

# Erosion Modeling and Citizen Science Working Together in the Sugar River Watershed



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# Goal of the Presentation

- What is USRWA?!?
- Background/initial goals
- The UW-Whitewater partnership
- Tools behind EVAAL and its results
- Combining citizen science with EVAAL
- Looking ahead
- How can this be replicated near you?
- Q & A



# What is USRWA?

- USRWA = Upper Sugar River Watershed Association
- Established in 2000 as a non-profit organization
- Upper Sugar River Watershed covers 170 square miles and 115 miles of rivers and streams
- **74.2% agricultural production**
- Works with businesses, schools, farmers, government, and volunteers to improve the land and water
- Mission: Provide leadership for continuous resource improvement through strategic partnerships that benefit the watershed's land, water and people.





# What does USRWA Do?



- Habitat Restoration
- River Clean-Ups
- Water quality monitoring
- Invasive species management
- Youth education
- Urban & agricultural runoff



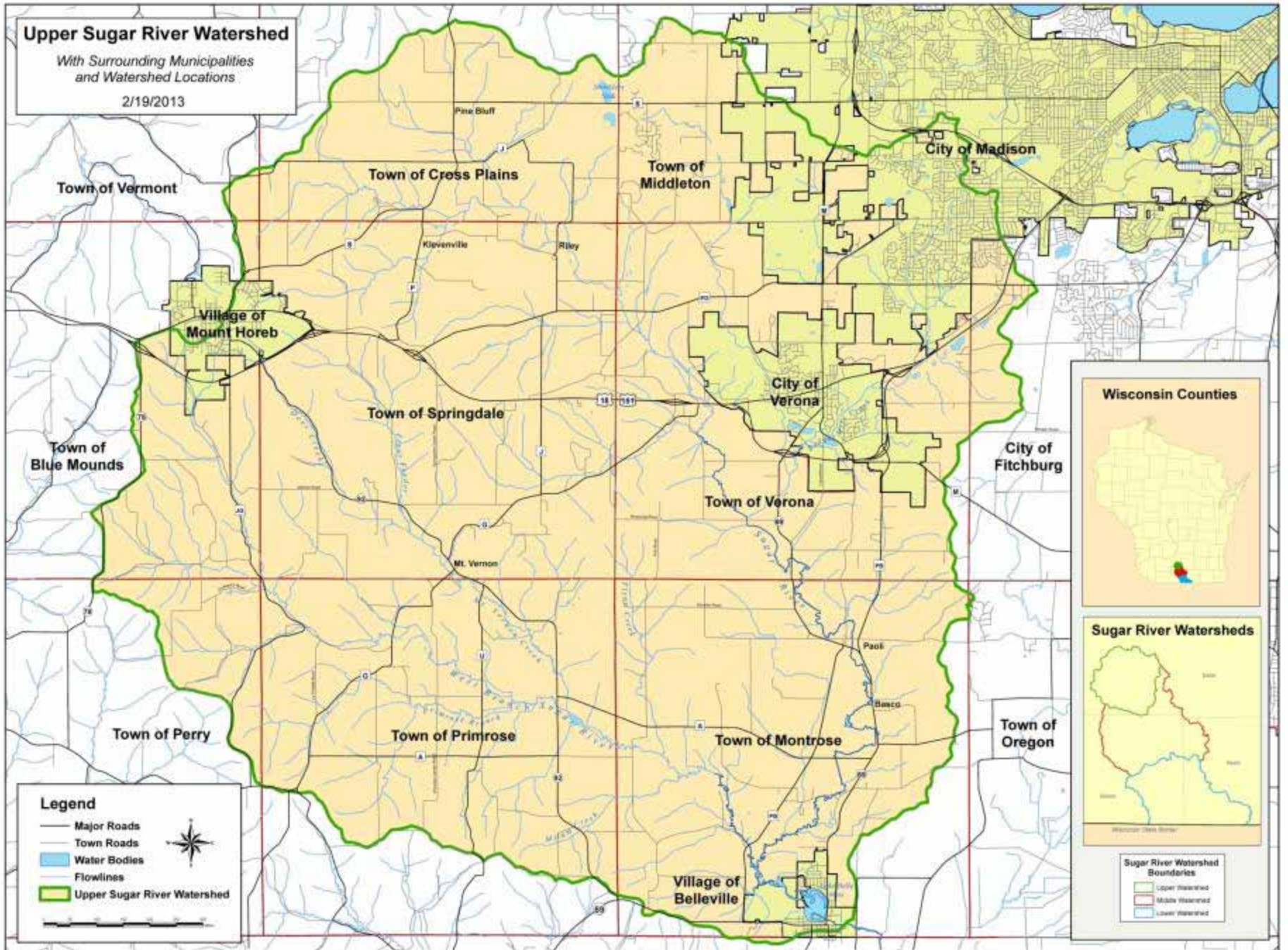




# Upper Sugar River Watershed

With Surrounding Municipalities  
and Watershed Locations

2/19/2013



## Wisconsin Counties



## Sugar River Watersheds



- Sugar River Watershed Boundaries**
- Upper Watershed
  - Middle Watershed
  - Lower Watershed

# Initial Goals

- Understand non-point source pollution in the watershed
- Educate ourselves on phosphorus standards set by Wisconsin DNR
- Establish baseline data total phosphorus data
- Start a relationship with farmers in our area



# Let's Talk Phosphorus

**Phosphorus** is the nutrient found in manure, leaves, soil, and lake sediments that fertilizes plant and algae growth in the lakes.

An estimated **60,000 pounds** of phosphorus each year flows in the Sugar River



1 pound of  
phosphorus



= 500 pounds of  
algae



# New 'P' Standards in WI

- WI passed the first total phosphorus standards in the nation
  - 0.075 mg/L in most rivers/creeks, 0.1 mg/L in larger rivers
- Rivers/Lakes over the standard limit can be classified as “impaired”
- Standards enforced on point-source discharge
  - Factories, wastewater treatment plants, etc.



# Solutions

- Make physical improvements (\$\$\$)
- Help limit non-point phosphorus runoff on farms and urban areas
  - ADAPTIVE MANAGEMENT- Complete necessary improvements to bring a watershed system into P compliance. Based on real testing over long term.
  - NUTRIENT TRADING- Earn “credits” by instituting programs that save phosphorus. Based on computer modeling.

**End goal: Begin tackling non-point source pollution through point sources**



# USRWA & UW-Whitewater

- Partnership formed to create an 'EVAAL' model of the Upper Sugar River Watershed as a semester project for UW-Whitewater geography students

ConnectVerona.com December 31, 2015 The Verona Press **3**

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## USRWA partners with UW-Whitewater

Geology students assist association with finding erosion in the watershed

**KIMBERLY WETHAL**  
*Press Correspondent*

Waterway culverts under-  
neath roads and driveways  
in the Verona and surround-  
ing Sugar River watershed  
area have been the biggest  
challenge for a team of  
University of Wisconsin-  
Whitewater students during  
the Fall 2015 semester.

Finding the location of  
those culverts became a  
problematic guessing game  
for the students, as they  
worked to create an ero-  
sion vulnerability model  
for the Upper Sugar River  
Watershed Association.

was "incredible," adding  
it's something the nonprofit  
wouldn't have been able to  
do on its own.

"It's going to allow us  
to consolidate our time to  
focus on the areas that need  
the most help," Moder said.  
"Given the amount of time  
and work that goes into this  
model, I'm pretty blown  
away by these results."

The model project will  
allow Moder and the USR-  
WA to save time and mon-  
ey by knowing the areas  
of the watershed most at  
risk for erosion. USRWA  
also plans to use the model  
to assist local farmers in



ideas off of each other ...  
it was individually a team  
effort," he said.

The final results were  
generated with the help of  
Geographic Information  
Services (Smith referred  
to this as a "Photoshop for  
maps") and five years of  
data from the area.

While three of the 11  
students on the team grad-  
uated on Dec. 19, Splinter  
hopes one of the remaining  
eight will be able to pick up  
where they left off during  
the next semester as they  
go even more in-depth into  
the watershed to further  
develop their results. Geol-



# EVAAL in a Nutshell



- **EVAAL = Erosion Vulnerability Assessment for Agricultural Lands**
- Designed by Wisconsin DNR
- Factors in readily available datasets like topography, land cover, and soils
- Intended for relatively small watersheds, less than  $\sim 75 \text{ km}^2$
- Enables watershed managers to prioritize and focus their field-scale data collection efforts
- The EVAAL toolset was designed to quickly identify areas vulnerable to erosion using readily available data and a user-friendly interface



# EVAAL in a Nutshell



- EVAAL estimates vulnerability by separately assessing the risk for sheet and rill erosion, and gully erosion
- Deprioritizes areas not often hydrologically connected to surface waters (also known as internally drained areas)
- The EVAAL toolset was designed to quickly identify areas vulnerable to erosion using readily available data and a user-friendly interface
- Saves time and money while increasing the probability of locating fields with high sediment and nutrient export for implementation of BMPs
- Can produce field-level data for landowners



# Outputs of EVAAL

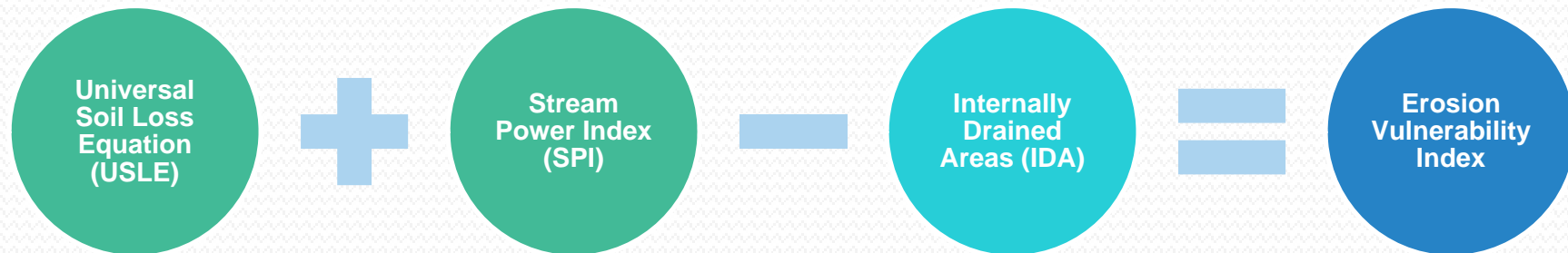


- Erosion vulnerability index for the area of interest
- Areas vulnerable to sheet and rill erosion
  - Sheet Erosion: thin layers of topsoil removed from hillsides, not readily noticed
  - Rill Erosion: Runoff water forms small channels as it concentrates down a slope, maximum 1 foot deep
- Areas of potential gully erosion
  - Gully erosion: Runoff water concentrates so strongly it creates massive “ditch” like caverns
- Areas hydrologically disconnected from surface waters





# EVAAL Equation



**Risk for Sheet and Rill erosion**  
(uniform surface erosion & erosion from concentrated water events)

**Risk for Gully Erosion**  
(erosion along drainage lines)

**Areas not hydrologically connected to surface water**

# The Headwaters

**30,366 Acres of Land**

## **Soil Composition**

Various Silt Loam and Clay

## **Comprised of:**

31.3% No Agriculture

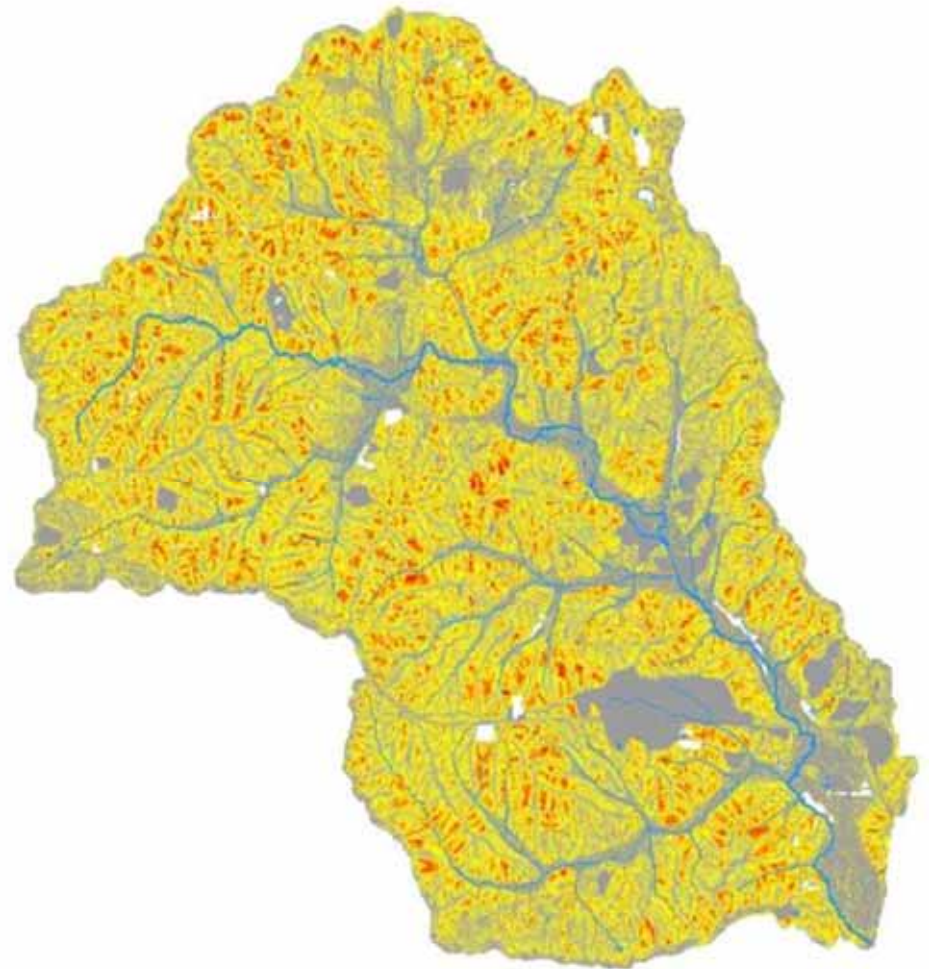
27.7% Dairy Rotation

26.9% Pasture/Hay/Grassland

13.8% Cash Grain

0.33% Continuous Corn

>0.1% Potato/Grain/Veggie



# Mount Vernon Creek

**10,795 Acres of Land**

## **Soil Composition**

Mostly Silt Loams, Gravelly, and Clayey

## **Comprised of:**

- 21.5% Dairy Rotation
- 1.8% Cash Grain
- >0.1% Continuous Corn
- 35.5% No Agriculture
- 33.85% Pasture/Hay/Grassland
- >0.1% Potato/Grain/Veggie Rotation





# Primrose

**21,035 Acres of Land**

## **Soil Composition**

Various Silt and Sandy Loams

## **Comprised of:**

- 33.45% Dairy Crop Rotation
- 38.75% Grassland and Pasture
- 7.7% Cash Crops
- 1.76% Continuous Corn
- >0.1% Potato/ Vegetable Rotation



# Paoli

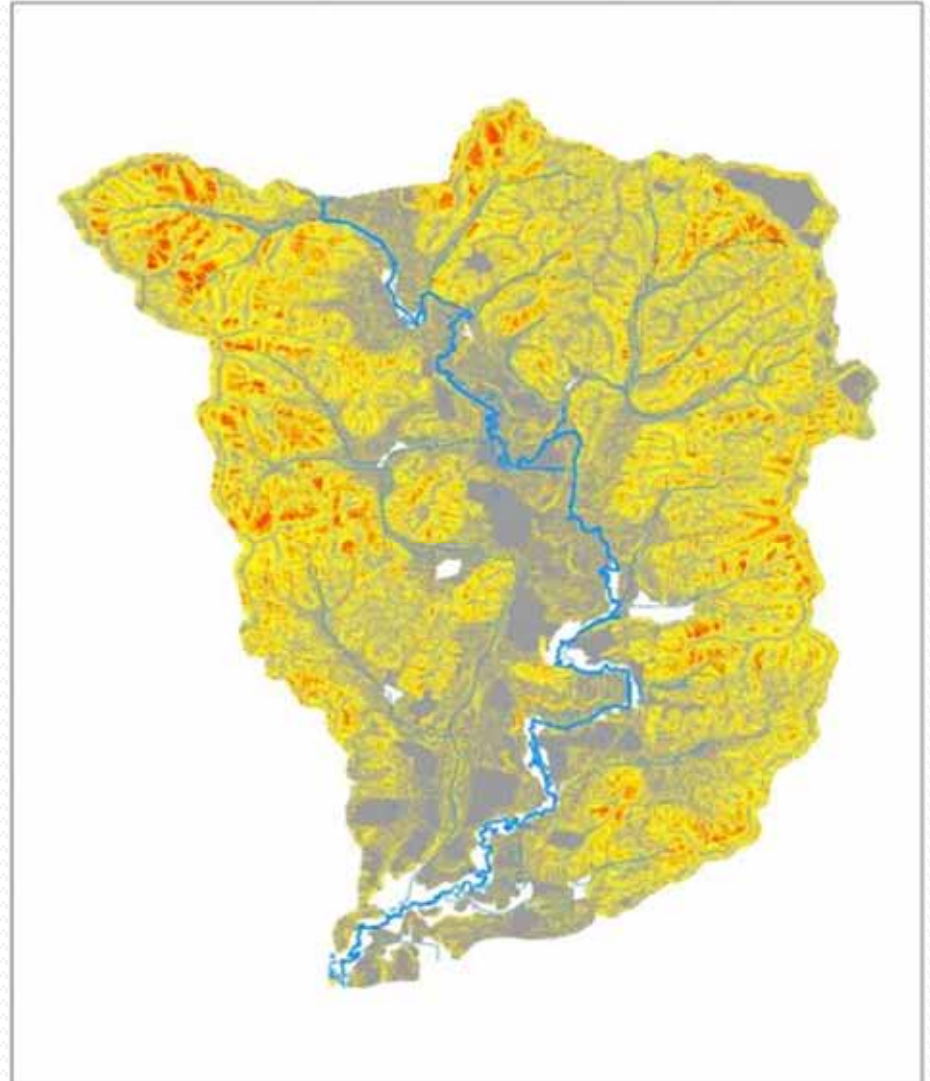
**14,155 Acres of Land**

## **Soil Composition**

Various Silt and Sandy Loams

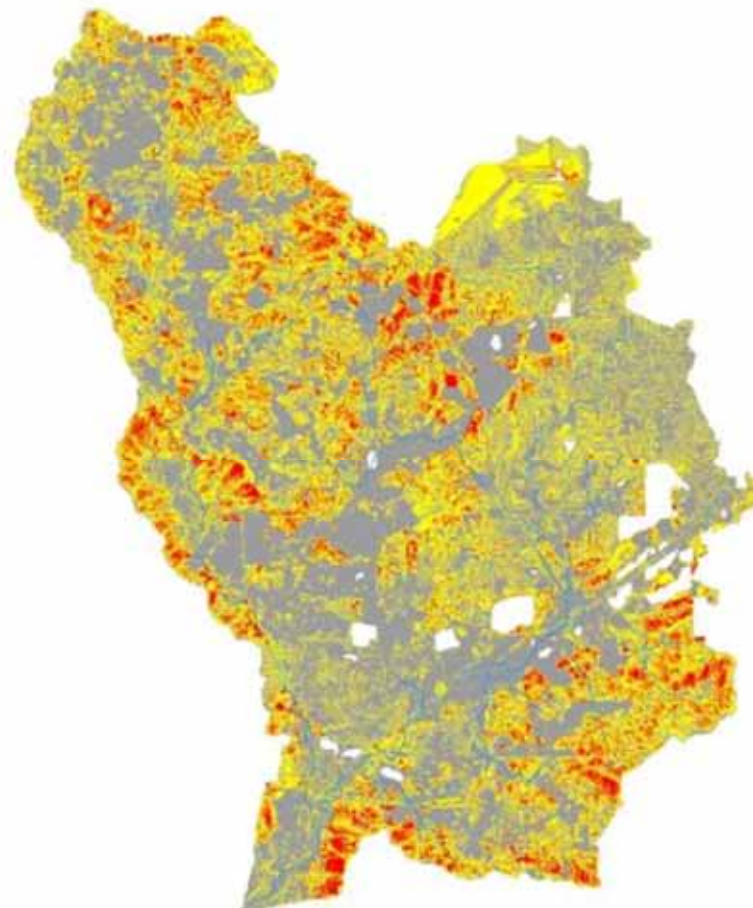
## **Comprised of:**

- 34.9% Dairy Rotation
- 13.2% Cash Grain
- 5.3% Continuous Corn
- 18.1% No Agriculture
- 28.2% Pasture/Hay/Grassland
- 0.2% Potato/Grain/Veggie Rotation
- >0.01% Dairy Potato Year



# Badger Mill Creek

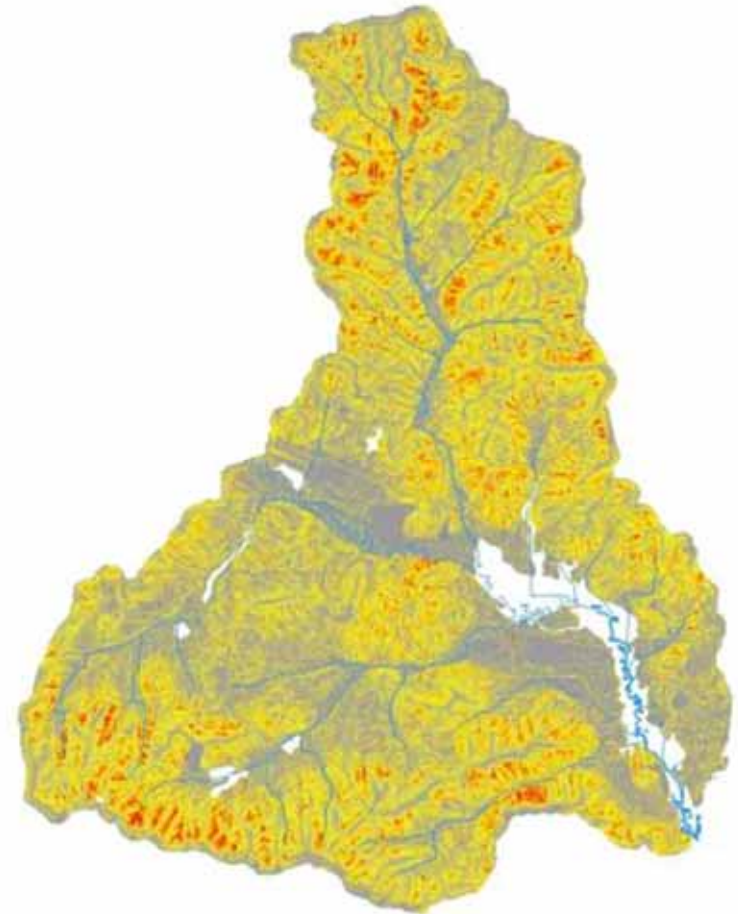
- 21,661 acres
- **Soil Composition**
  - Silt Loam and Gravelly
- **Comprised Of:**
  - 21% Dairy Rotation
  - 10.8% Cash Grain
  - >0.1% Continuous Corn
  - 38.5% No Agriculture
  - 27% Pasture/Hay/Grassland
  - >0.1% Potato/Grain/Veggie Rotation



# West Branch Sugar River

- **11,053 Acres of Land**
- **Soil Composition**
  - Mostly Silt Loams and Adrian Muck
- **Comprised of:**
  - 34.6% Dairy Rotation
  - 13.9% Cash Grain
  - 3.1% Continuous Corn
  - 1.8% No Agriculture
  - 30.9% Pasture/Hay/Grassland
  - >0.1% Potato/Grain/Veggie Rotation

West Branch





# Citizen Science at Work in 2015

- **9** volunteers monitored **26** water quality monitoring sites in the Upper Sugar River Watershed, totaling **146** volunteer hours
- Began total phosphorus monitoring at **10** watershed sites



# Citizen Science at Work

- Comparing the USRW with the new Wisconsin DNR phosphorus standards

2015 Upper Sugar River Watershed Total Phosphorus Data								
Site Information			2015 Total Phosphorus Data (mg/L)					
Site	Latitude	Longitude	May	June	July	August	September	October
Trib to Sugar River at White Crossing Rd	43.0061	-89.595	<b>0.103</b>	0.0691	0.0598	<b>0.168</b>	<b>*0.469</b>	0.0718
Sugar River upstream of CTH P	43.0349	-89.6658	0.0748	<b>0.0848</b>	0.0593	0.0114	<b>*1.46</b>	<b>0.115</b>
West Branch Sugar River at Docken Rd	42.9926	-89.7453	<b>0.112</b>	<b>0.1</b>	<b>0.11</b>	<b>0.123</b>	<b>*0.156</b>	<b>0.181</b>
West Branch Sugar River at CTH U	42.9197	-89.6474	<b>0.234</b>	<b>0.151</b>	<b>0.111</b>	<b>0.141</b>	<b>0.107</b>	<b>0.0863</b>
Primrose Branch at CTH U	42.9109	-89.647	<b>0.157</b>	<b>0.0846</b>	0.0462	0.0595	0.0509	0.0528
Fryes Feeder upstream of Highway 92	42.9628	-89.6745	<b>0.087</b>	0.0501	0.0559	0.0495	0.0398	0.0361
Flynn Creek at CTH A	42.9083	-89.5895	0.0692	0.0459	0.039	0.0449	0.0626	0.0547
Milum Creek at Fritz Rd	42.8913	-89.5972	<b>0.102</b>	<b>0.0986</b>	<b>0.0939</b>	<b>0.0791</b>	<b>0.0863</b>	0.0629
Sugar River at Frenchtown Rd	42.8914	-89.5307	<b>0.109</b>	<b>0.181</b>	<b>0.0857</b>	<b>0.144</b>	0.0492	0.061
Badger Mill Creek upstream of Highway 69	42.9655	-89.5467	<b>0.173</b>	<b>0.334</b>	<b>0.284</b>	<b>0.236</b>	<b>0.275</b>	<b>0.176</b>

\* = Significant rain event prior and during data collection

**Bold** = Data collected exceeds the 0.075 mg/L total phosphorus standard set by WI

**Bold in Orange** = Data collected is at least 2x the 0.075 mg/L total phosphorus standard

**Bold in Red** = Data collected is at least 3x the 0.075 mg/L total phosphorus standard

# How did all this happen?

- Ag committee made up of concerned citizens was created
- Committee educated themselves on the issues
  - Phosphorus limits
  - Adaptive Management/Nutrient Trading
  - What can be done
- Got key players involved
  - Farmers
  - Wastewater treatment plants
  - Local universities
  - DNR



# Vision for 2016

- Continue water quality monitoring program at current sites
- Phosphorus Planning
  - Monitor same 10 sites from 2015 again in 2016 to solidify baseline data, and add three new sites
    - Mt. Horeb Wastewater Utility sponsored
  - Add five additional sites through DNR volunteer monitoring grant
  - Fine-tune EVAAL model to use on individual properties







# Vision for 2016

- Farmer-led Coalition forming
  - Locally-based way to bring new ideas and methods to farmers
  - Mutually beneficial for the environment and farmers
  - For farmers, by farmers
  - Being organized by the USRWA Ag Committee
  - Goal in 2016: Create a mission, recruit more farmers, apply for cost-sharing programs

Shameless  
Plug!!

- **Sunday June 5, 2016**
- Cycle through the beautiful countryside beginning in Mount Horeb, WI, then paddle the sparkling Sugar River until you reach your destination south of Verona, WI
- Shuttle back to Mount Horeb for lunch, beer tasting, and live music
- Adults: \$40, Children: \$10
- All proceeds support Upper Sugar River Watershed Association
- [usrwa.org/ramble](http://usrwa.org/ramble)



# Contact Info

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