

# YAHARA 2070

## Possible futures for the Yahara Watershed

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# Ecosystem services – the benefits we get from nature that we rely on for our survival and well-being

Crop production

Climate regulation

Flood regulation

Aesthetics

Water quality

Recreation

Groundwater supply



How could changes in land use, climate, and human demand impact our ecosystem services for future generations in the Yahara Watershed?



# This is a complex problem.

- Uncertainty is high.
- Time frames of environmental change span many generations.
- People will reach different conclusions.
- Multiple solutions are “good enough.”



# Environmental change is slow and long term



Best Management Practice implementation

Increasing precipitation and heavy rainfall

Intensive fertilizer use

Wheat

Dairy revolution

Mechanization

Corn & soybeans dominant

Extensive prairie, savanna, wetland

Intensification of agricultural production

Urbanization, more impervious surfaces

Raw sewage directed to lakes

Diversion begins

Sewage treatment

Madison founded

Research on lake and watershed

Cyanobacteria blooms

Massive summer blooms of cyanobacteria

1800

1900

2000

Major Changes in the Yahara Watershed  
1800-present

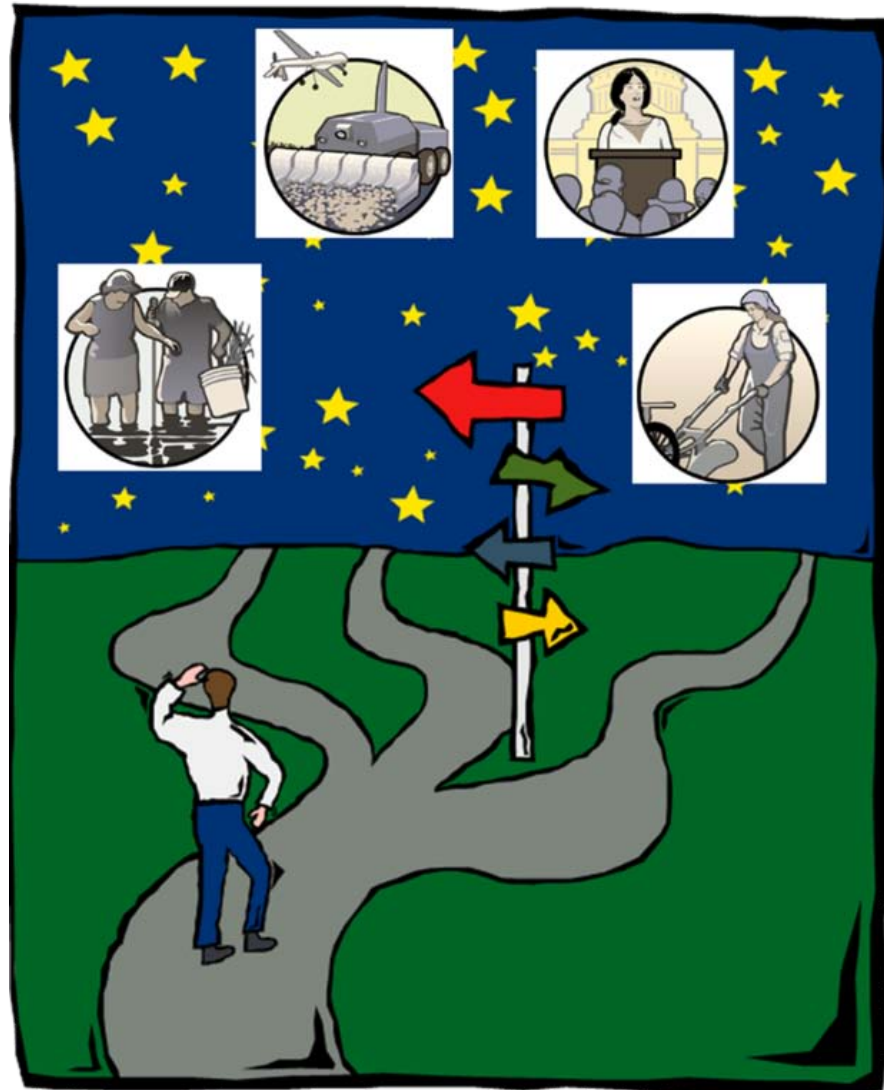
**Branch  
Points**

← a time for choices →

**TIME** →


**Throughout time, we face branch points, when our choices affect future outcomes.**

This leaves us with alternative pathways to alternative futures.





**We have to start somewhere.**



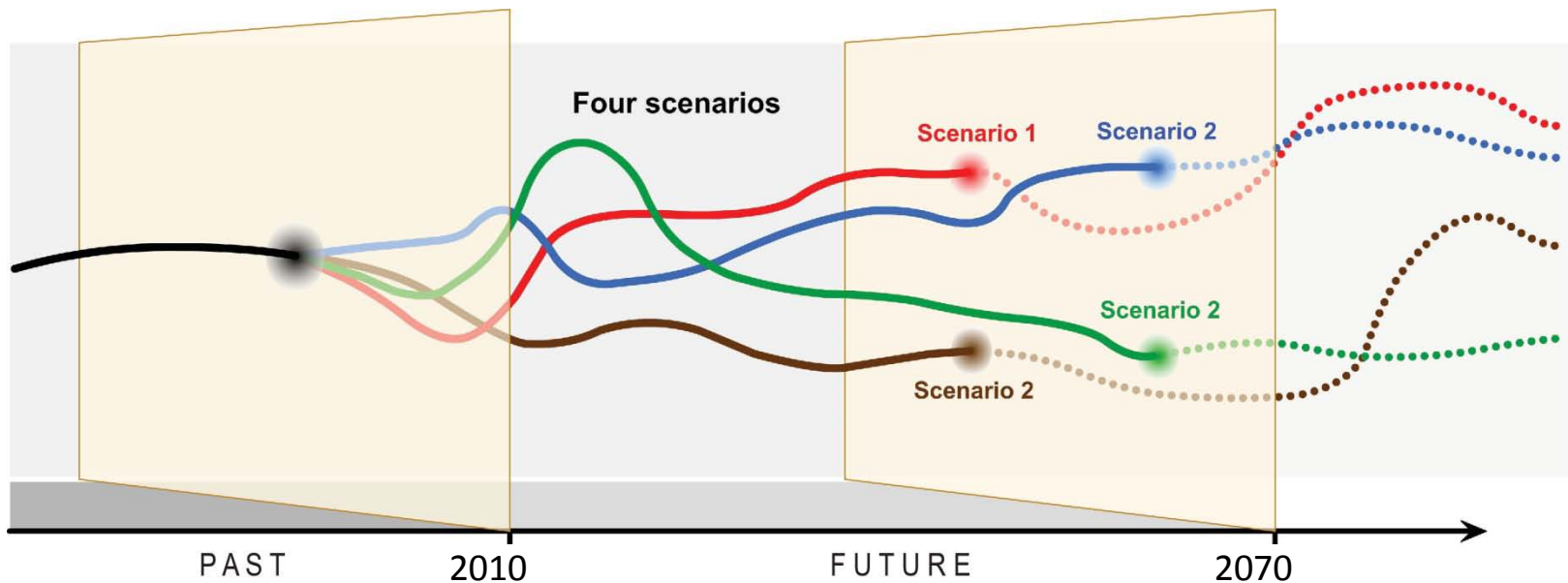
“Conversation is at the heart of what we know and how we know it. It is central to both constructing the future and learning how to act on it.”

– Andrew Curry, The Futures Company

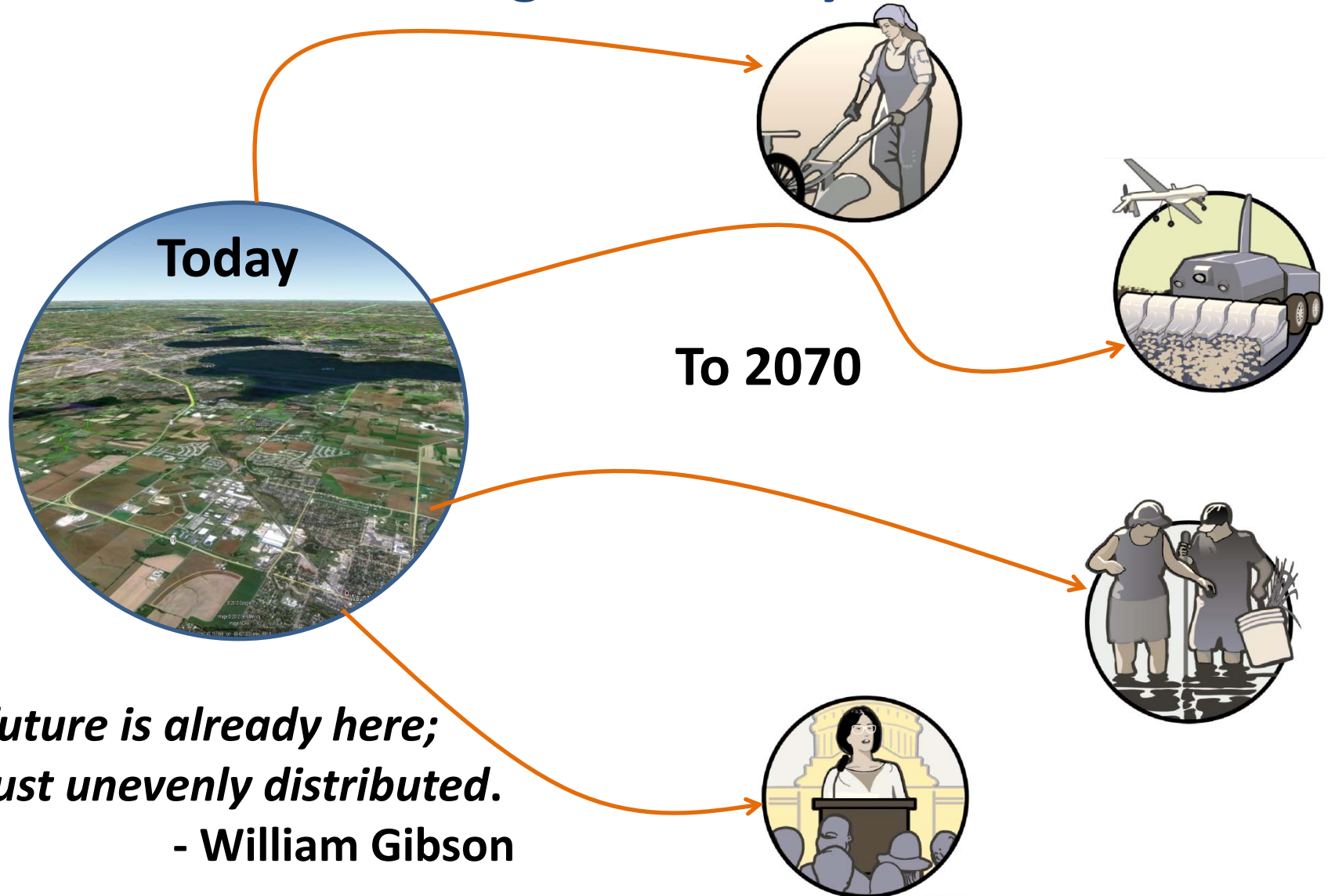


# Start with scenarios

- Provocative, plausible stories about the future with contrasting social and environmental conditions.
- Explore questions of “What if?”
- Facilitate long-term thinking.
- Help us learn ways to prepare for and cope with change and vulnerabilities.



# Scenarios help us think through uncertainty and alternatives in an organized way.



Today

To 2070

*The future is already here;  
it's just unevenly distributed.*  
- William Gibson



**How did we develop the Yahara 2070 scenarios?**



We started with stories that connect us  
with future generations.

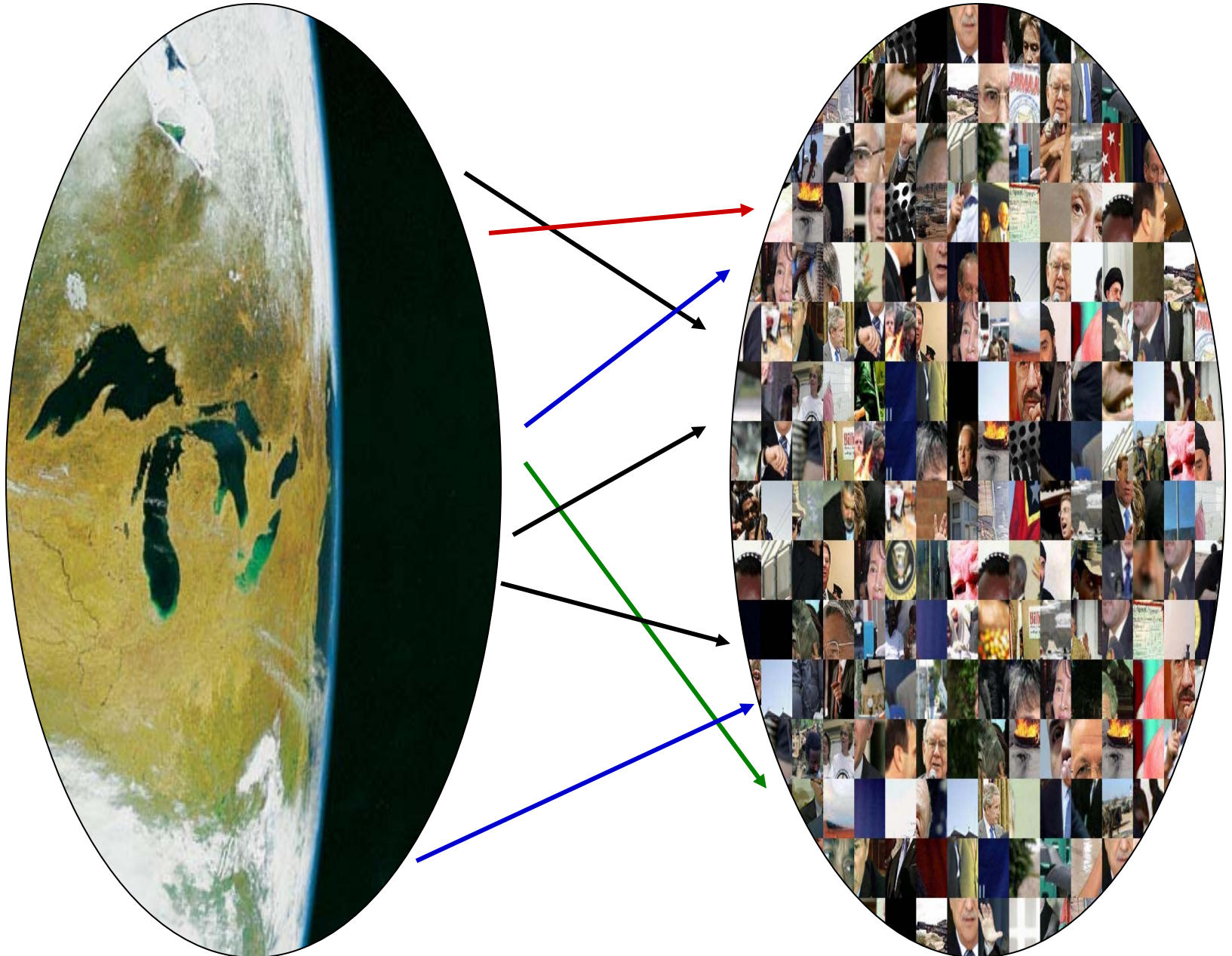


**The universe is made of stories, not of atoms.**

- Muriel Rukeyser (1913 -1980), "The Speed of Darkness"



In the world there are lots of perspectives.





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

clustered them into themes,

and condensed them into a few stories.



Illustrations by John Miller

# The Stories



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

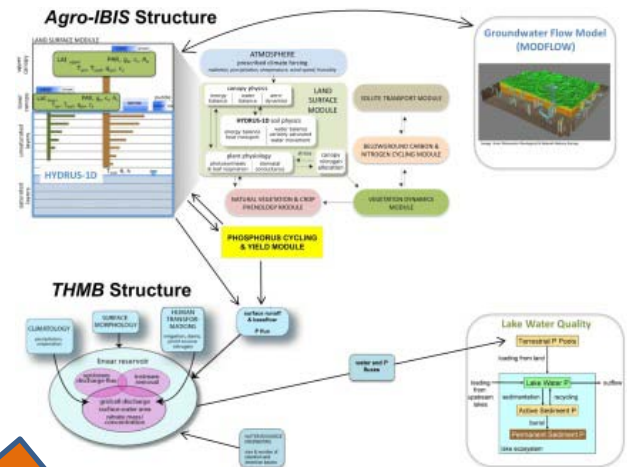
# The "Atoms"

Translations of the stories into numbers that a biophysical computer model can understand

## Narratives



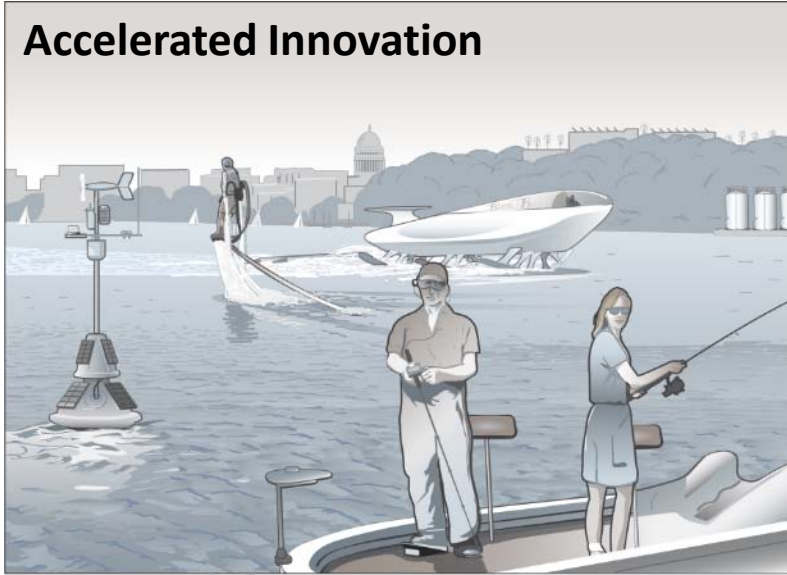
## Models



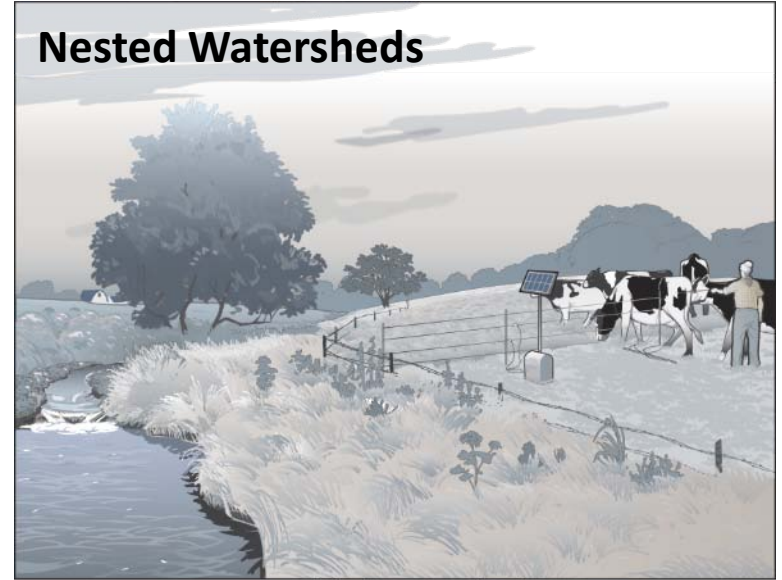


# Stories + Atoms = Implications for future human well-being

**Accelerated Innovation**



**Nested Watersheds**



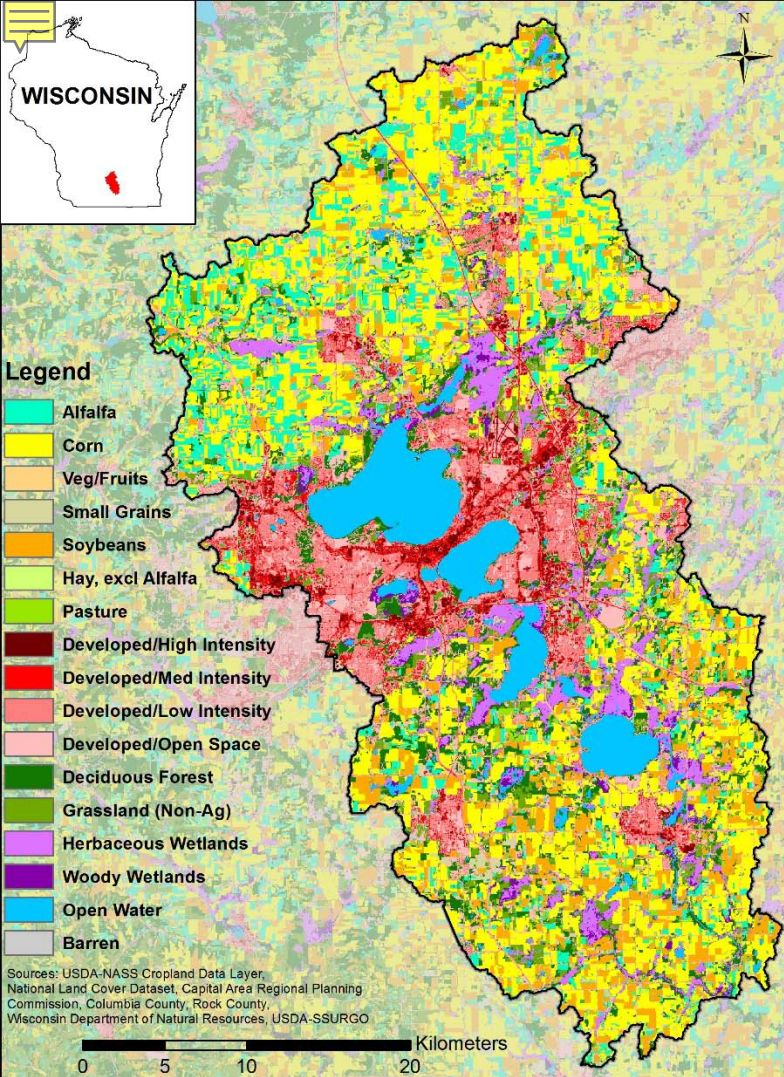
**Connected Communities**



**Abandonment & Renewal**







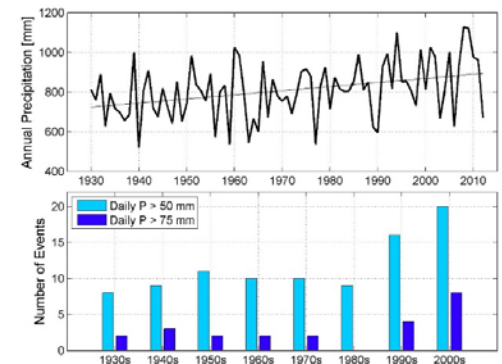
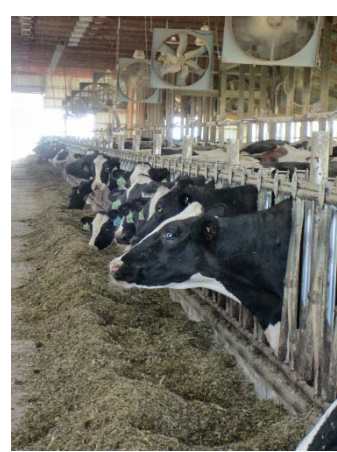
# Yahara River Watershed





# Main Drivers of Change

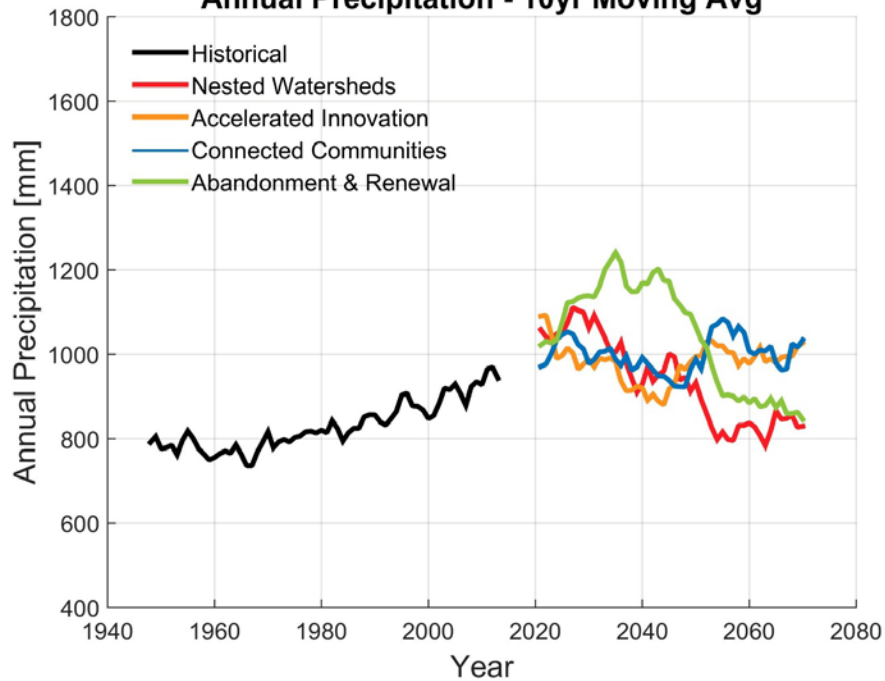
- Intensification of Dairy Agriculture
  - Trend towards fewer farms and cows but WAY more milk (and manure) per cow
  - Main source of water quality impairment
- Increasing Biofuel Economy
  - What doesn't end up as livestock feed has increasingly become ethanol
- Urban Development
  - Increase in impervious surfaces → lake flooding
  - Decrease in agricultural land base → concentration of manure
- Changes in Climate
  - Increase in annual precipitation
  - More frequent heavy rainfall events



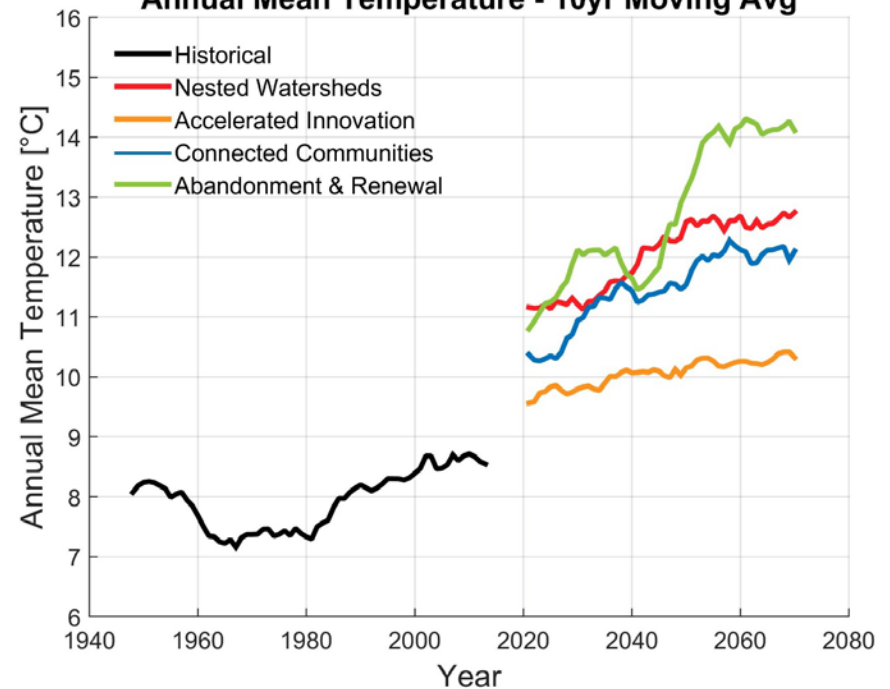
# Climate Scenarios at a Glance



### Annual Precipitation - 10yr Moving Avg



### Annual Mean Temperature - 10yr Moving Avg





# Accelerated Innovation

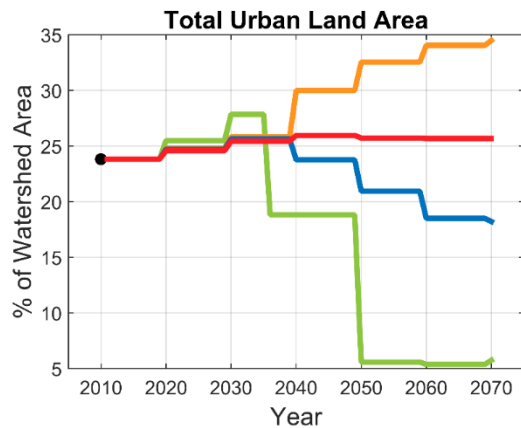
What if we prioritize technology to solve water and climate challenges?





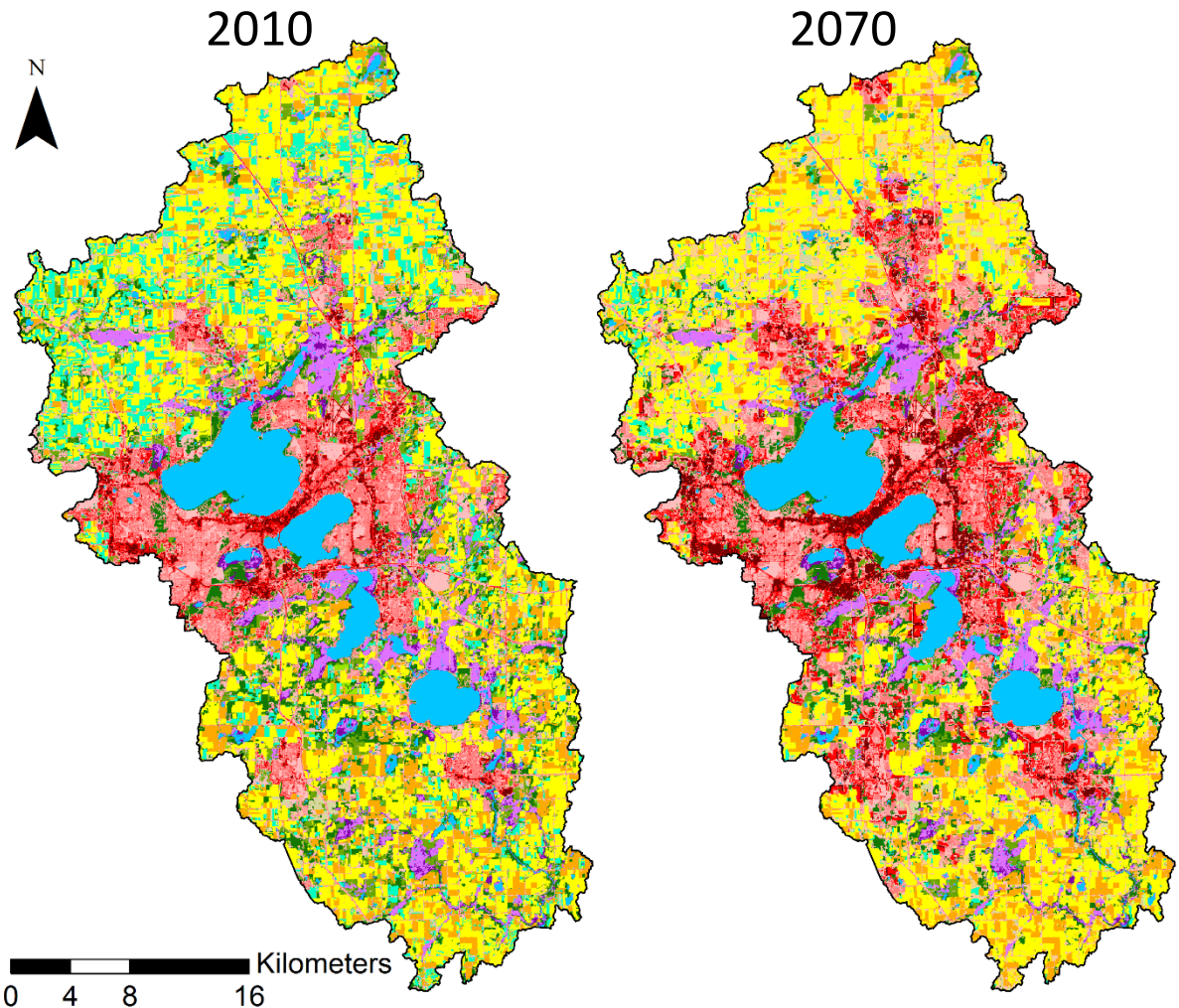
# Accelerated Innovation

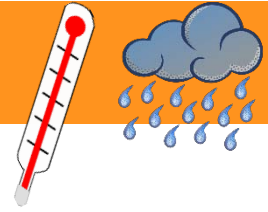
- Urban footprint expands to accommodate larger population
- Precision-tech agriculture boosts productivity
- GM corn used as feedstock for motherless meat and dairy



- Land Area Percentage in 2010
- Abandonment & Renewal
- Accelerated Innovation
- Connected Communities
- Nested Watersheds

## LANDSCAPE CHANGES





## Climate Changes

Scenario	Precipitation	Temperature	Extreme rainfall	Heat waves
<b><i>Accelerated Innovation</i></b>	Slightly wetter	3°F increase	Slight increase in frequency	Increase in frequency
<b><i>Nested Watersheds</i></b>	Slightly wetter then drier	7°F increase	Increase in frequency	Large increase in frequency
<b><i>Connected Communities</i></b>	Slightly wetter	6°F increase	Increase in frequency	Large increase in frequency
<b><i>Abandonment &amp; Renewal</i></b>	Much wetter then drier	9°F increase	Large increase then decrease	Very large increase in frequency





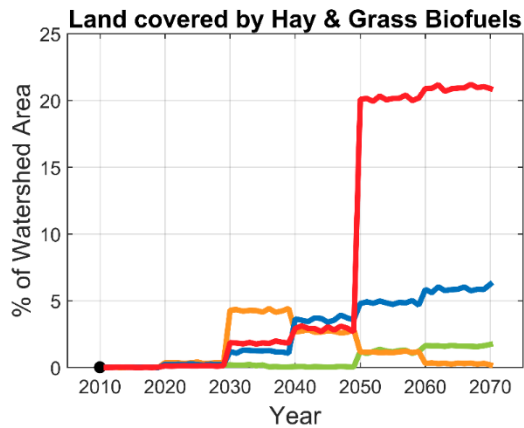
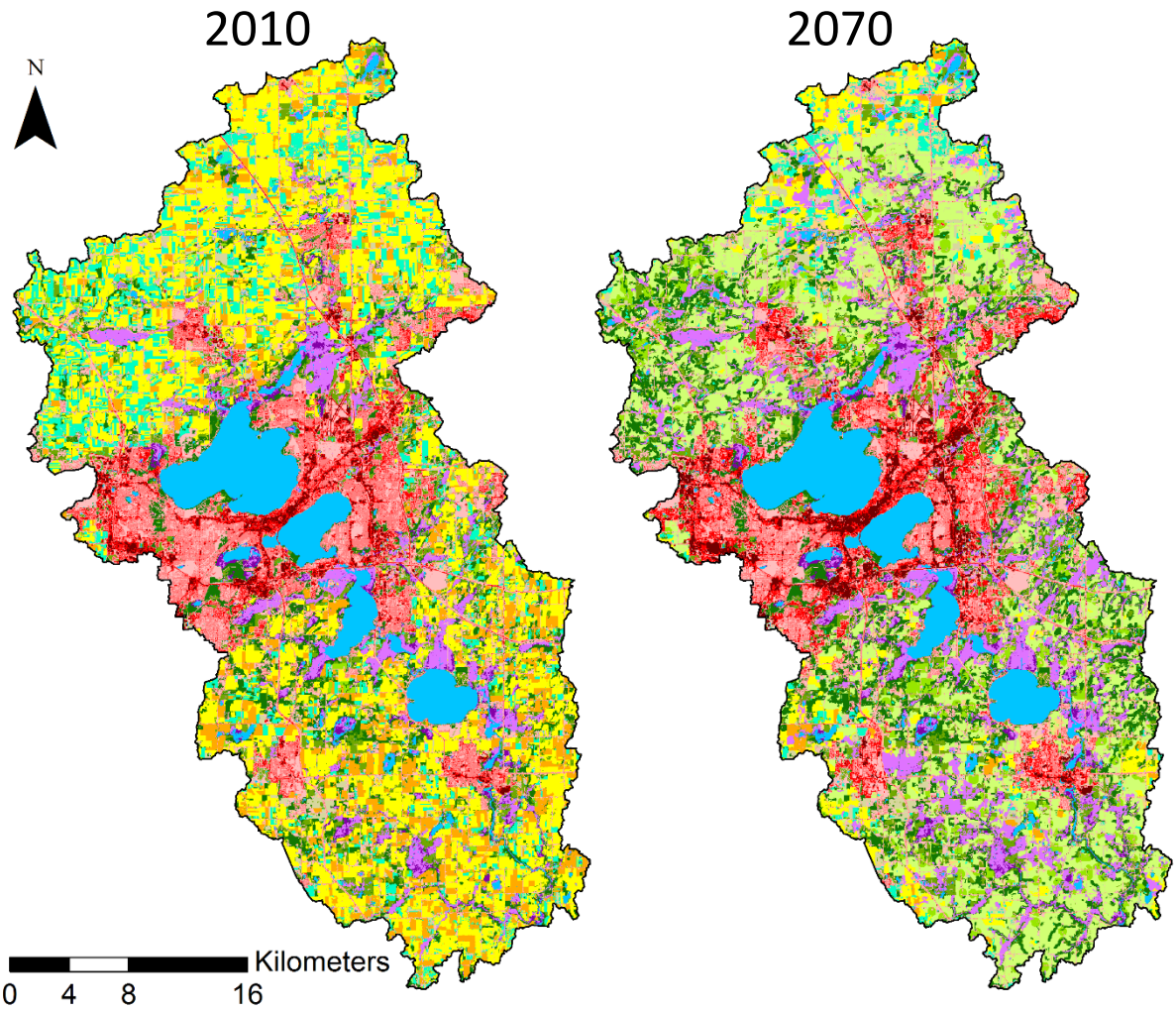
# Nested Watersheds

What if we reform how we govern to address water and climate challenges?

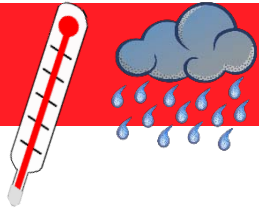


- WQ and food policy drives changes away from row-crop ag towards biofuels, forest, and wetlands
- Urban density increases to accommodate larger population on existing footprint

## LANDSCAPE CHANGES



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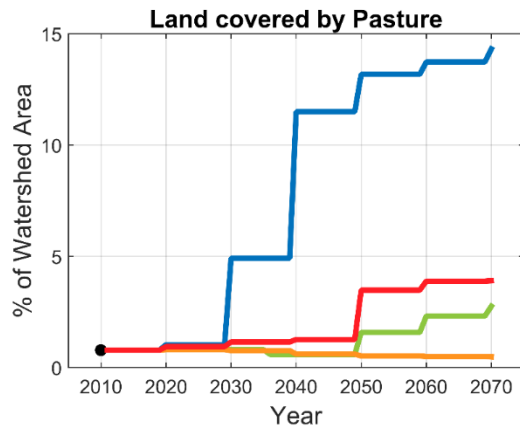


What if we shift our values in response to water and climate challenges?

Connected Communities

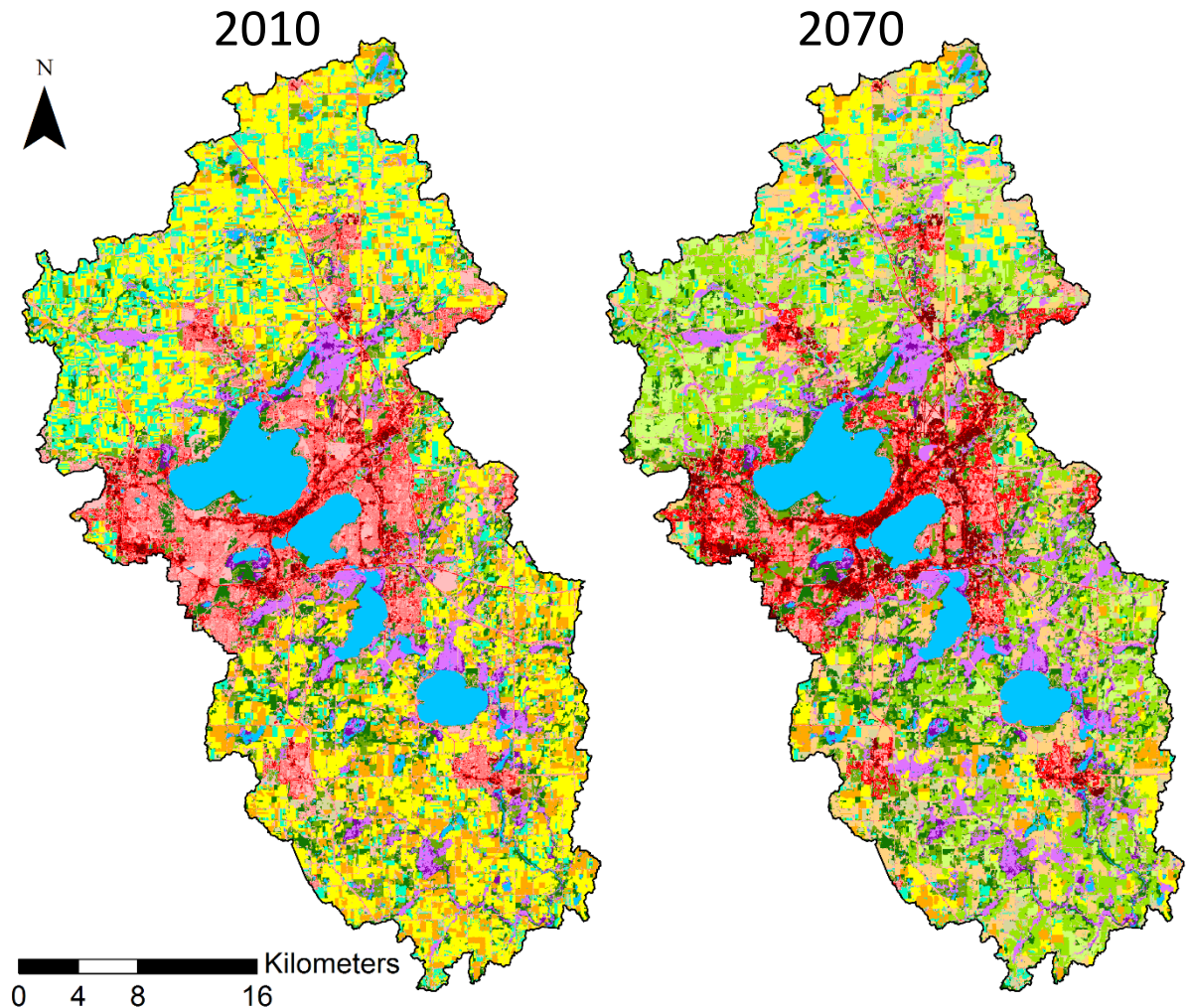


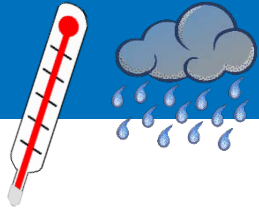
- Diet shift away from meat and dairy towards vegetables, fruits, legumes, small grains changes ag landscape
- Remaining meat and dairy is largely pasture-fed
- Urban open space is largely converted to prairie and forest



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What if we aren't prepared for water and climate challenges?

# Abandonment & Renewal

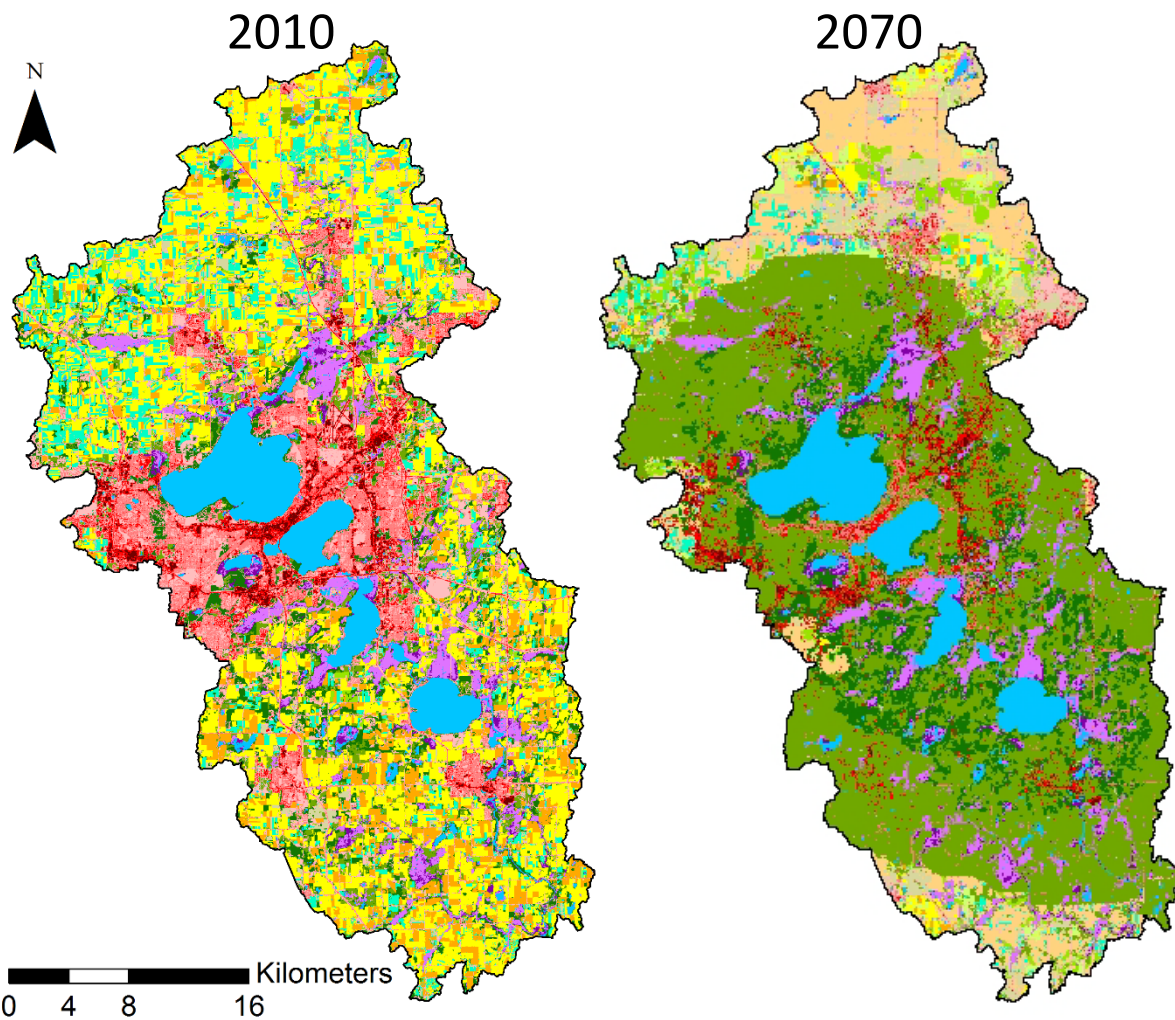
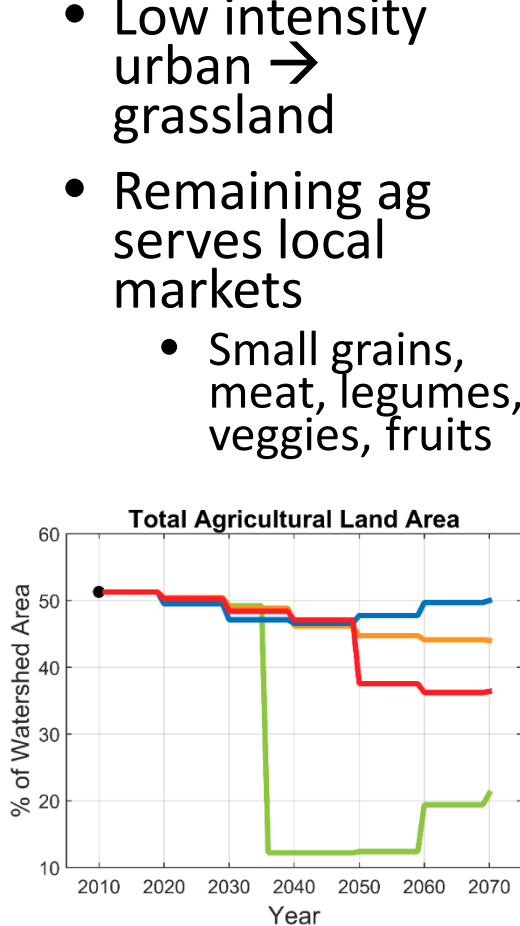




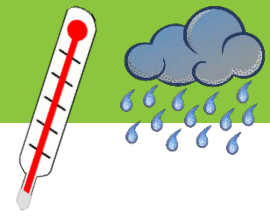
# Abandonment & Renewal

- Agriculture → grassland
- Low intensity urban → grassland
- Remaining ag serves local markets
  - Small grains, meat, legumes, veggies, fruits

## LANDSCAPE CHANGES



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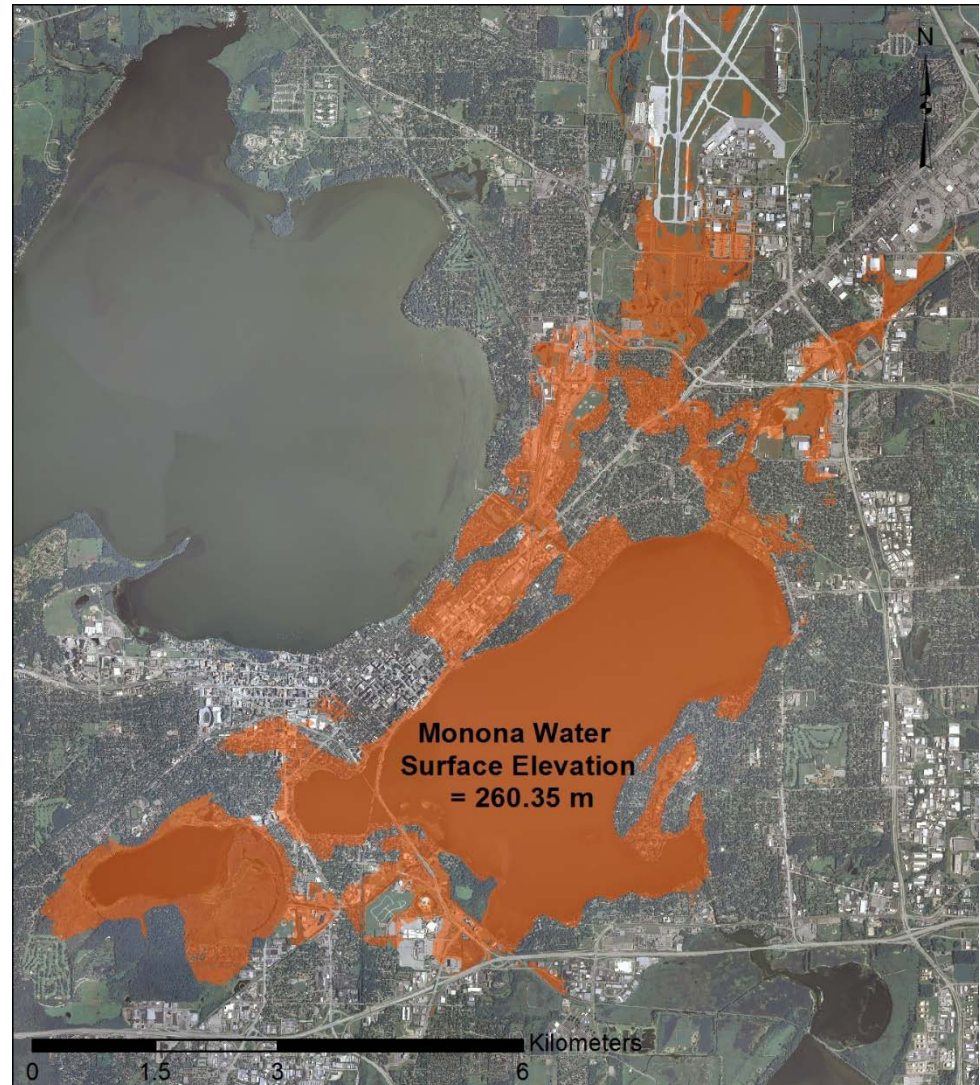
# What can you do with Yahara 2070?

- A tool to help you prepare for vulnerabilities
- A framework for weighing tradeoffs and making choices
- A backdrop for your priorities and the potential changes that could affect them
- An opportunity to engage your constituents in discussions about the future and think beyond business-as-usual



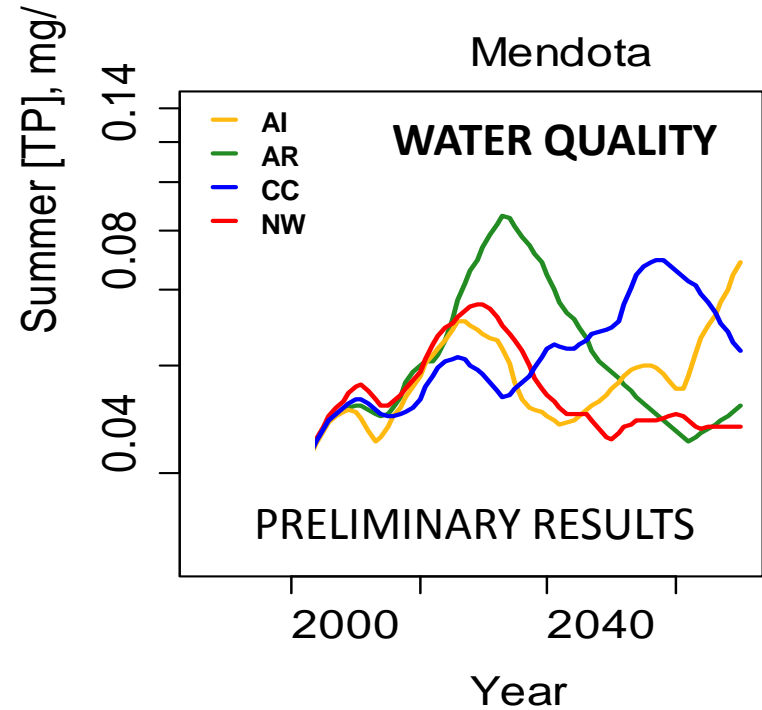
# Illuminating Vulnerabilities

- Impacts of Extreme Flooding
  - Example from Abandonment & Renewal, 2031
  - Similar to Lake Delton storm in 2008



# Illuminating Vulnerabilities

- Challenge of Improving Water Quality
  - Large changes in landscape do not **automatically** lead to improved water quality
  - Phosphorus legacy in soils



g/



The four scenarios **together** raise cross-cutting questions.

Connected Communities



Accelerated Innovation



Nested Watersheds



Abandonment & Renewal



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

**What are the best ideas and how can they be combined?**

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



The four scenarios **together** raise cross-cutting questions.

Connected Communities



Accelerated Innovation



Nested Watersheds



Abandonment & Renewal



**How can we make sure the natural benefits, or ecosystem services, we get from the watershed are equitably distributed, especially as land-use, climate and human demands change?**

# The “5<sup>th</sup>” scenario or Leitbild: A guiding vision of a future we want



“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*)

# Engagement Opportunities

- Yahara 2070 Discussion Guide
  - Uses Yahara 2070 to start conversations about creating a vision of a resilient and desirable future and how to achieve it
- Our Waters, Our Future Writing Contest
  - Submissions due Feb. 1, 2016

<https://wsc.limnology.wisc.edu/writing-contest>



# Questions?

## Contact us:

Jenny: [jseifert2@wisc.edu](mailto:jseifert2@wisc.edu)

Eric: [egbooth@wisc.edu](mailto:egbooth@wisc.edu)

# Yahara2070.org

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Water Sustainability and Climate  
In the Yahara Watershed

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# YAHARA2070

Yahara 2070 is an exploration of possible futures for human well-being in Wisconsin's Yahara Watershed

What would life in 2070 be like if...

- we aren't prepared?
- we prioritize technology?
- we shift our values?
- we reform governance?

- ABOUT SCENARIOS
- ABOUT YAHARA 2070
- YAHARA 2070'S DEVELOPMENT
- YAHARA'S PAST