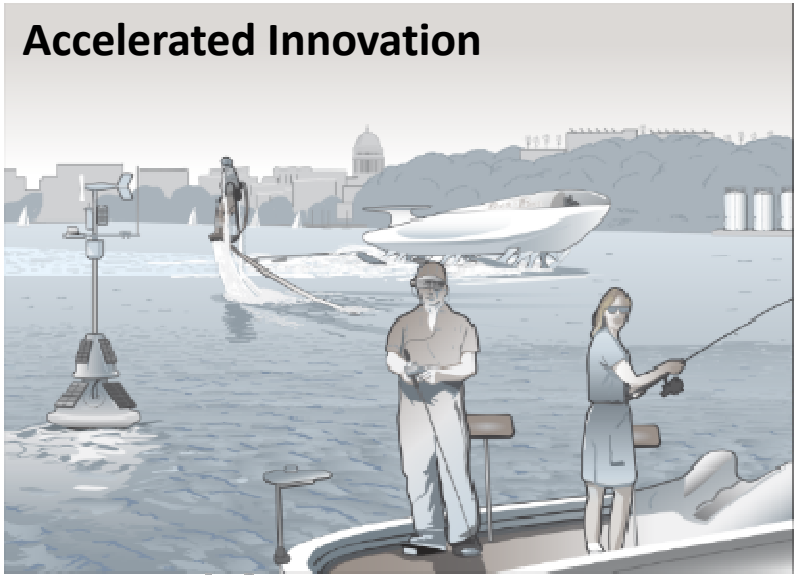


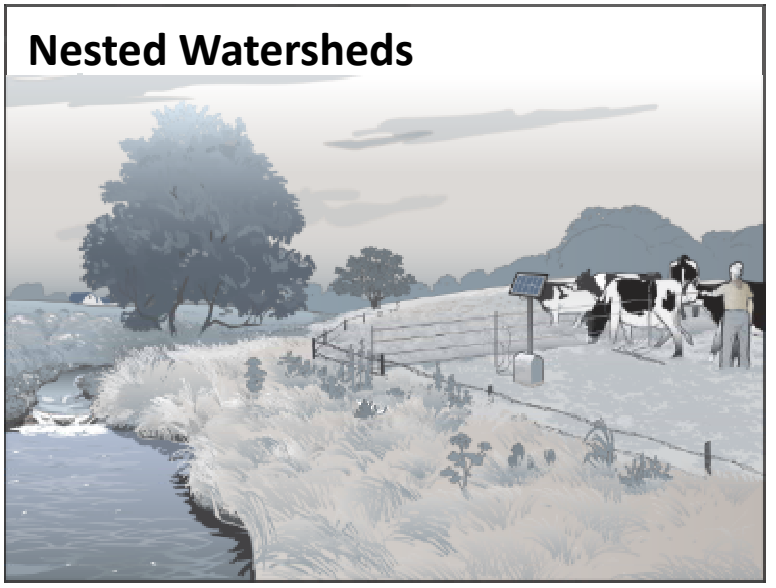
Model Outputs

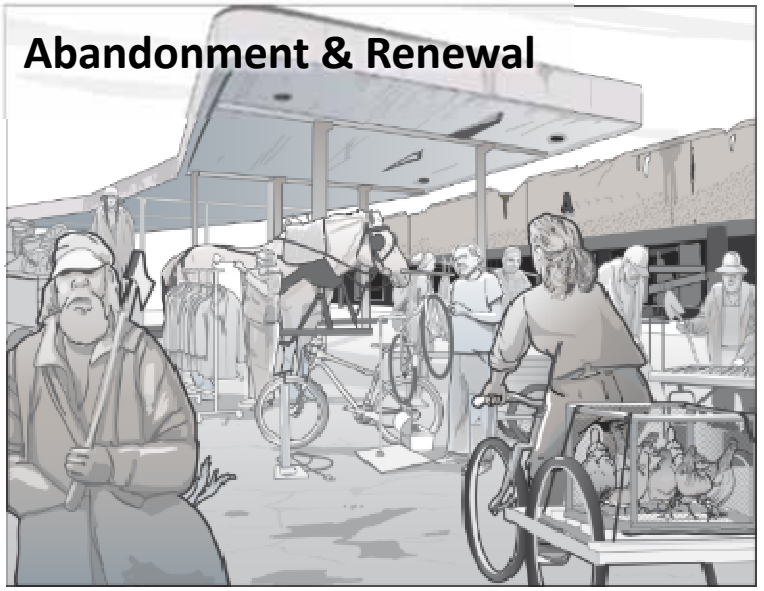
- Food production
- Biofuel production
- Climate regulation
- Freshwater supply
- Flood regulation
- Groundwater quality
- Surface water quality



Implications for future of water and people







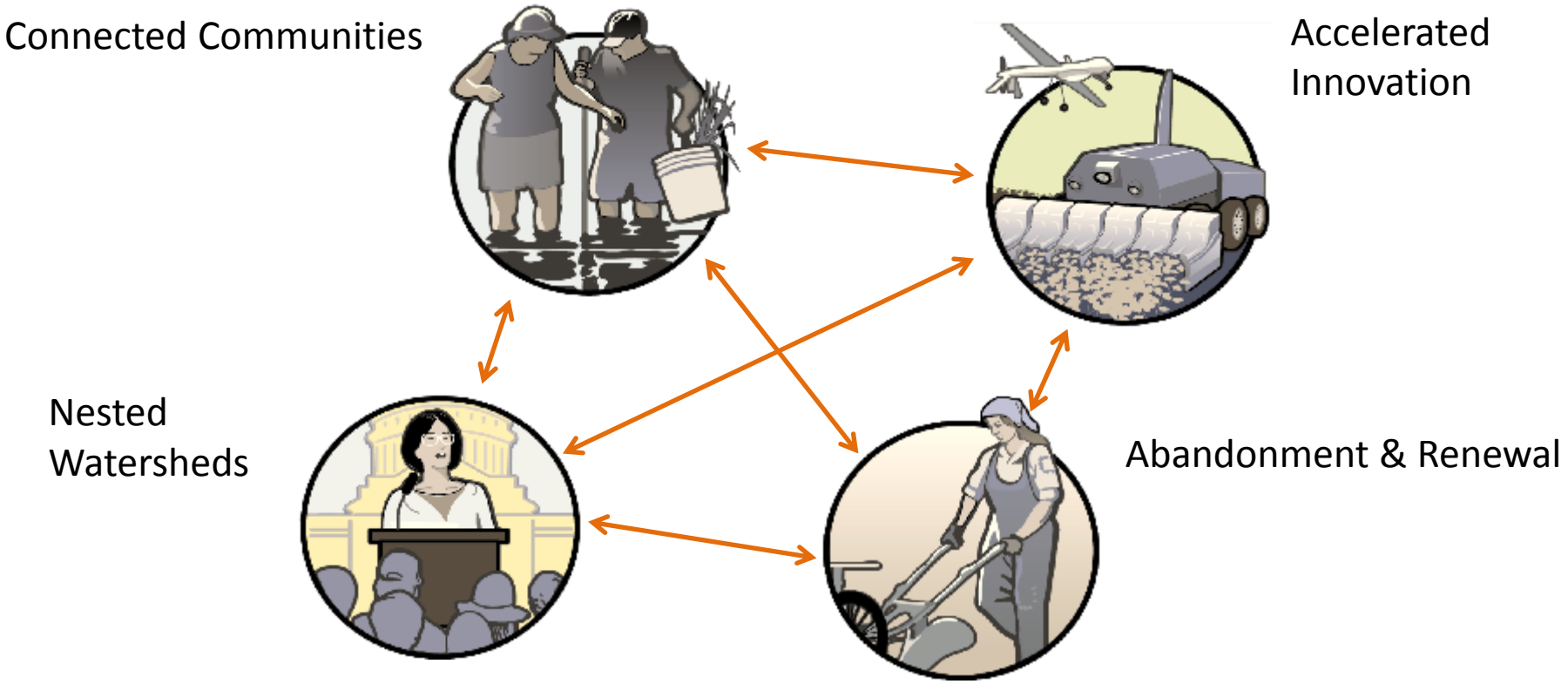
Scenario Applications

- A tool to identify and prepare for vulnerabilities and ways to build resilience
- A framework for weighing tradeoffs and making choices
- A backdrop for priorities and the potential changes that could affect them
- An opportunity to engage people in transformative discussions about the future

Vulnerability and Resilience: Prepare for surprises

Invasive species could be game changers

Tradeoffs and Choices: What do we need/want?



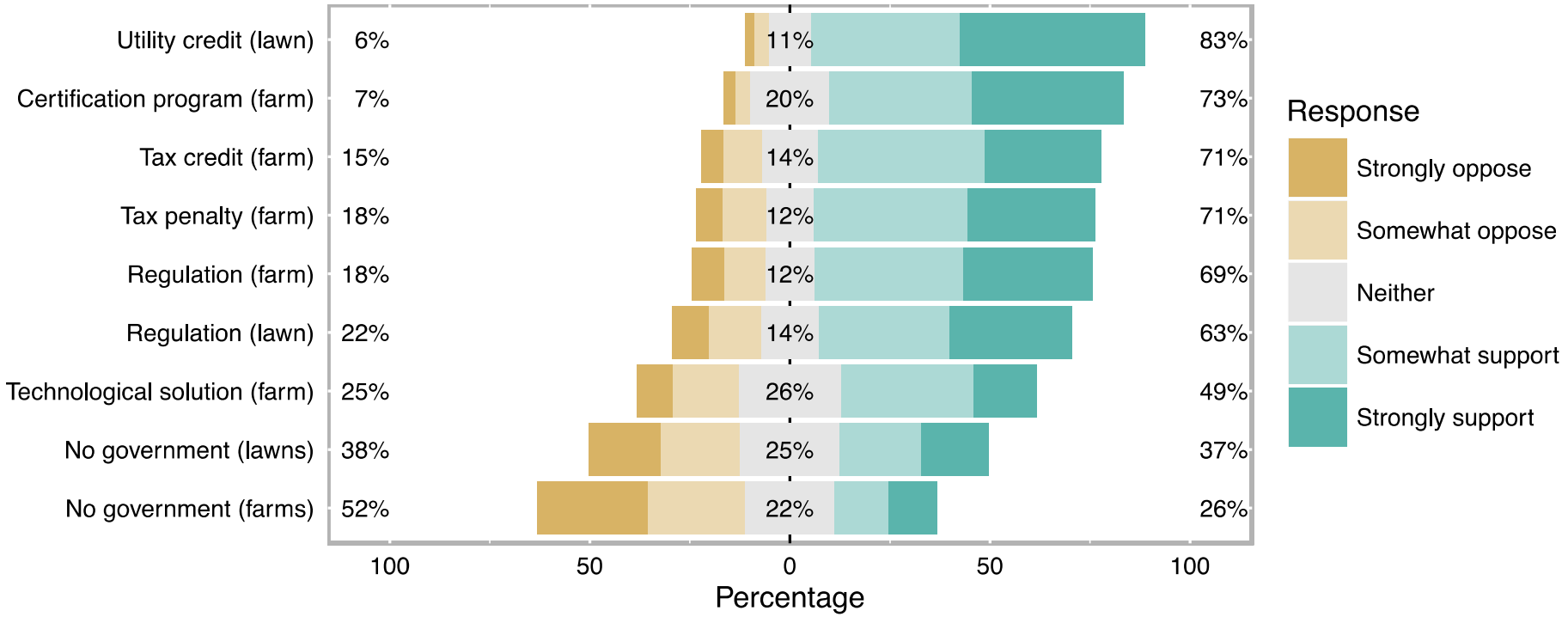
What do we want—or need—the watershed to provide?

What is biophysically possible *and* socially acceptable?

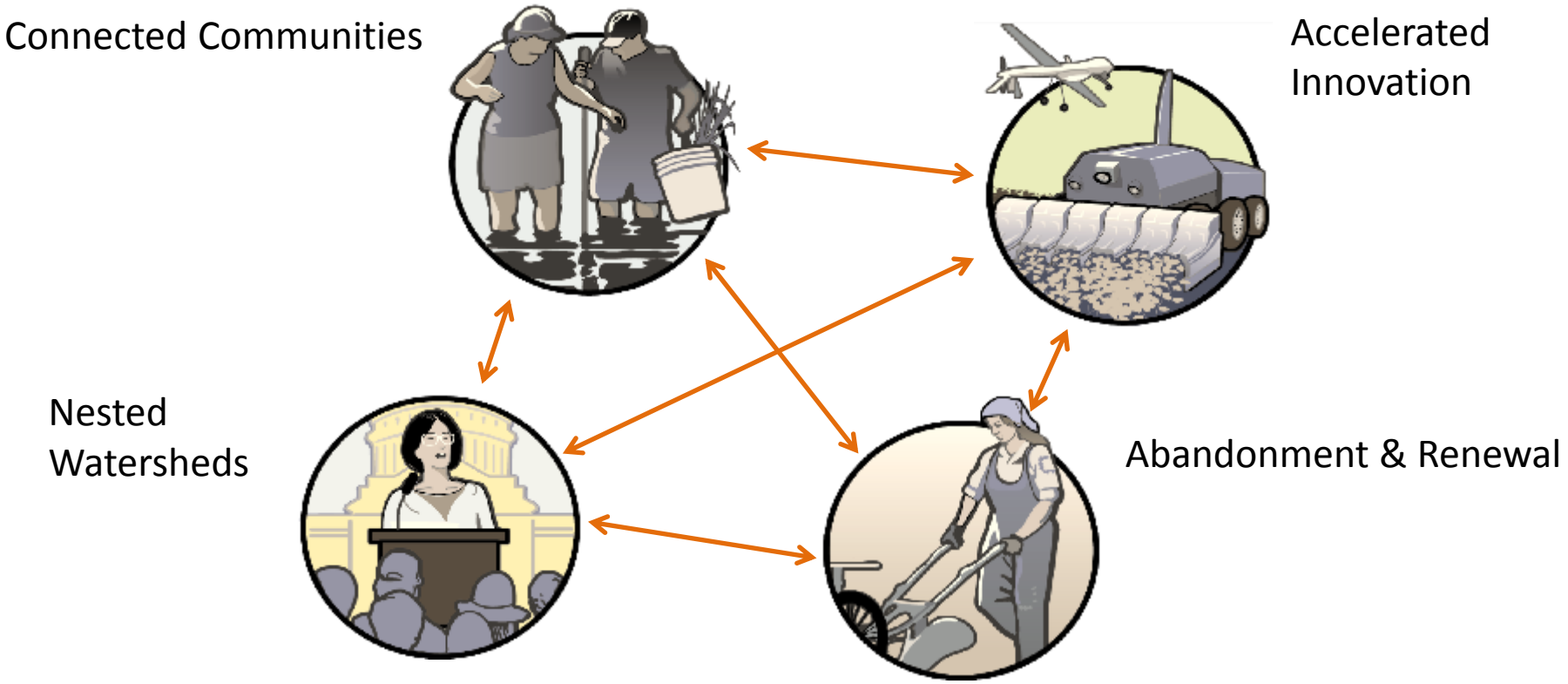
What choices will allow us to handle shocks and build resilience?

Backdrop for Priorities: What do we value?

People value clean water,
and voluntary actions without government intervention are least favored



Transformative conversations



What are the worst threats, and how can we avoid them?

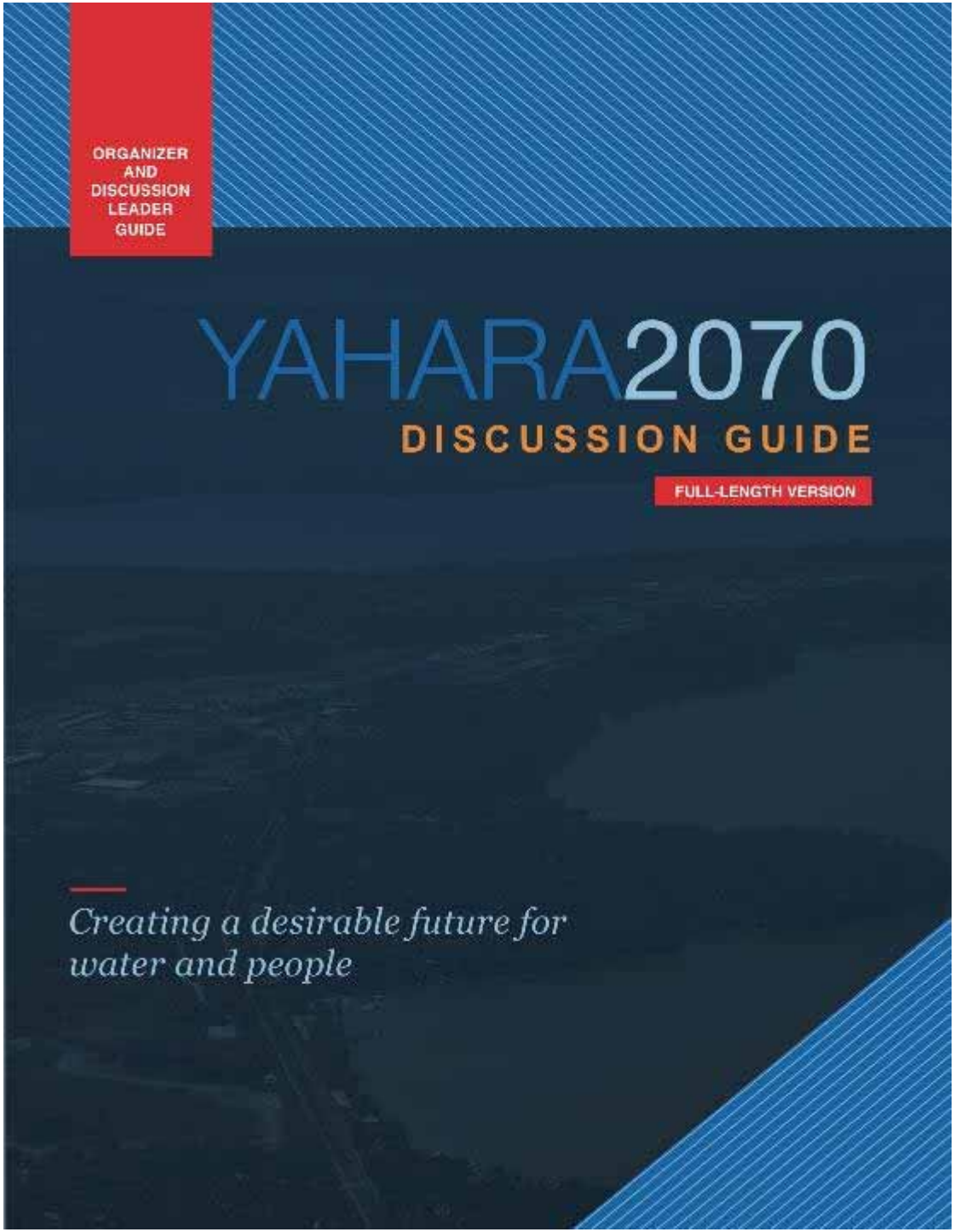
What are the best ideas or results, and how can we achieve them?

What is a desirable future, and how do we get there?

Transformative conversations

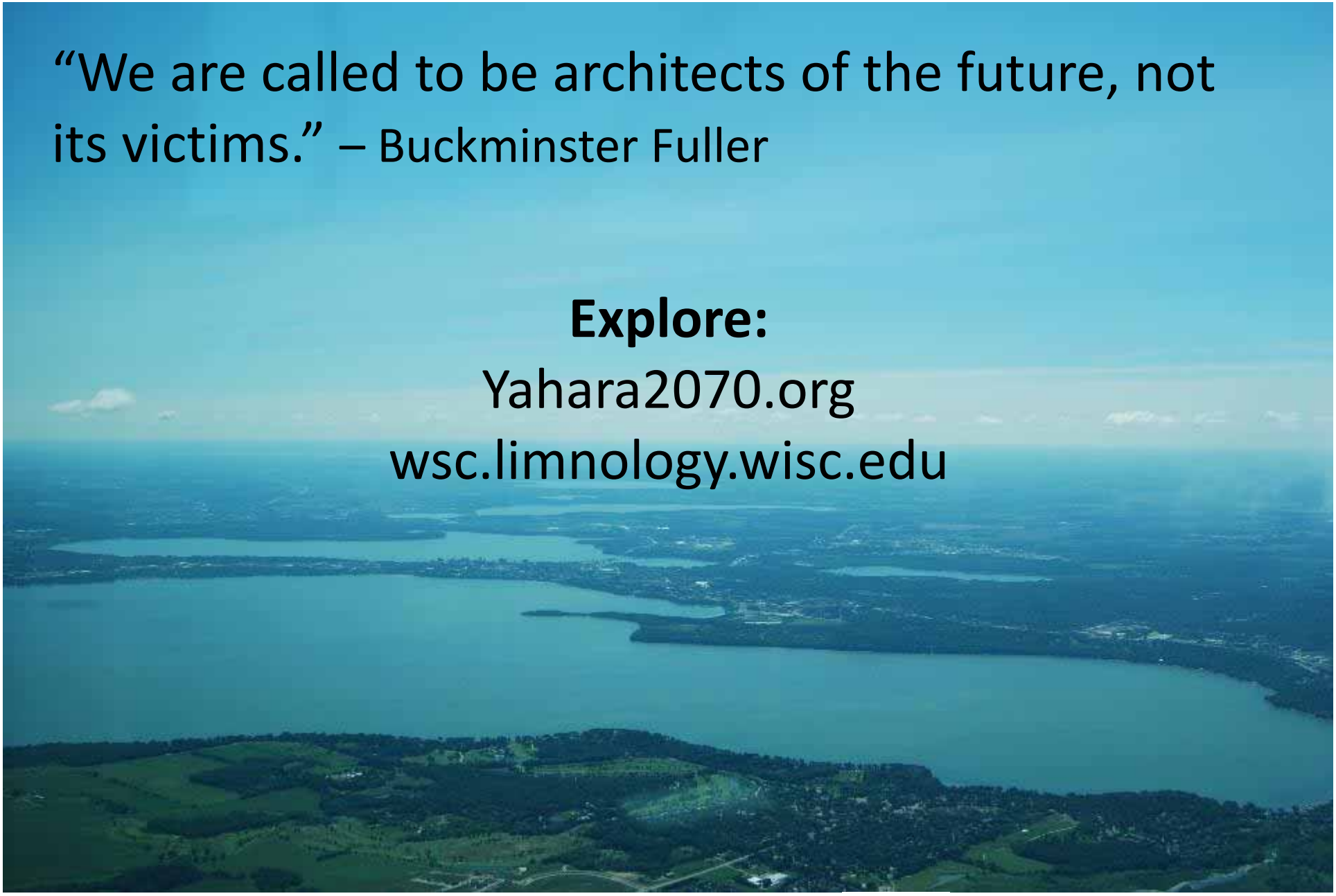
"If you want to build a ship, don't start with collecting wood, cutting the plank and assigning work, but awake in people the longing for the wide and open sea."

– Antoine de Saint-Exupery (*Citadelle*)



"Conversation is at the heart of what we know and how we know it. It is central to both constructing the future and learning how to act on it."

- Andrew Curry, The Futures Company


"We are called to be architects of the future, not its victims." – Buckminster Fuller
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