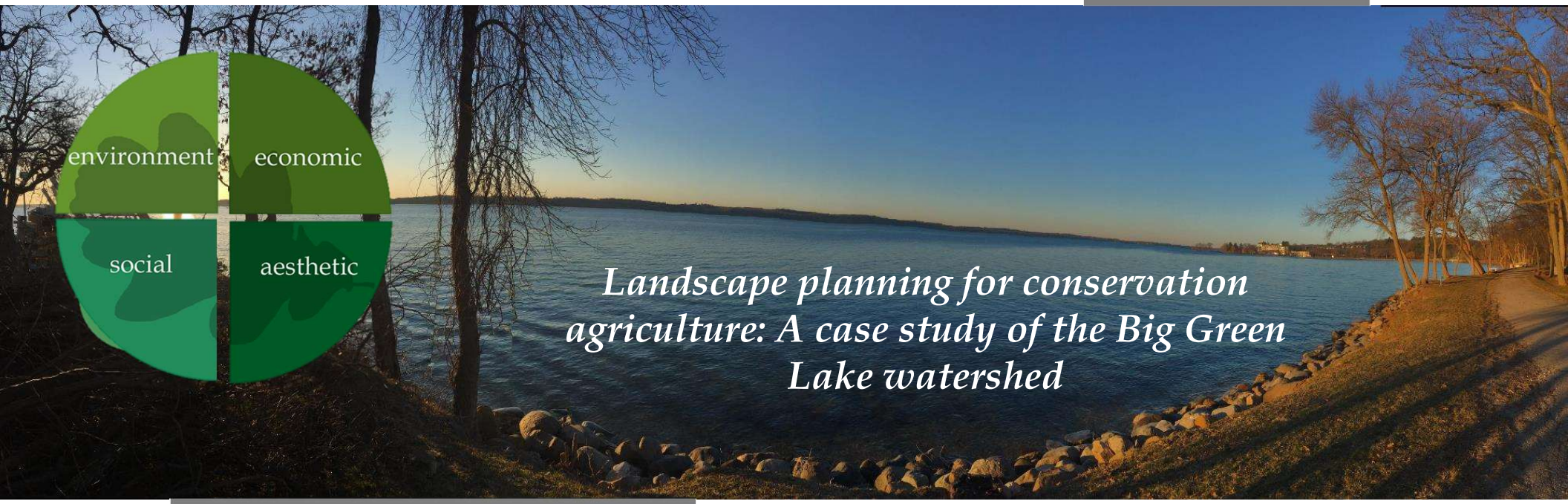
PURDUE UNIVERSITY



Landscape planning for conservation agriculture: A case study of the Big Green Lake watershed

Aaron Thompson, Ph.D.
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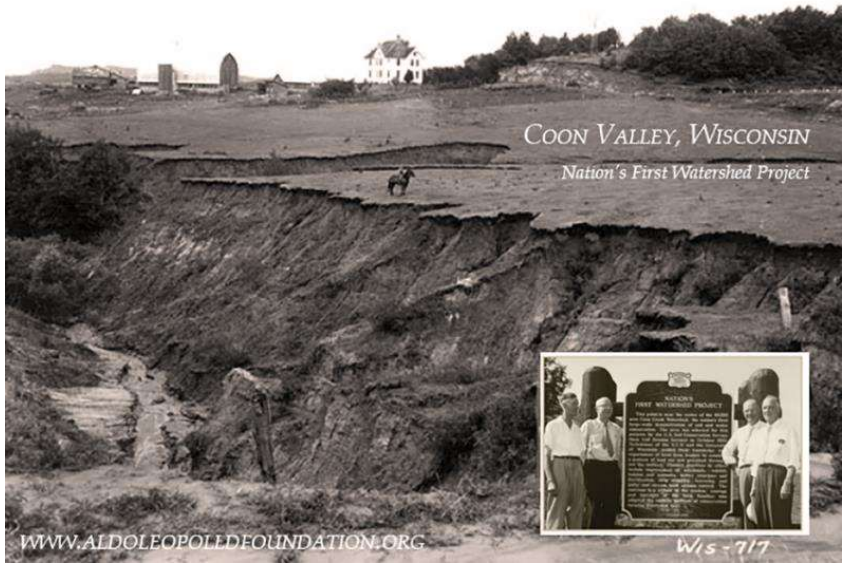
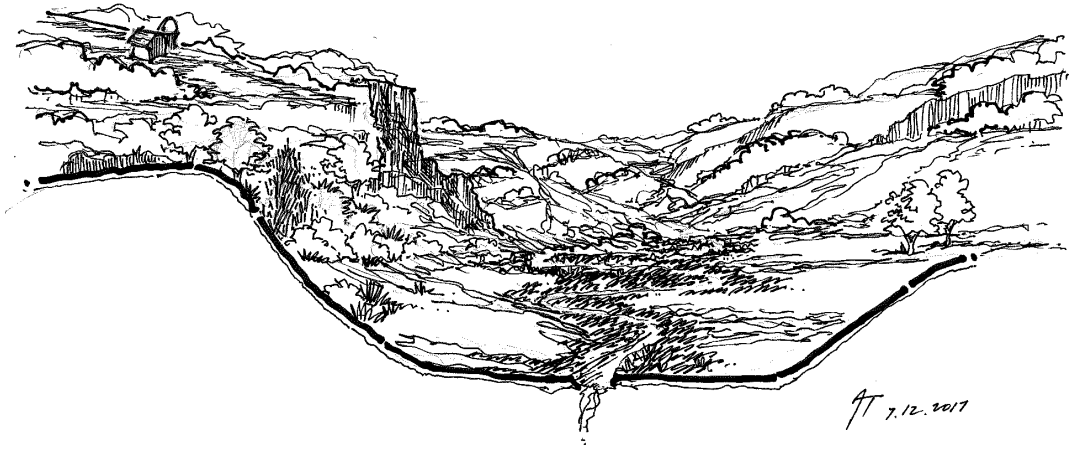
"{Hugh Hammond Bennett, a soil surveyor with the USDA}, recruited a team from the University of Wisconsin-Madison, including Leopold, and proposed Coon Valley as an ideal site for a conservation effort due to its location and …



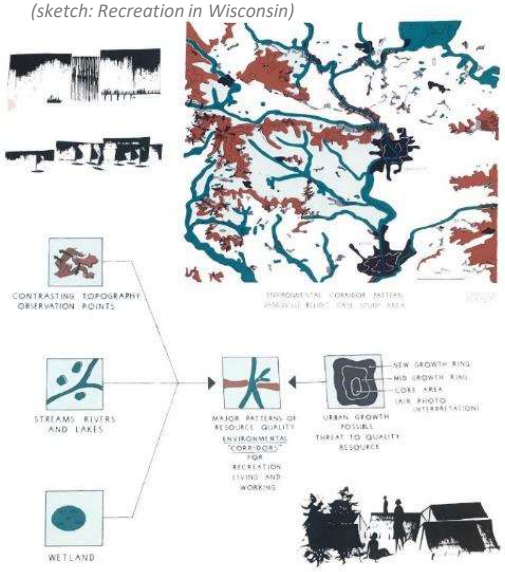


… and the perception that the landowners would perhaps be more cooperative there than elsewhere. The first watershed project in the nation was born.

(Caroline Schneider, https://www.soils.org/)

PHILIP H. LEWIS JR.

(sketch: Recreation in Wisconsin)



"The Regional Design Process … requires interdisciplinary teams of two kinds: a **land team** and a **people team**."

"The *people team's mission* is to acquire a comprehensive understanding of the basic needs and expectations of the people of the region … includes the behavioral sciences, which are concerned with information about human needs."

Tomorrow by Design

Wisconsin Think Water School

Lakes Team

Brian Weigel
WDNR

Eric Olson
UWEX

Nels Paulson
UW-Stout

Buzz Sorge
WDNR (retired)

Mark Hazuga
WDNR

Aaron Thompson
UW-Stevens Point

Photo Credit: Jeremy Solin

Our team-based strategy for the ThinkWater School program is to develop a new approach that can be applied to enhance existing watershed planning practices by leveraging an understanding of both social and ecological conditions to increase the effectiveness of these community efforts.

Wisconsin Think Water School

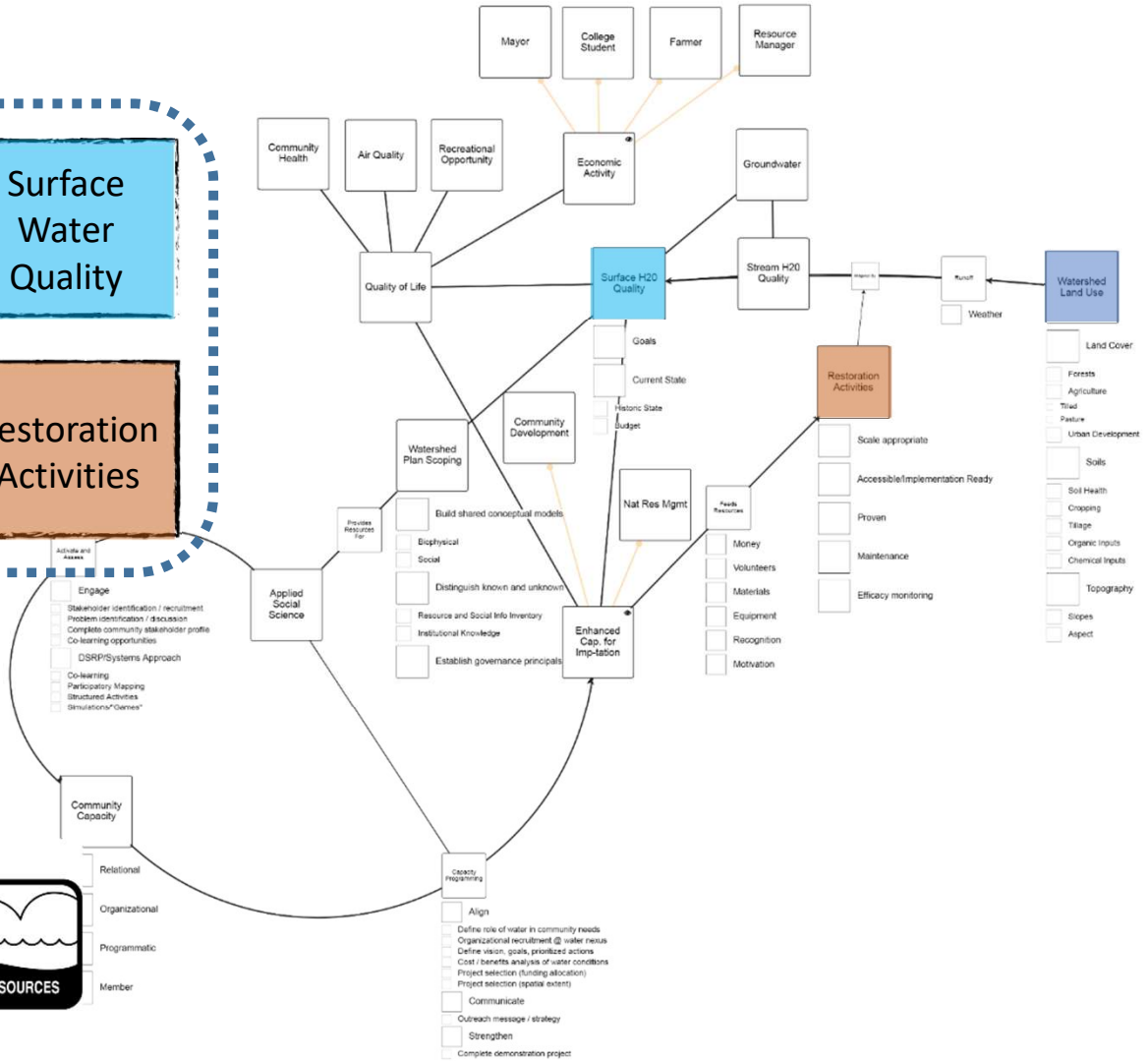
Lakes Team

Relationship

Watershed (Land Use) → Runoff → Surface Water Quality

Surface Water Quality ← Mitigated By ← Restoration Activities

Biological, chemical, physical systems



Proud tradition of excellence in building the monitoring and support network to manage this (part of the) problem.

WISCONSIN DEPT. OF NATURAL RESOURCES

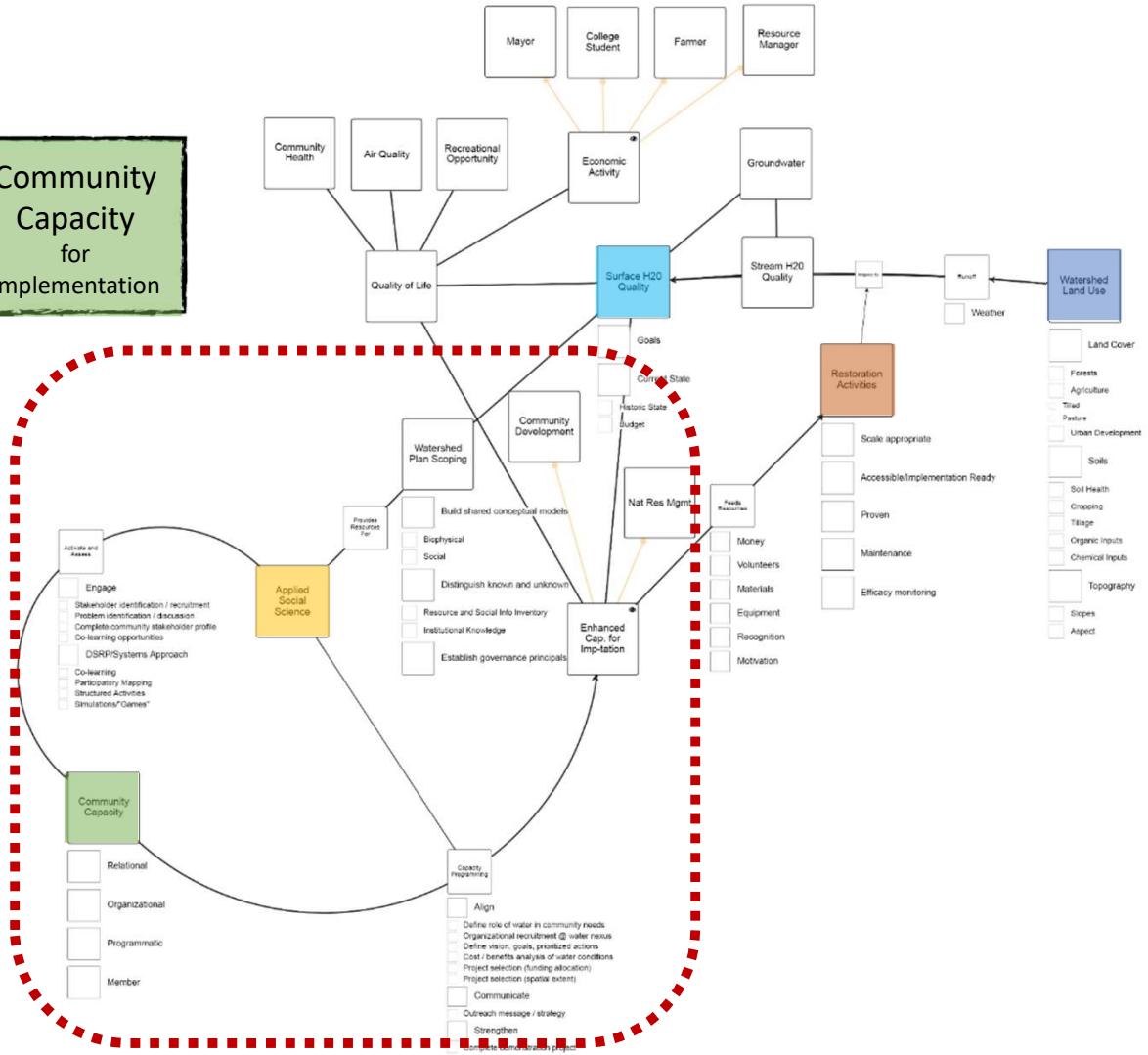
Wisconsin Think Water School

Lakes Team

Relationship

Restoration Activities <<< Depend on resources <<< Community Capacity for Implementation

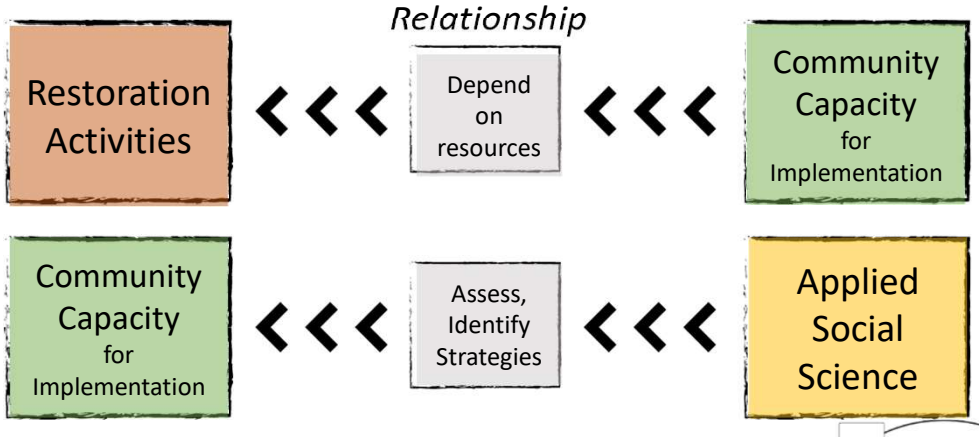
Water quality protection and restoration, in a resource constrained context, is the necessary reliance on community resources for implementation of these activities -- **thus community capacity is a LIMITING FACTOR in this system**.



Social systems

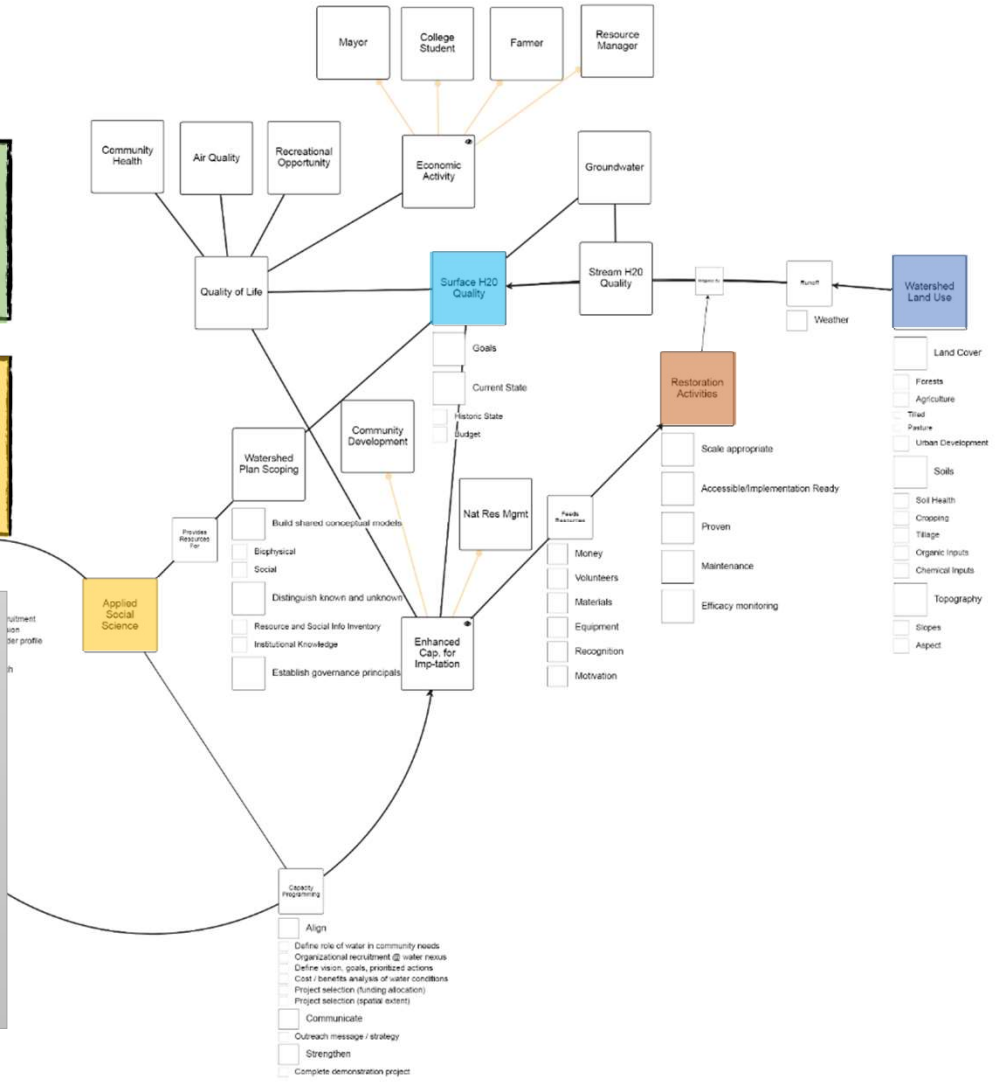
Wisconsin Think Water School

Lakes Team



APPLIED HUMAN DIMENSIONS SCIENCE is the process of **describing, explaining, and predicting social attitudes, processes, and behaviors** relevant to understanding how we conserve, protect, enhance, or use our natural resources.

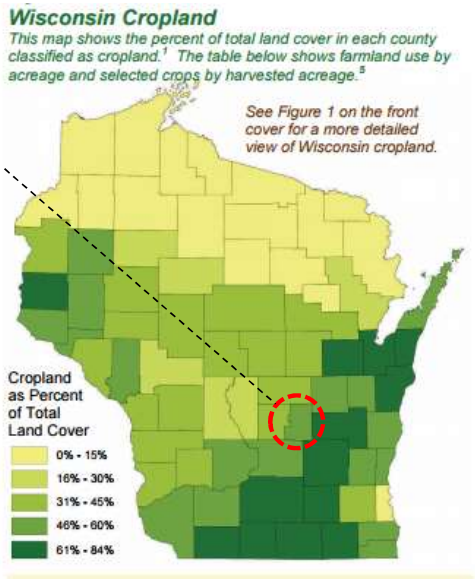
(Peroff, 2016; human-dimensions.org)



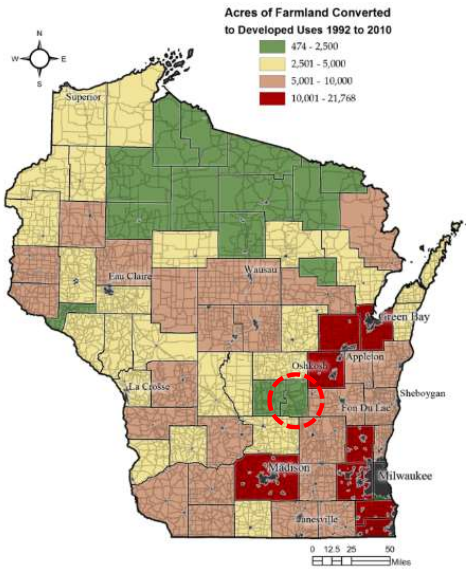
Our agricultural landscape is in transition … average age, vertical integration, shifts in farming technology will all play a significant role in the success of conservation efforts over the next 10-20 years.

Study Area:
Big Green Lake Watershed

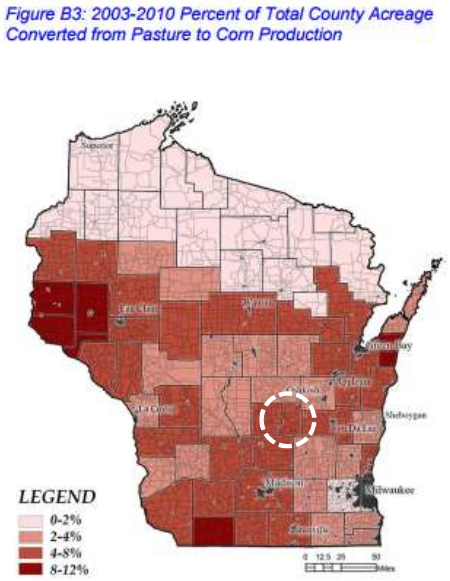
Total Cropland
10.1 Million Acres
(~25% pasture)



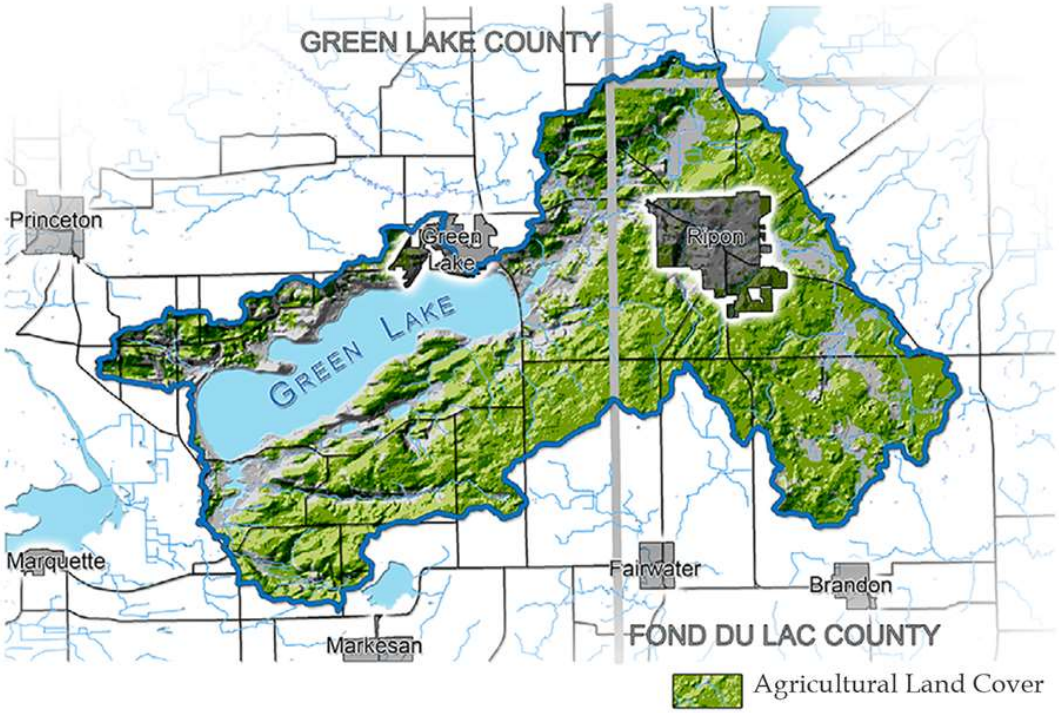
Urban Conversion
22,000 acres / year lost



Pasture to Corn
>100,000 acres / year



CLUE: Megatrends



Big Green Lake

- Listed as impaired (2014) for low dissolved oxygen
- Phosphorus loading is primary driver of water quality change
- Agriculture dominates land use with only 3% of landscape in developed (residential, commercial, or industrial) uses

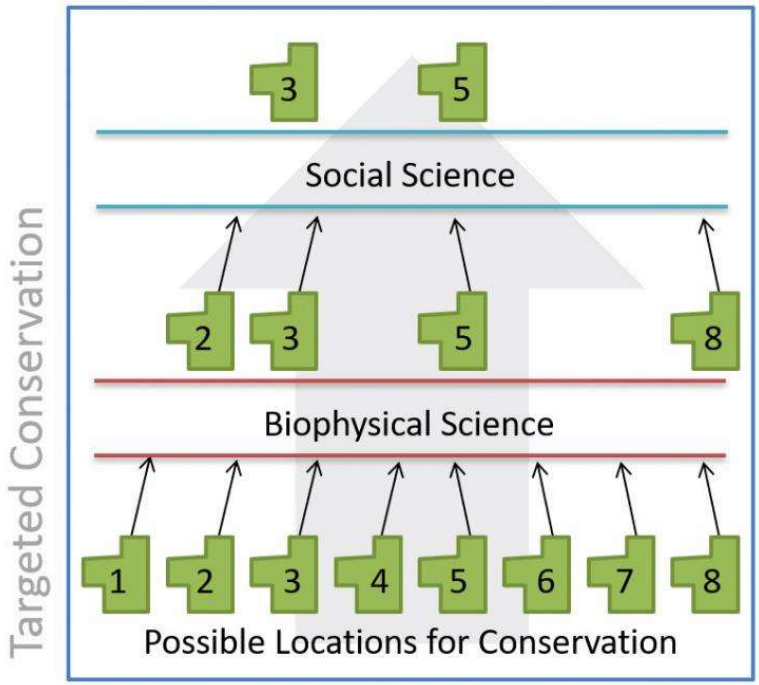
Research Objectives:

1. Segment agricultural landowners into groups distinguished by key attitudes and demographic characteristics.

2. Test for significant differences between attitude groups for experience, interest, and perceived benefit of conservation practices.

3. Leverage VGI and GIS to incorporate attitude data into **spatial framework**, while maintaining individual respondent confidentiality.

Social-Ecological Targeting



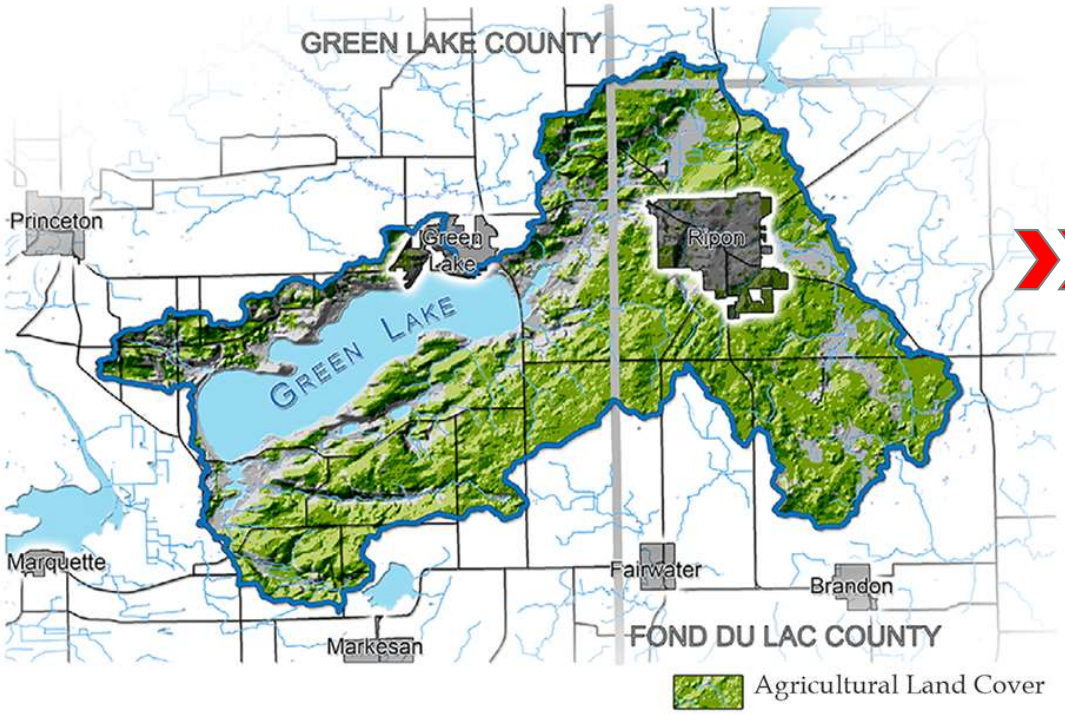
Adapted from Walter et al. (2007)

Social science data collected using landowner surveys can reveal where landowners are more likely to adopt conservation practices.

Biophysical science (i.e. SWAT, EVAAL, stream survey) data reveal areas where management action will have the greatest effect on water quality.

Within a watershed there are many places where BMPs are appropriate, but funding typically limits how many can be constructed within the landsacpe.

Green Lake Watershed



Acreage Participation in Survey

51.0% - 62.1%

Estimate (rent + own duplication = 46741)

Response Rate			
Valid Responses	Valid Addresses		
184	459	Total	40.09%

Green Lake Farmer Survey

College of Natural Resources
University of Wisconsin-Stevens Point

GREEN LAKE COUNTY

FOND DU LAC COUNTY

We're asking for your help! A group in your community – the Green Lake Management Planning (LMP) Team – is working hard to protect the health of Big Green Lake. The multi-organization team works around Green Lake's shorelines, urban and agricultural areas in their effort to improve lake water quality. As highlighted in green in the map shown here, this lake is part of an agricultural landscape, which means that problem solving help from the farming community is critical to the success of community efforts.

We want your input on the priorities of those who know the land best: agricultural producers and landowners in the Green Lake watershed. We are asking you to complete this survey, which should take about 20 minutes of your time. The survey is being conducted by the UW-Extension Center for Land Use Education at UW-Stevens Point that assists communities in understanding the priorities of key stakeholders. Please contribute to this effort by completing the survey and returning it in the enclosed postage paid envelope.

Here are a few important notes about this study:

- All results will be kept confidential; we're just looking for your important perspective about how to better manage Green Lake and the surrounding watershed.
- All responses will be treated as anonymous and records used to contact respondents containing identifying information will be destroyed prior to the research team reviewing data.
- Please skip any questions that make you feel uncomfortable or that you don't know how to answer.
- We do not anticipate any potential for risk or harm due to participation in this study; however, if you have any complaints about your treatment as a participant in this study please contact Dr. Debbie Palmer, IRB Chair at (715) 346-3953, e-mail at irbchair@uwsp.edu, or mail at University of Wisconsin-Stevens Point, Science Building D240, Stevens Point Wisconsin 54481.

While your participation is voluntary your input can help bring local voices into these important efforts to benefit Green Lake! If you have any questions or comments about this project you may contact me using the information provided below.

Thank you for your time and we're looking forward to hearing from you!

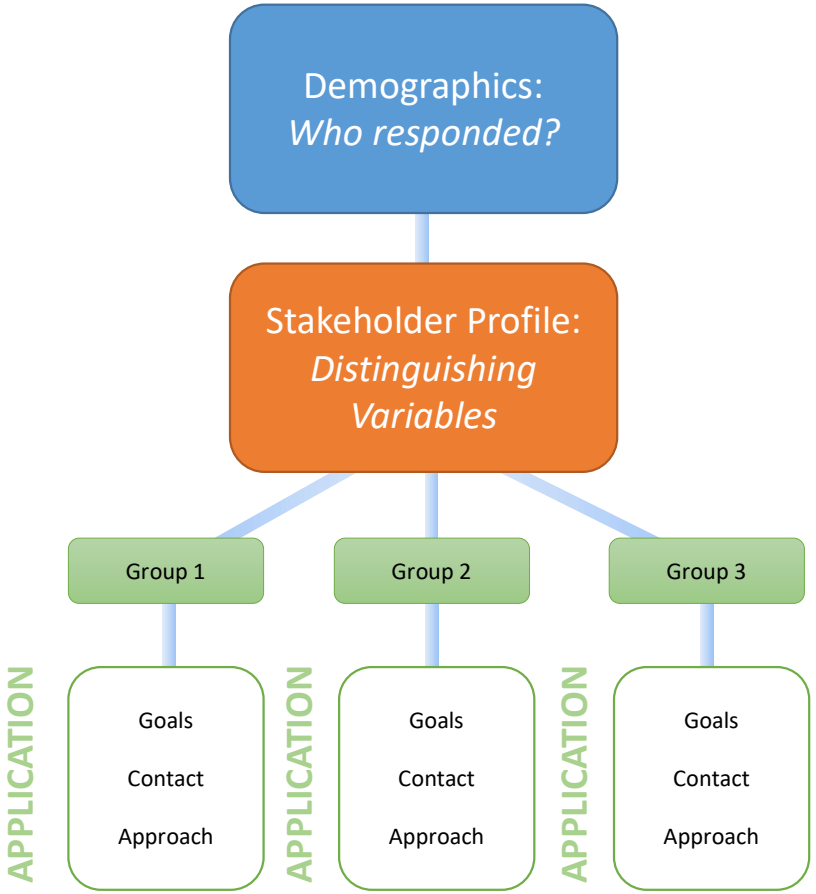
Dr. Aaron Thompson, Associate Professor
E-mail: aaron.thompson@uwsp.edu Phone: 715.346.2278

PLEASE READ BEFORE BEGINNING THIS SURVEY:

This survey must be completed by an adult 18 years of age or older. Due to the type of research being conducted it is important that the individual responsible for making land management decisions is the individual who completes this survey to the best of his or her ability.

Please mark all answers clearly, in pen or pencil, as indicated below.

Example "A" ☐ ☐ ☒ Example "B" ☐ ☐ ☑



Demographics:
Who responded?

Please answer the following questions about yourself, the **information will be used for classification purposes only.**

What is your gender? ☐ Male ☐ Female

In what year were you born? ☐

What is your highest level of formal education?
- ☐ Some high school
- ☐ High school graduate or GED
- ☐ Some college
- ☐ 2 year degree
- ☐ 4 year degree
- ☐ Graduate degree
- ☐ Other (specify) ☐

In 2016 how many acres of land did you:

a. Own (Total) ..... ☐

b. Rent from others..... ☐

c. Set aside for conservation..... ☐

Please indicate which best describes your farm operation based on **gross farm sales.**
- ☐ Less than $50,000
- ☐ $50,000 - $100,000
- ☐ $100,000 - $250,000
- ☐ $250,000 - $499,999
- ☐ More than $500,000
- ☐ Do not farm

Describe your farming operation by marking the response that best describes you.
- ☐ Farmer -- primarily row crops
- ☐ Farmer -- primarily dairy
- ☐ Farmer -- other: not dairy or row crops
- ☐ Primarily a landlord -- do not farm
- ☐ Hobby farm -- full-time, off-farm job

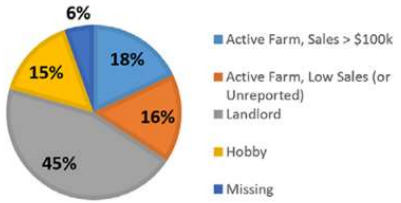
Which of these responses best describes your retirement plans?
- ☐ I will never fully retire from farming (retaining control of management and providing some labor).
- ☐ I will semi-retire from farming (providing some management and / or labor).
- ☐ I will fully retire from farming (leaving all management and labor to others).

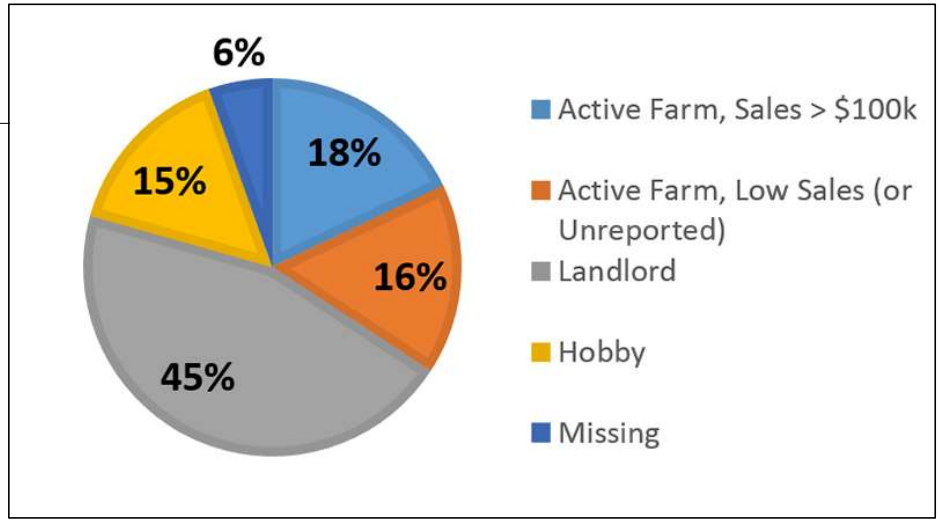
What would you consider to be the most likely outcome for your farm when you decide to quit farming?

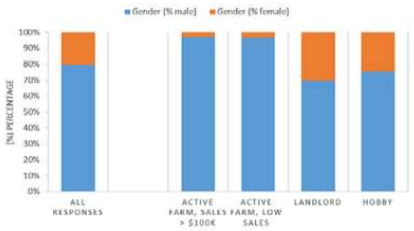
Check all that apply.
- ☐ A family member will continue the farm operation.
- ☐ Sell my land to another farmer.
- ☐ Sell all or part of the land to a developer.
- ☐ Sell all or part of the land for conservation.
- ☐ I don't know what options are available for my land.

Farm Operation Type

Combining the responses to the bottom two demographic questions shown on the previous page (gross farm sales and farming operation) allowed for constructing an overall profile of our sample of agricultural landowners. The chart shows that respondents are about 40 percent active farmers, 45 percent landlords, and 15 percent hobby farms.

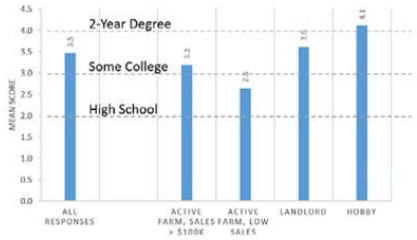






Gender

Nearly 80 percent of all respondents are male, which is consistent with other surveys conducted in Wisconsin of those who make farm management decisions. It is important to note that between active farms and landlords there is a significant difference in gender distribution, with significantly more women reporting their involvement as landlords (non-farming) than active farming situations.

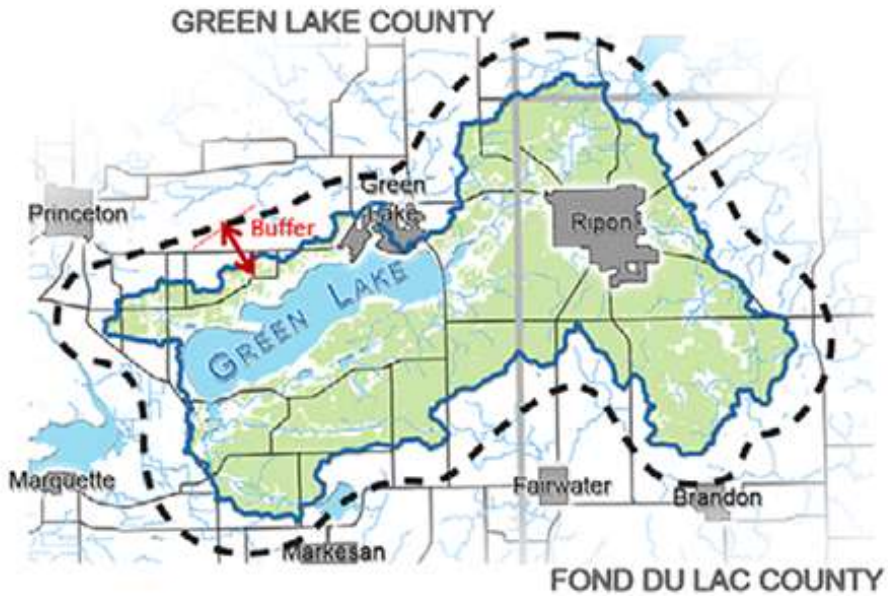


Education

Overall education levels are very similar with the average respondent having "some college" training.

Sample Analysis

	Wisconsin	Fon du Lac	Green Lake	Survey
# Farms	69754	1399	608	185
Land in Farms	14568926	315553	154595	46741
Average Farm Size	209	226	254	241
Percent farms >=50 acres	67.8%	68.1%	73.0%	70.3%
# Farms >=50 acres	47326	953	444	130
Percent farms >=500 acres	8.8%	10.7%	13.2%	11.4%
# Farms >=500 acres	6136	149	80	21
Percent of farm sales <$100000	75.4%	62.2%	73.5%	60.2%
Percent of farms sales >=$100,000	24.6%	37.8%	26.5%	39.8%
Percent of farms: primary occupation	49.8%	59.0%	48.4%	36.2%
Percent of farms: Milk cows	16.5%	20.7%	15.3%	15.2%
Percent of farms: Corn for Grain	39.9%	49.7%	52.6%	58.2%
*Note "do not farm, hobby" excluded from milk / corn				
Percent of farms sales < $50,000	66.3%	52.4%	59.4%	69.7%
Percent of farms sales $50,000-$99,999	9.1%	9.8%	14.6%	10.3%
Percent of farms sales >=$100,000	24.6%	37.8%	26.5%	20.0%
*Note "do not farm" included in <$50,000				



Green Lake Farmer Survey:

Factors Motivating Conservation Agriculture

Areas for Improvement

University of Wisconsin-Stevens Point
College of Natural Resources

Green Lake Watershed
Social Science Assessment

FARMER SURVEY REPORT

Survey Invitation Letter

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Dr. Aaron Thompson, Associate Professor
E-mail: aaron.thompson@uwsp.edu Phone: 715.346.2278

UW Extension
University of Wisconsin-Extension

Wisconsin Think Water School

Lakes Team

Relationship

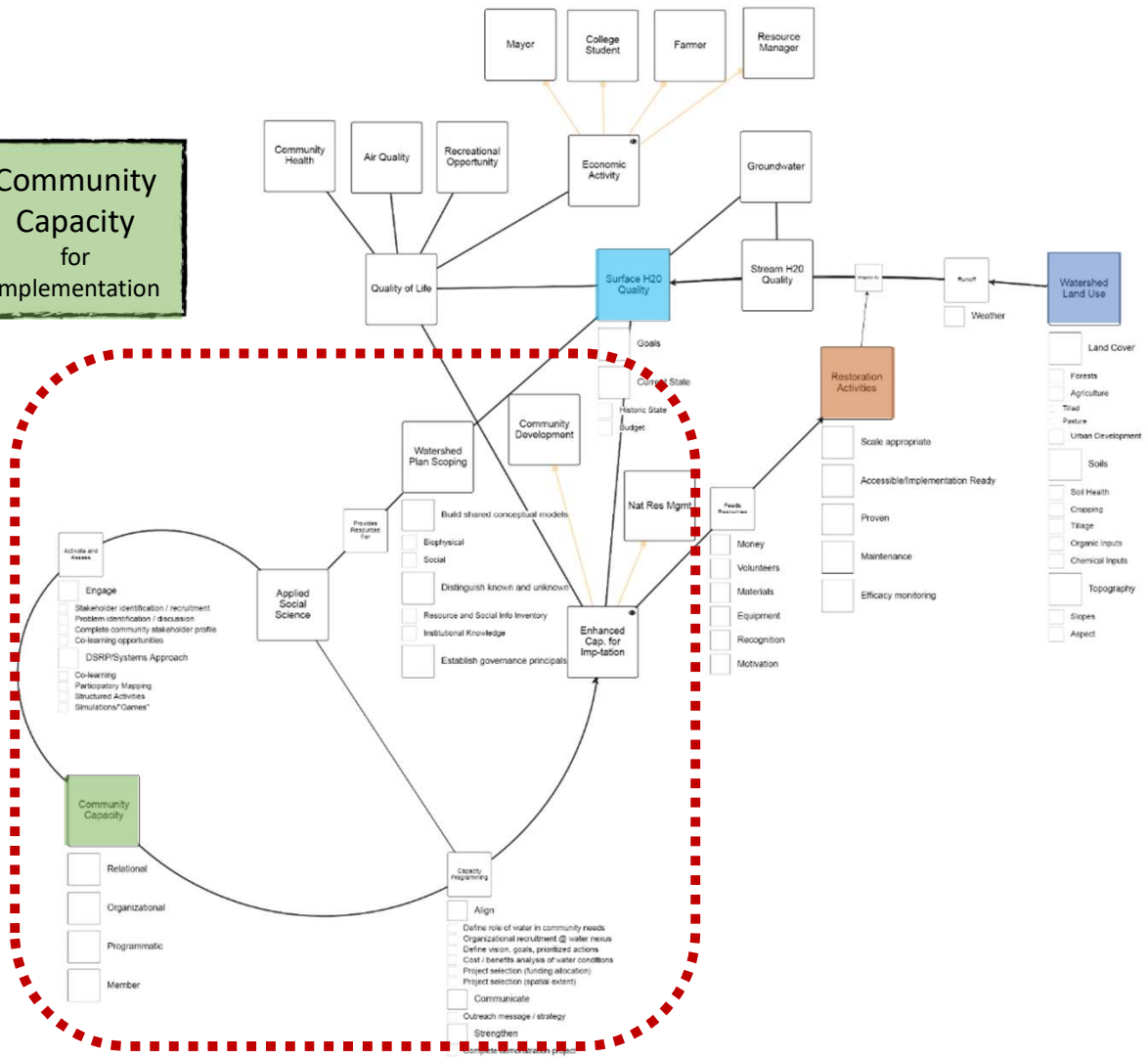
Restoration Activities ‹‹‹ Depend on resources ‹‹‹ **Community Capacity for Implementation**

Community Capacity for Implementation

Limiting Factor: *How do we enhance capacity?*

- ☐ Member Capacity
- ☐ Relationship Capacity
- ☐ Organization Capacity
- ☐ Program Capacity

Adapted from Davenport (2015)



Social systems

Wisconsin Think Water School

Lakes Team

Individual / Member Capacity

Engage

- Recruitment of resources (members, expertise, funding) and public participation (individual problem setting).

Problem Identification

Stakeholder Recruitment

Relationship

Restoration Activities <<< Depend on resources <<< Community Capacity for Implementation

BUILD RELATIONSHIPS & AWARENESS

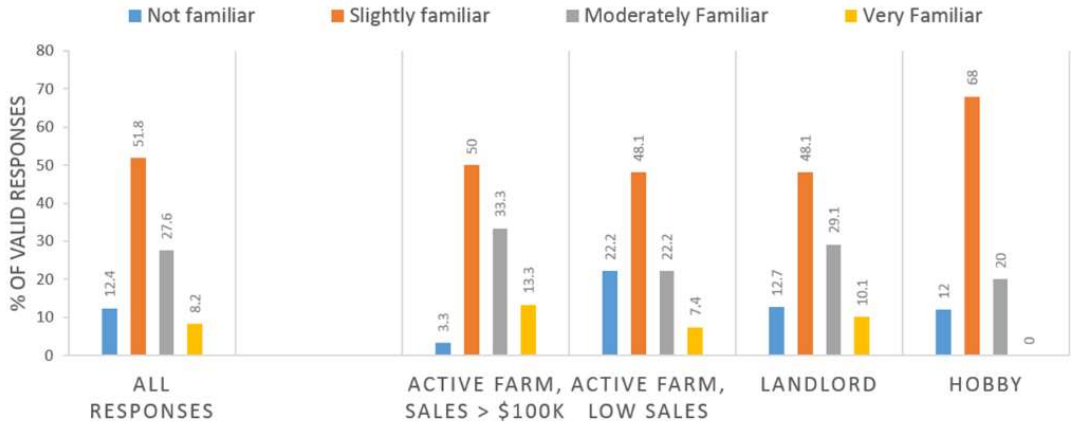
GROWING AWARENESS WITHIN THE AGRICULTURE COMMUNITY

The survey results confirmed anecdotal evidence conveyed by partners through past experience that the efforts of the Green Lake Association to address water quality are not widely known or understood by the agricultural community. In fact, only about 1 in 3 agricultural landowners are familiar with the Green Lake Association. Efforts to address this challenge must continue to focus on building these relationships through:

Green Lake Association

Have you heard about Green Lake Association's efforts? They work to promote the conservation of Green Lake by addressing negative water quality trends before they become a critical issue that will affect this lake over the long term. Please select the response that best describes your familiarity.

☐ Never heard about these efforts ☐ Heard of them, but don't know much about them ☐ Heard of them and know what they are doing ☐ I've attended meetings or events in the past



There is no 1 "new" practice or incentive program that will solve this problem. We will have to build capacity of communities to respond in order to address water quality challenges … especially in agricultural watersheds.

Wisconsin Think Water School

Lakes Team

Identify Allied Organizations / Build Shared Networks / Search for Consensus

Community Capacity for Implementation

Limiting Factor: *How do we enhance capacity?*

- ☐ Member Capacity
- ☐ Relationship Capacity
- ☐ Programmatic Capacity
- ☐ Organizational Capacity

Relationship Capacity

Align

- Building relationships and working toward consensus on a common definition of the problem.

Obj. (1): Segment agricultural landowners into groups distinguished by key attitudes and demographic characteristics.

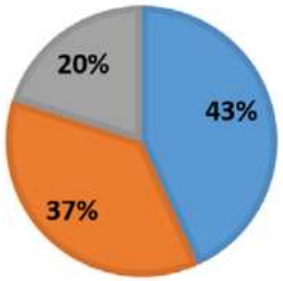
Stakeholder Profile: *Distinguishing Variables*

Stewardship Attitudes

Positive Stewardship, Negative Business
- 43 percent of survey responses
- Higher % female owned, smaller farms

Positive Stewardship, Positive Business
- 37 percent of survey responses
- Mid-size farms, more rental acres

Negative Stewardship, Positive Business
- 20 percent of survey responses
- Largest farms (average acres owned)



STEP 1. FVE ATTITUDE SCALES *(Thompson, 2015)*

FARMERS AND THE ENVIRONMENT

The next series of questions ask about trade-offs farmers must make between production and conservation considerations. Please indicate whether you agree or disagree with each of the following statements:

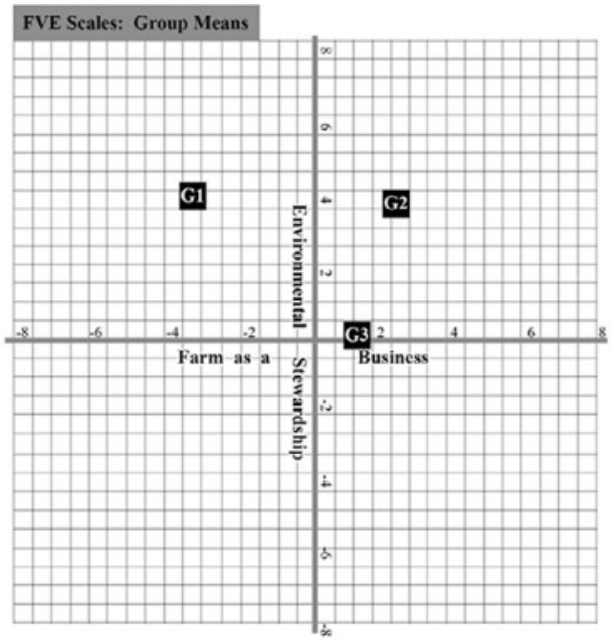
	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA	Don't Know DK
Good farming requires using all available acreage as efficiently as possible to maximize yields. (Business)	-2	-1	0	1	2	☐
To protect the rural landscape, farmers must move away from conventional agricultural practices to approaches that more closely mimic natural processes. (Stewardship)	-2	-1	0	1	2	☐

STEP 2. CLUSTER ANALYSIS

Positive Stewardship, Negative Business
- These individuals view conservation as a primary goal for their land, while holding negative views of actions that maximize production at the expense of the land.

Positive Stewardship, Positive Business
- These individuals hold views that balance both conservation and business goals. This reflects a set of dual-interests that can influence conservation decisions depending on specific circumstances.

Negative Stewardship, Positive Business
- These individuals view farming as a business, while being neutral (or more negative than other members of their community) toward conservation goals.



Obj. (1): Segment agricultural landowners into groups distinguished by key attitudes and demographic characteristics.

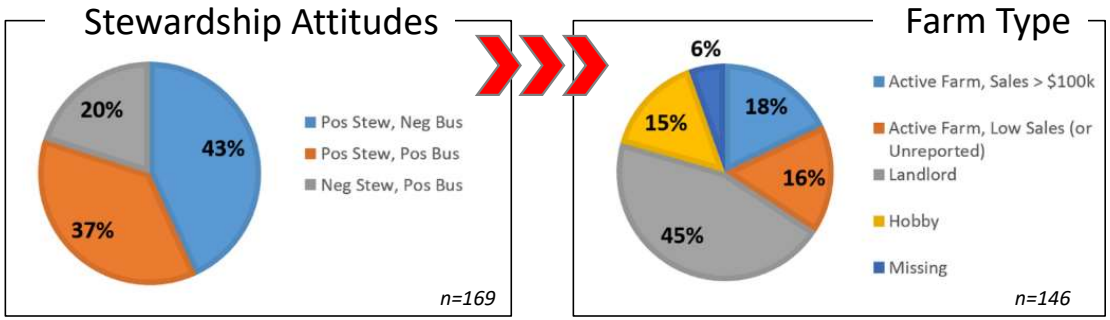
Stakeholder Profile: *Distinguishing Variables*

Stewardship Attitudes

X

Farm Type

STEP 3. ATTITUDE – FARM TYPE RELATIONSHIP



ACTIVE FARMS

Positive Stewardship, Negative Business
- 13 percent of survey responses

Positive Stewardship, Positive Business
- 18 percent of survey responses

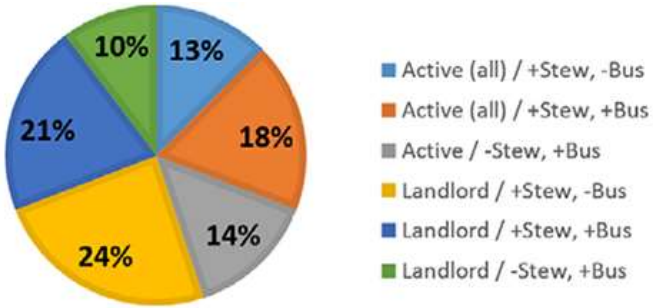
Negative Stewardship, Positive Business
- 14 percent of survey responses

LANDLORDS

Positive Stewardship, Negative Business
- 24 percent of survey responses

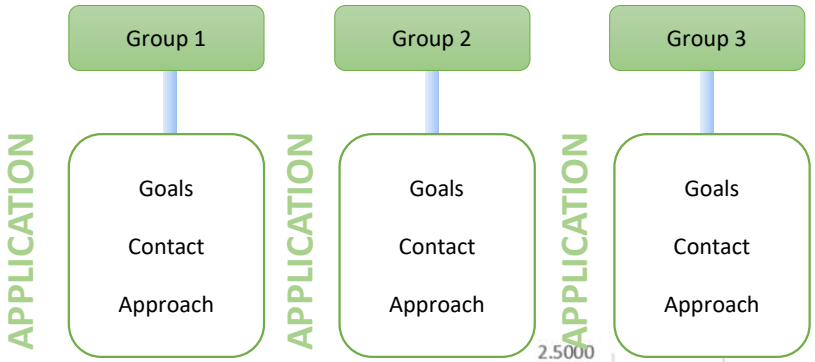
Positive Stewardship, Positive Business
- 21 percent of survey responses

Negative Stewardship, Positive Business
- 10 percent of survey responses

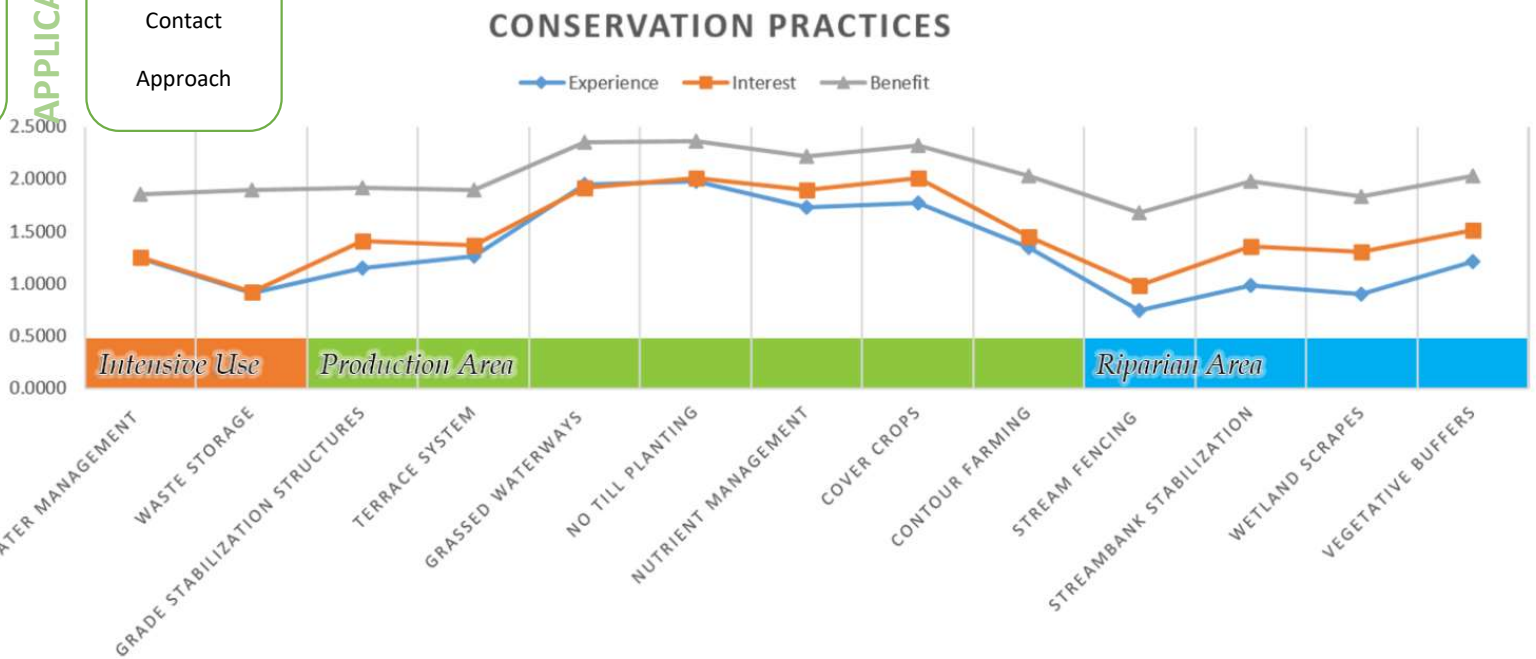


n=136

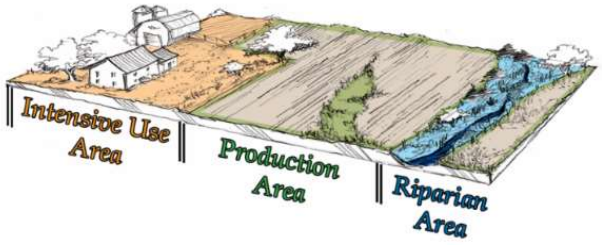
Obj. (2): Test for significant differences between attitude groups for experience, interest, and perceived benefit of conservation practices.

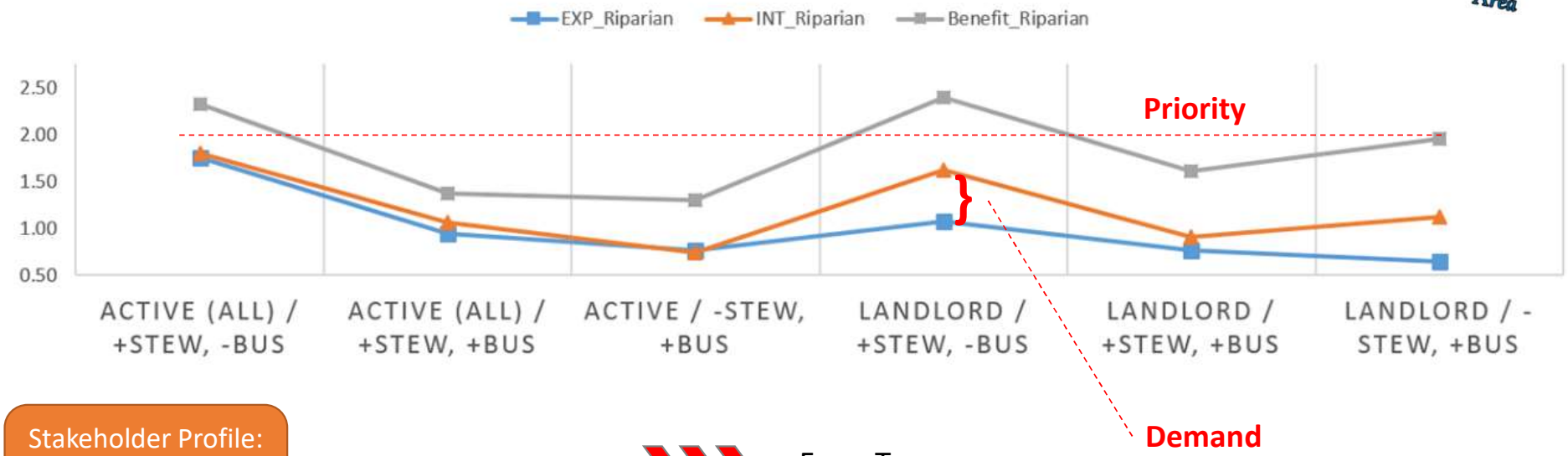


Intensive Use Area Practices	**EXPERIENCE** *on your land*	**INTEREST** *in trying practice*	**BENEFIT** *to the watershed*
BARNYARD WATER MANAGEMENT is a set of practices, such as gutters, roof structures over barnyards, or other methods that divert clean water (rainfall) away from possible sources of contamination.	3 Very Experienced 2 Some Experience 1 Little Experience 0 Unfamiliar	3 Very Interested 2 Some Interest 1 Little Interest 0 No Interest	3 Very Beneficial 2 Some Benefit 1 Little Benefit 0 No Benefit



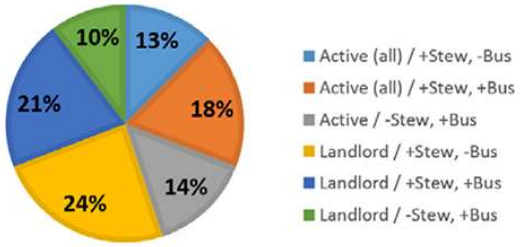
Obj. (2): Test for significant differences between attitude groups for experience, interest, and perceived benefit of conservation practices.





Stakeholder Profile: *Distinguishing Variables*

Stewardship Attitudes → Farm Type



Green Lake Watershed

Obj. (2): Test for significant differences between attitude groups for experience, interest, and perceived benefit of conservation practices.

Intensive Use Area Practices	EXPERIENCE *on your land*	INTEREST *in trying practice*	BENEFIT *to the watershed*
BARNYARD WATER MANAGEMENT is a set of practices, such as gutters, roof structures over barnyards, or other methods that divert clean water (rainfall) away from possible sources of contamination.	3 Very Experienced 2 Some Experience 1 Little Experience 0 Unfamiliar	3 Very Interested 2 Some Interest 1 Little Interest 0 No Interest	3 Very Beneficial 2 Some Benefit 1 Little Benefit 0 No Benefit

	Comparison Group	Group Name	Mean Diff.	Std. Error	Sig.	p<.10
EXPERIENCE_13itemSum	Active (all) / +Stew, -Bus	Active (all) / +Stew, +Bus	6.6	3.0	0.230	
	Mean = 26.3	Active / -Stew, +Bus	9.1	3.2	0.060	x
		Landlord / +Stew, -Bus	10.3	2.8	0.005	x
		Landlord / +Stew, +Bus	10.4	3.0	0.009	x
		Landlord / -Stew, +Bus	12.8	3.5	0.006	x
INTEREST_13itemSum	Active (all) / +Stew, -Bus	Active (all) / +Stew, +Bus	8.0	3.2	0.141	
	Mean = 26.1	Active / -Stew, +Bus	11.0	3.5	0.026	x
		Landlord / +Stew, -Bus	1.4	3.0	0.997	
		Landlord / +Stew, +Bus	11.1	3.2	0.011	x
		Landlord / -Stew, +Bus	10.4	3.9	0.085	x
BENEFIT_13itemSum	Active (all) / +Stew, -Bus	Active (all) / +Stew, +Bus	7.7	2.9	0.094	x
	Mean = 30.5	Active / -Stew, +Bus	8.9	3.1	0.059	x
		Landlord / +Stew, -Bus	-1.5	2.7	0.994	
		Landlord / +Stew, +Bus	6.1	2.9	0.304	
		Landlord / -Stew, +Bus	3.5	3.5	0.917	

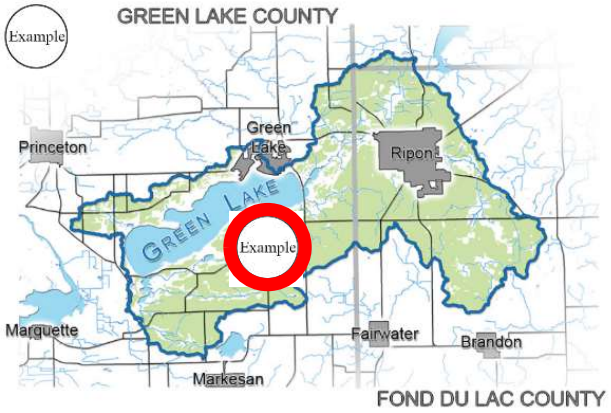
Note: Possible Score Range 0-39; Mean Diff. (Comparison Group-G1, G2, … G6)

- Attitude and Farm Type affect on Experience
- Underserved landowner demand
- "Farm as Business" priority: Sig. less experience, interest, and perceived benefit of practices.

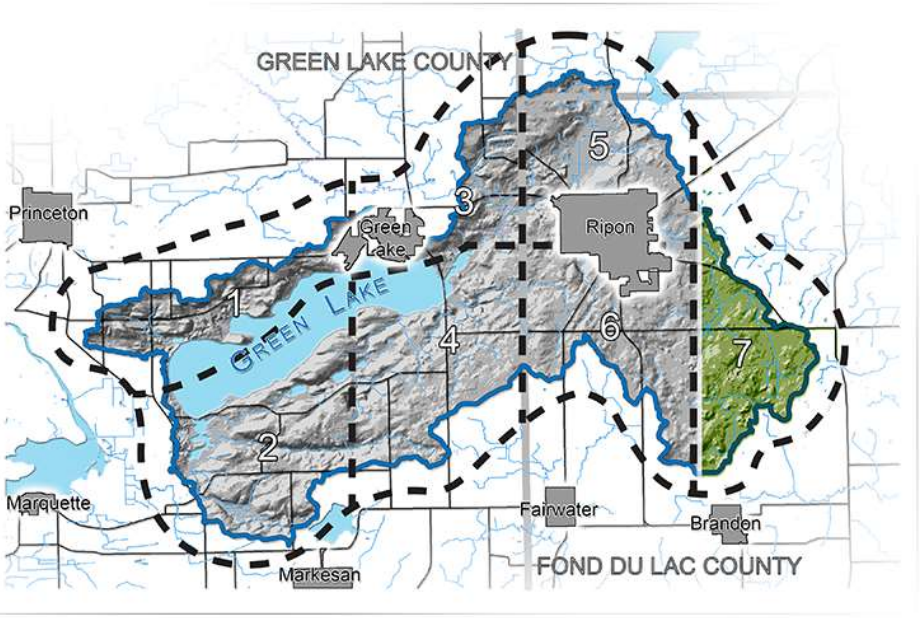
Obj. (3): Leverage VGI and GIS to incorporate attitude data into spatial framework, while maintaining individual respondent confidentiality.

STEP 1. VOLUNTEERED GEOGRAPHIC INFORMATION

Please draw a circle about this size that best describes the general area where you farm, or own farmland, in the Green Lake watershed.



We're asking you to give us a general idea of the part of the watershed you call home, such as Green Lake versus Fond du Lac County, to help us better understand different landowner priorities across the watershed. *Remember if any questions make you uncomfortable feel free to skip to the next question.*



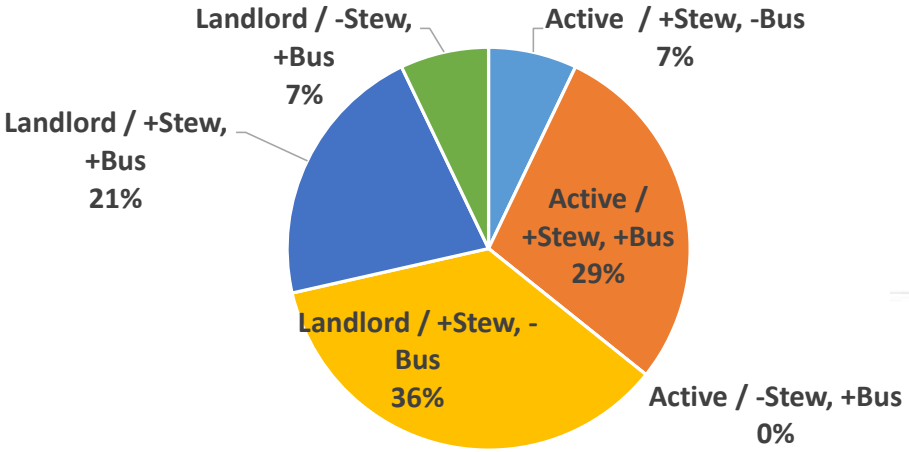
STEP 2. LINK WITH UNIQUE SURVEY IDENTIFIER

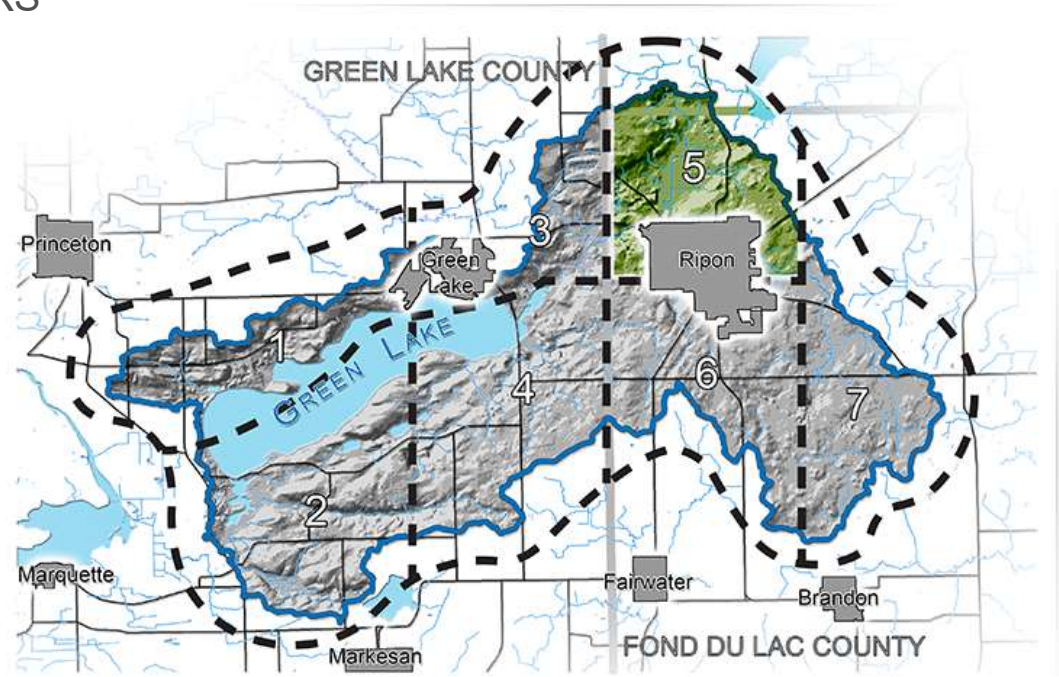
- REMOVE IDENTIFYING INFORMATION (NAME, ADDRESS, ETC.)
- GROUPED I50 VALID RESPONSES (81.5% participation) INTO 7 GEOGRAPHIC GROUPS

STEP 3. RUN STATISTICAL ANALYSES TO DETERMINE PLACE-SPECIFIC MEASURES OF LANDOWNERS' CONSERVATION MOTIVATION

- DEMOGRAPHICS
  - # Survey Reponses: 19
  - Farmland Owned: 2,122 acres (total)
  - Farmland Rented: 690 acres (total)

- STEWARDSHIP ATTITUDE X FARM TYPE





Wisconsin Think Water School

Lakes Team

Community Capacity for Implementation

Limiting Factor:
How do we enhance capacity?

- [ ] Member Capacity
- [ ] Relationship Capacity
- [ ] Organization Capacity
- [ ] Program Capacity

Outreach Message & Strategy

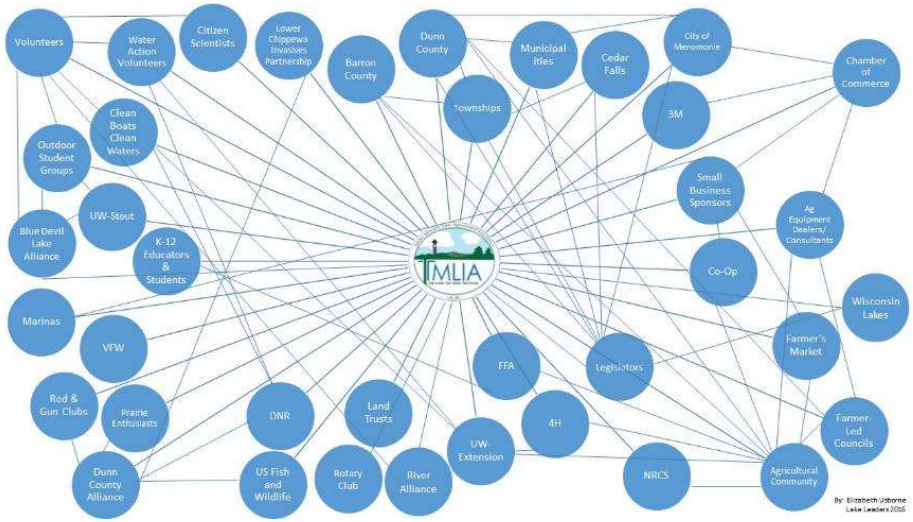
Manage Volunteers

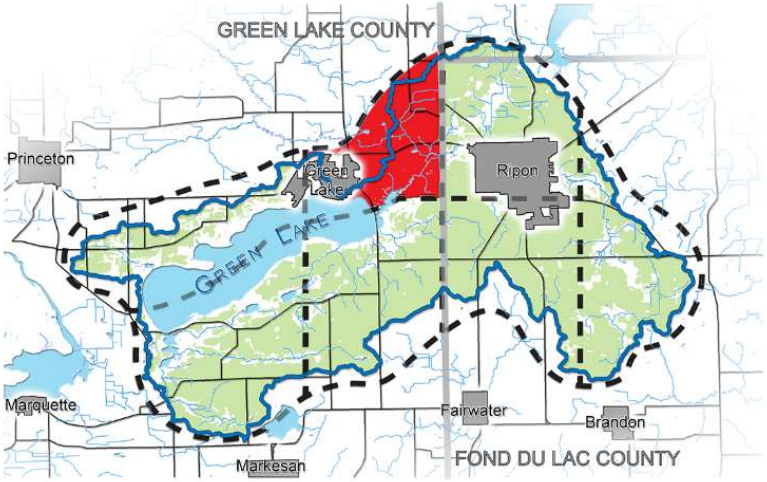
Organization Capacity

Communicate

- Building the organizational capacity to collaborate, including communication and volunteer management strategies.

EFFECTIVE COMMUNICATION NETWORKS



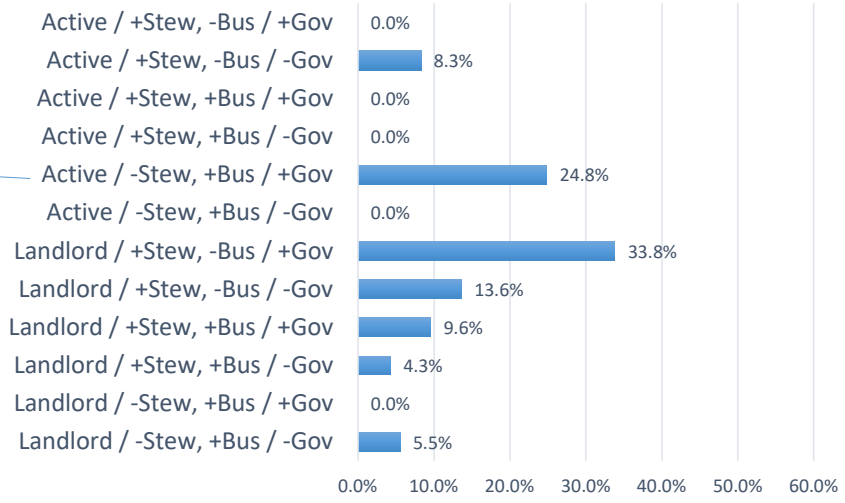


Need strategies that reach both

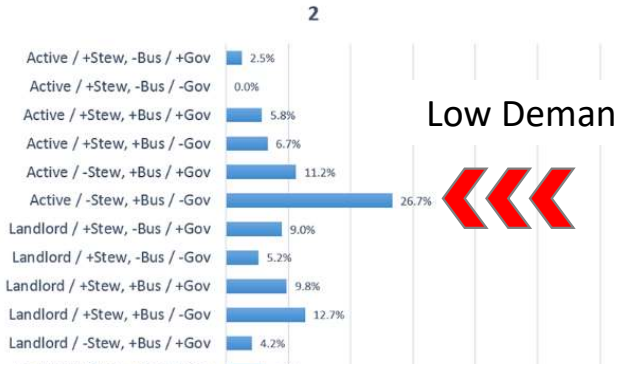
- Active farmer
- View "farm as a business", doesn't prioritize conservation goals
- **Does NOT view government agencies as a partner**

- Landlord (does not farm)
- View conservation goals as priority for their land
- **View government agencies as a partner, express strong likelihood to work with existing programs**

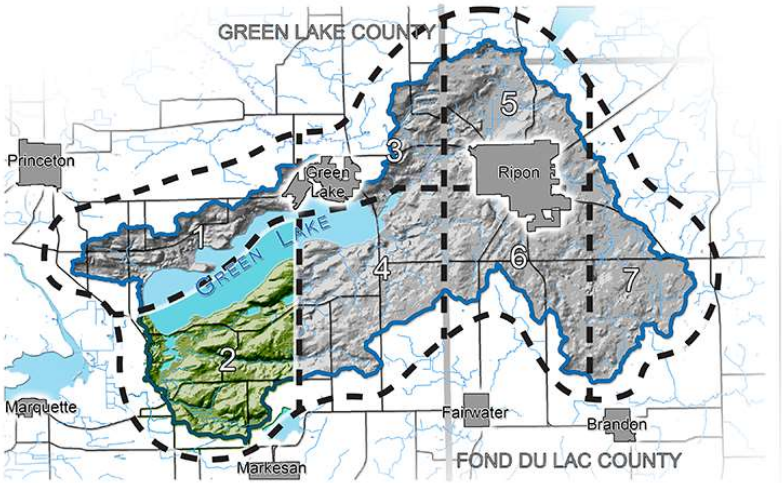
% Total Acres (Own) by Location



Respond to Social Conditions



Low Demand

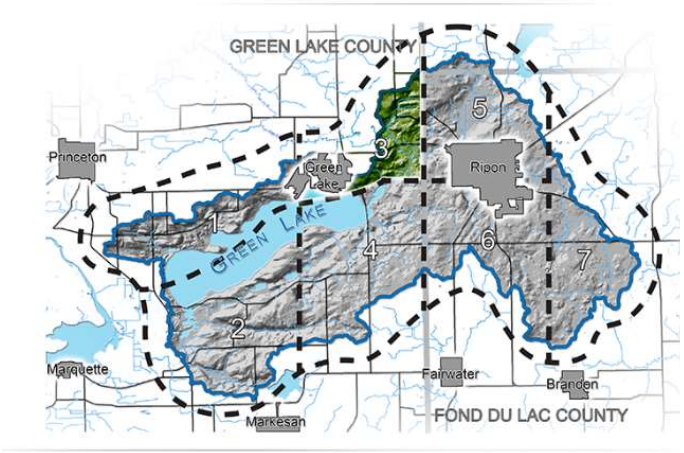


Who are they willing to work with? (Few existing partners)

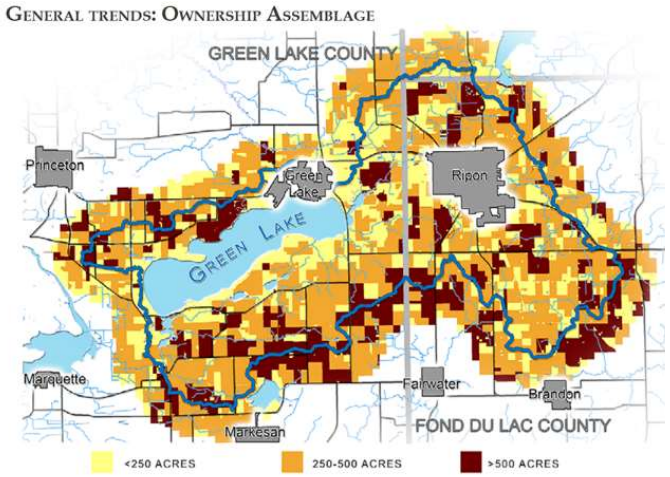
INTEGRATE SOCIAL & ECOLOGICAL DATA

(2020): Partnering with UW-Madison to complete SWAT modeling to identify nutrient loading priority areas, integrate social-ecological data, develop land management tools.

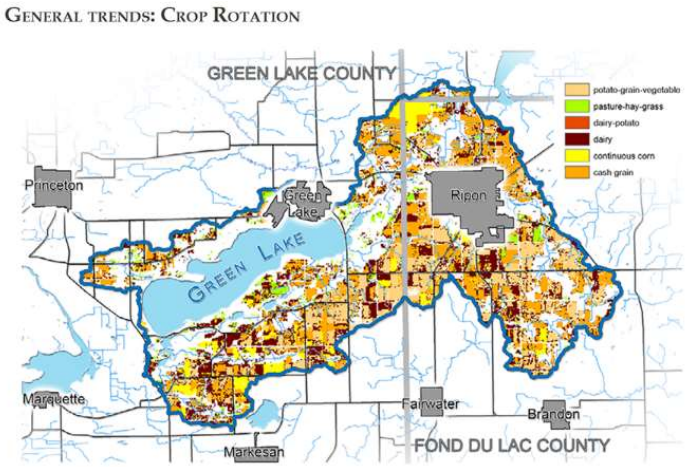
Social Data



Ownership / Service Boundaries

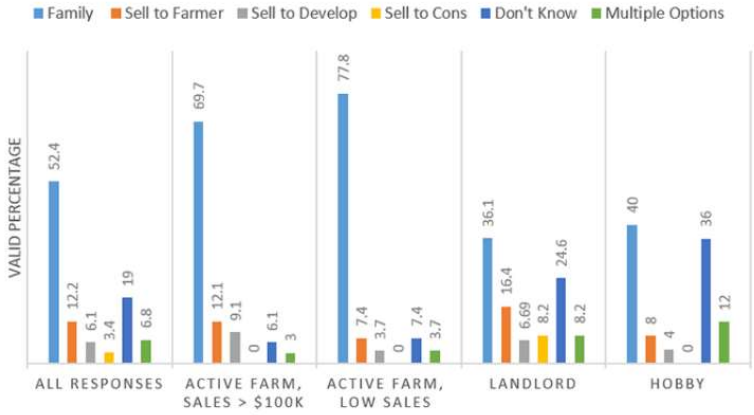


Land Use / Ecological Data

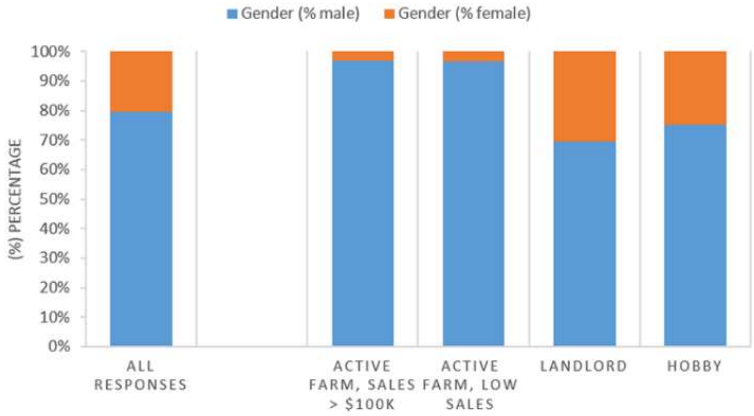


RESPOND TO EMERGING STAKEHOLDERS

Building Relationships with the Next Generation



Support for Women Who Own Farmland



Wisconsin Think Water School

Lakes Team

Community Capacity for Implementation

Limiting Factor

- ☐ Member Capacity
- ☐ Relationship Capacity
- ☐ Organization Capacity
- ☐ Program Capacity

Complete Demonstration Project

Program Capacity

Strengthen

- Program development and network building to achieve results. (Policy & Institutional Capacity)

Respond to Training Gaps

PROGRAM DEVELOPMENT

?

What is the ultimate ask of farmers?

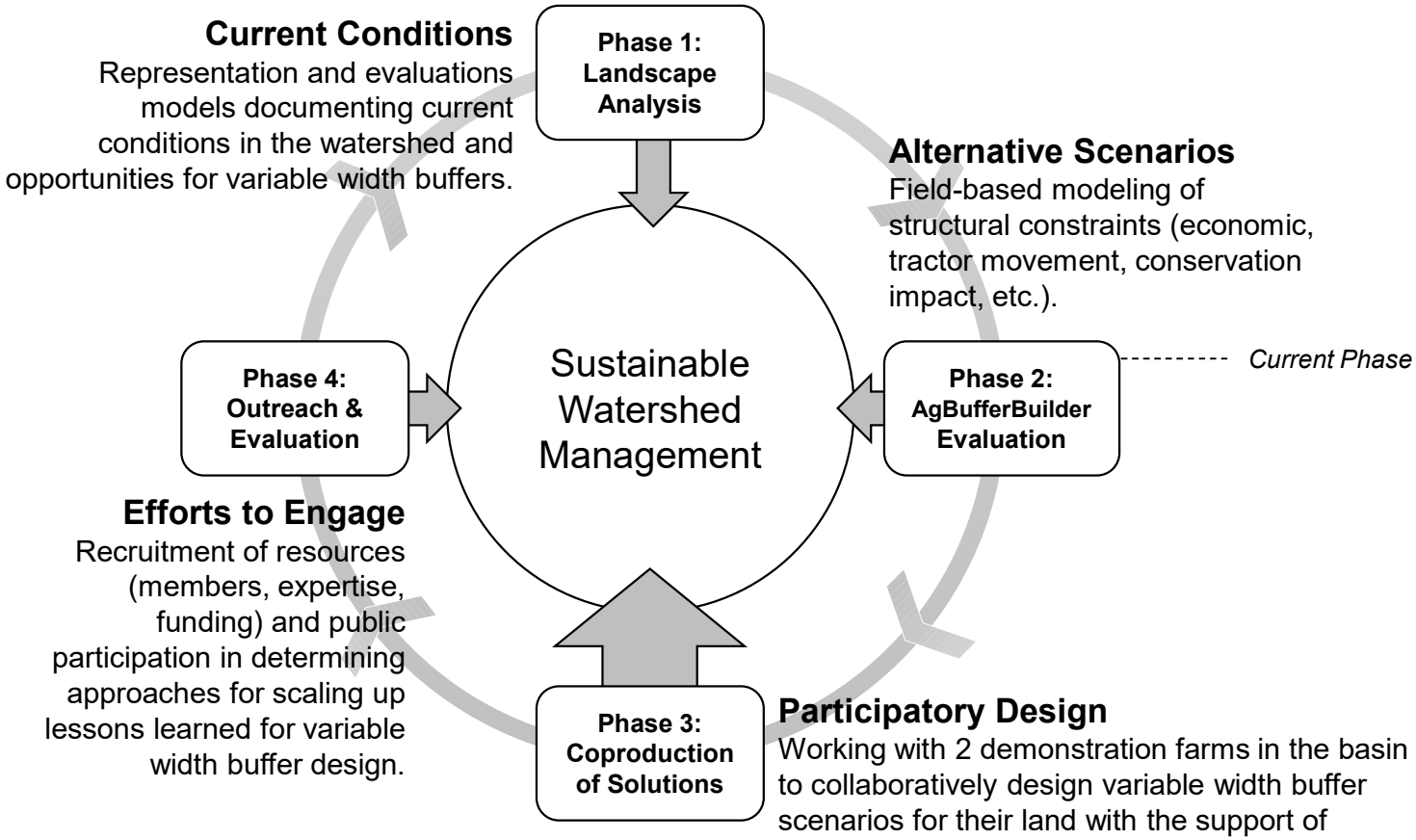
How will they know when they've done enough?

Is the level of responsibility being asked of farmers reasonable?

Who has to pay for the maintenance of these conservation services?

PROGRAM DEVELOPMENT

Designing Ecobuffers



Current Conditions
Representation and evaluations models documenting current conditions in the watershed and opportunities for variable width buffers.

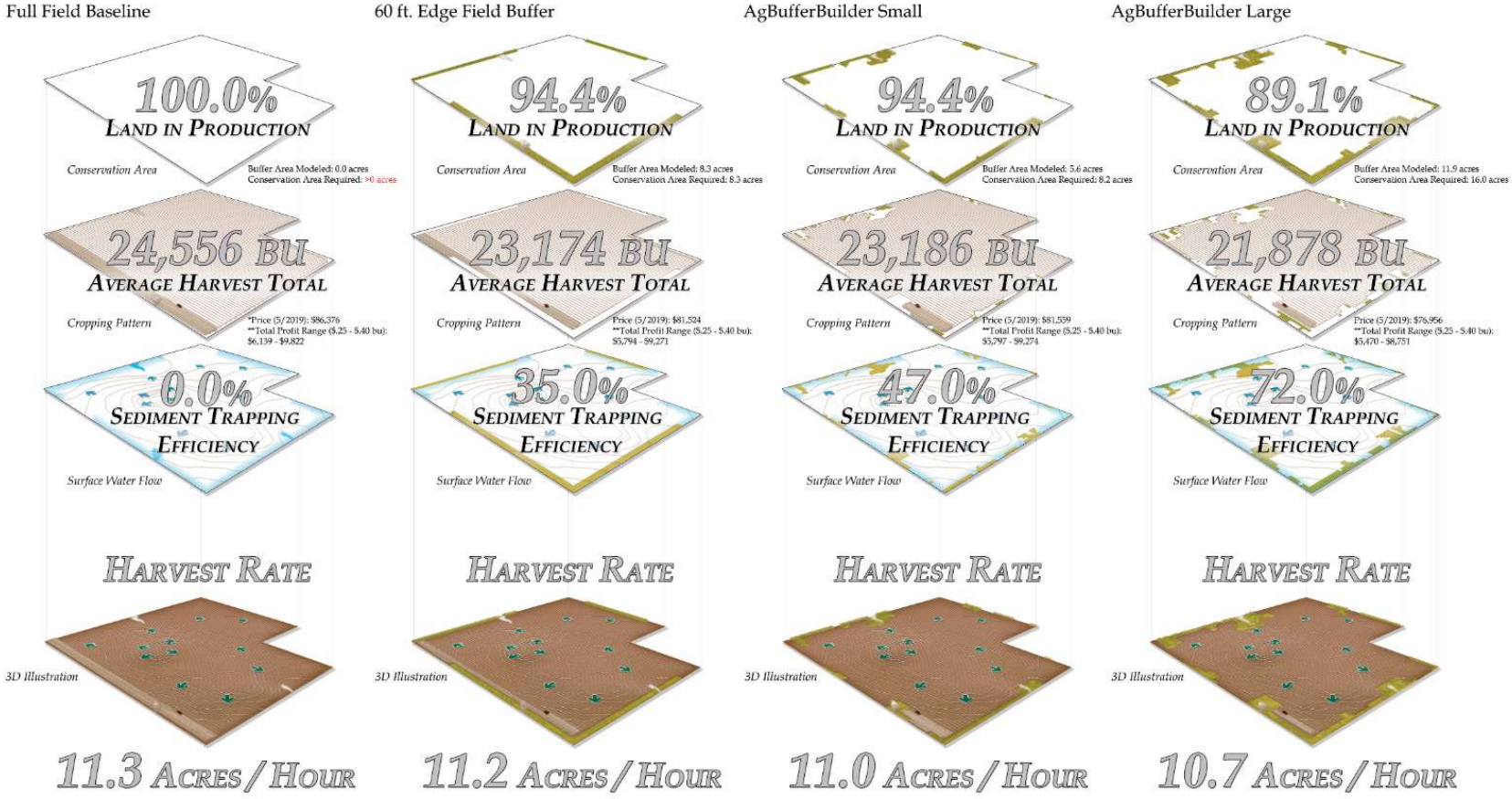
Alternative Scenarios
Field-based modeling of structural constraints (economic, tractor movement, conservation impact, etc.).

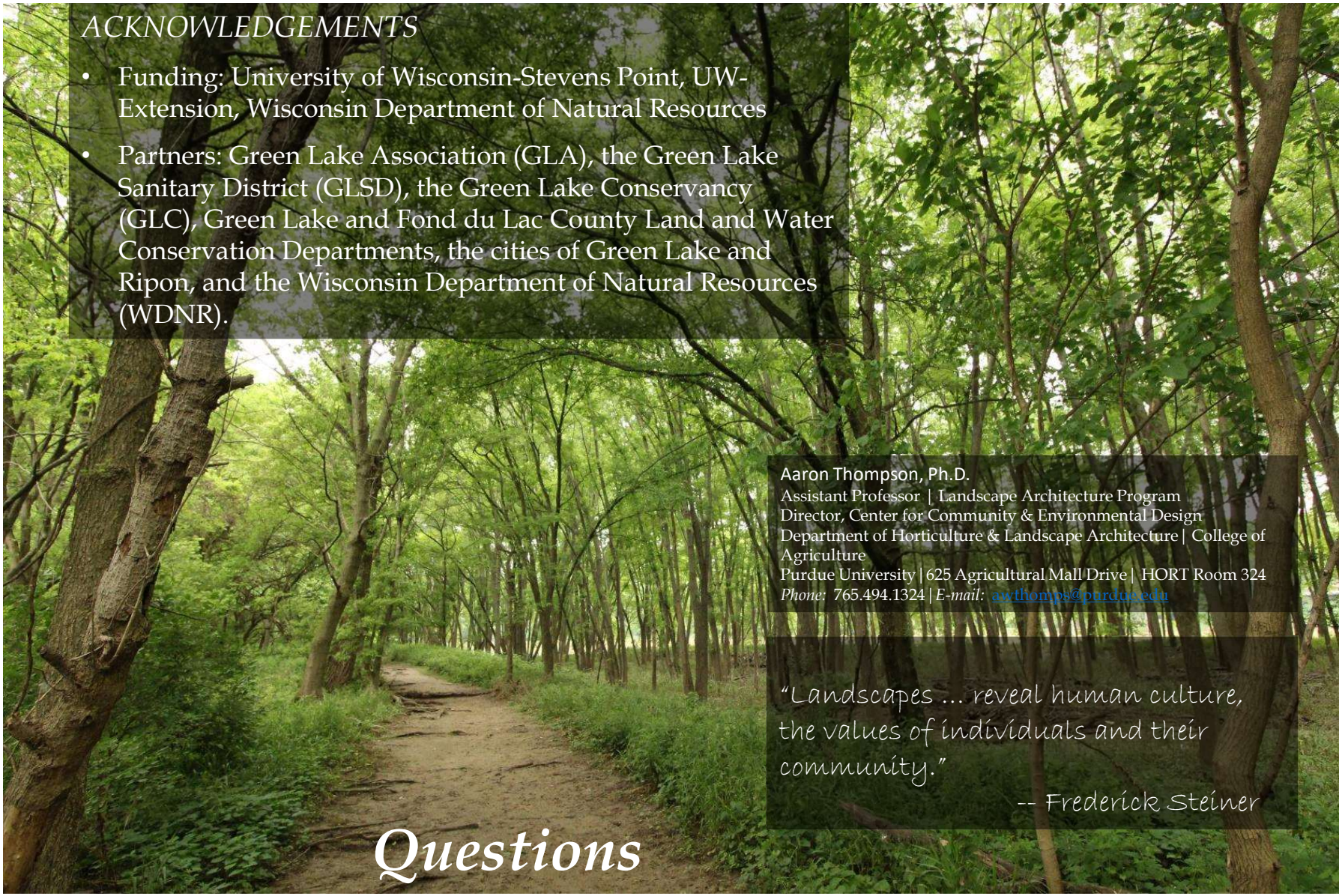
Efforts to Engage
Recruitment of resources (members, expertise, funding) and public participation in determining approaches for scaling up lessons learned for variable width buffer design.

Participatory Design
Working with 2 demonstration farms in the basin to collaboratively design variable width buffer scenarios for their land with the support of AgBufferBuilder & landscape visualizations.

PROGRAM DEVELOPMENT

Alternative Scenarios: Structural Constraints for Variable Width Buffer Design





ACKNOWLEDGEMENTS

- Funding: University of Wisconsin-Stevens Point, UW-Extension, Wisconsin Department of Natural Resources
- Partners: Green Lake Association (GLA), the Green Lake Sanitary District (GLSD), the Green Lake Conservancy (GLC), Green Lake and Fond du Lac County Land and Water Conservation Departments, the cities of Green Lake and Ripon, and the Wisconsin Department of Natural Resources (WDNR).

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"Landscapes … reveal human culture, the values of individuals and their community."

-- Frederick Steiner

Questions