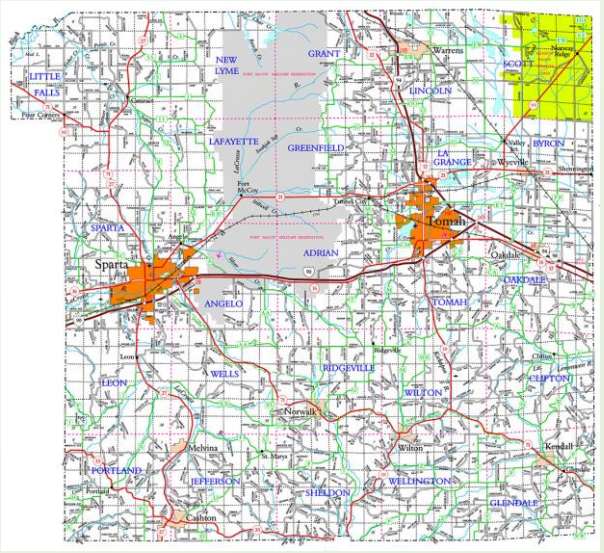


Monroe County Climate Readiness and Rural Economic Opportunity Assessment

Project Update

Fred Clark, fclark@wigreenfire.org

WISCONSIN'S greenfire
VOICES FOR CONSERVATION

Project Goals

- Identify and Project **Future Climate Risks**
- Strategies and Practices to **Reduce Risks to Infrastructure and Watersheds**
- Identify **Climate Vulnerabilities in Farms, Forests, and Conservation Lands**
- Recommend Strategies and Practices to **Increase Climate Resiliency**
- Assess **income opportunities** for carbon offsets and other ecosystem services

Project Partners

Monroe County Climate Task Force

Wisconsin Initiative on Climate Change Impacts

WI Land + Water

NIACS Northern Institute of Applied Climate Science

Wisconsin Department of Natural Resources

Monroe County Wisconsin

UW Extension University of Wisconsin-Extension

The Nature Conservancy

U.S. Army, Fort McCoy

Wisconsin's Greenfire Voices for Conservation

Monroe County Climate Readiness and Rural Economic Opportunity Assessment

Core Team

Fred Clark, Executive Director, Wisconsin's Green Fire
Bob Micheel, Monroe County Land Conservation Dept. Director
Joanne Kline, Conservation Strategies Group, LLC
Rob Montgomery, PE, Consulting Engineer
Christina Anderson, Climate Specialist, Wisconsin Land and Water
Nick Miller, Director of Conservation Science, The Nature Conservancy
Pam Porter, Policy Advisor, Wisconsin Department of Natural Resources
Nancy Turyk, UWSP Emeritus, Wisconsin's Green Fire
Sarah Peterson, Science Director, Wisconsin's Green Fire

Core Team Advisors

Prof. Anna Haines, Director Center for Land Use Education, UW-Stevens Point
Dr. Steve Vavrus, Nelson Institute Center for Climatic Research, UW-Madison

Monroe County Climate Readiness and Rural Economic Opportunity Assessment

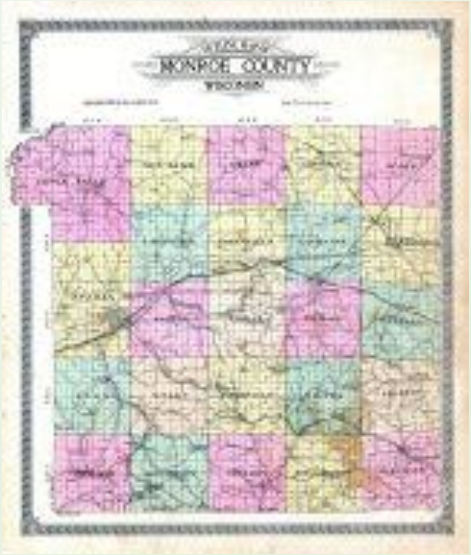
Host Team

- **Bob Micheel**, Monroe County Land Conservation Department Director
- **Cedric Schnitzler**, Monroe County Board Chair
- **Tina Osterberg**, Monroe County Administrator
- **John Noble**, Biologist, U.S. DOD Fort McCoy
- **Bill Halfman**, Agriculture Agent, UW-Extension Monroe County
- **Jack Herricks**, Agricultural Producer, County Supervisor, Town of Jefferson Supervisor
- **Ron Luethe**, County Supervisor, Town of Ridgeville Supervisor
- **Mark Van Wormer**, Public Works Director, City of Sparta

Monroe County Climate Readiness and Rural Economic Opportunity Assessment

Technical Teams

Climate and Hydrology



Climate and Agriculture

Flood Resilience - Infrastructure

Climate and Forests

Community Engagement

Project Structure

Identify

Identify vulnerabilities within the county that includes:

- Infrastructure (buildings, culverts, etc)
- Flood risk
- Ecosystems at risk

Engage

Engage with county officials, tribal officials, community members and other stakeholders.

Prioritize identified vulnerabilities through community workshops, field days, and open communication.

Plan

Use data and best-available science, alongside community input, to develop resiliency recommendations.

Nature-based and community-centric solutions will be emphasized.

Spatial Data

Land Cover / Land Use

Spatially-explicit data of agriculture, forests, cities, etc.

Using Wiscland-II data.

Hydrography

Rivers, streams, wetlands, lakes, as well as floodplain boundaries, watershed delinations, etc.

Topography

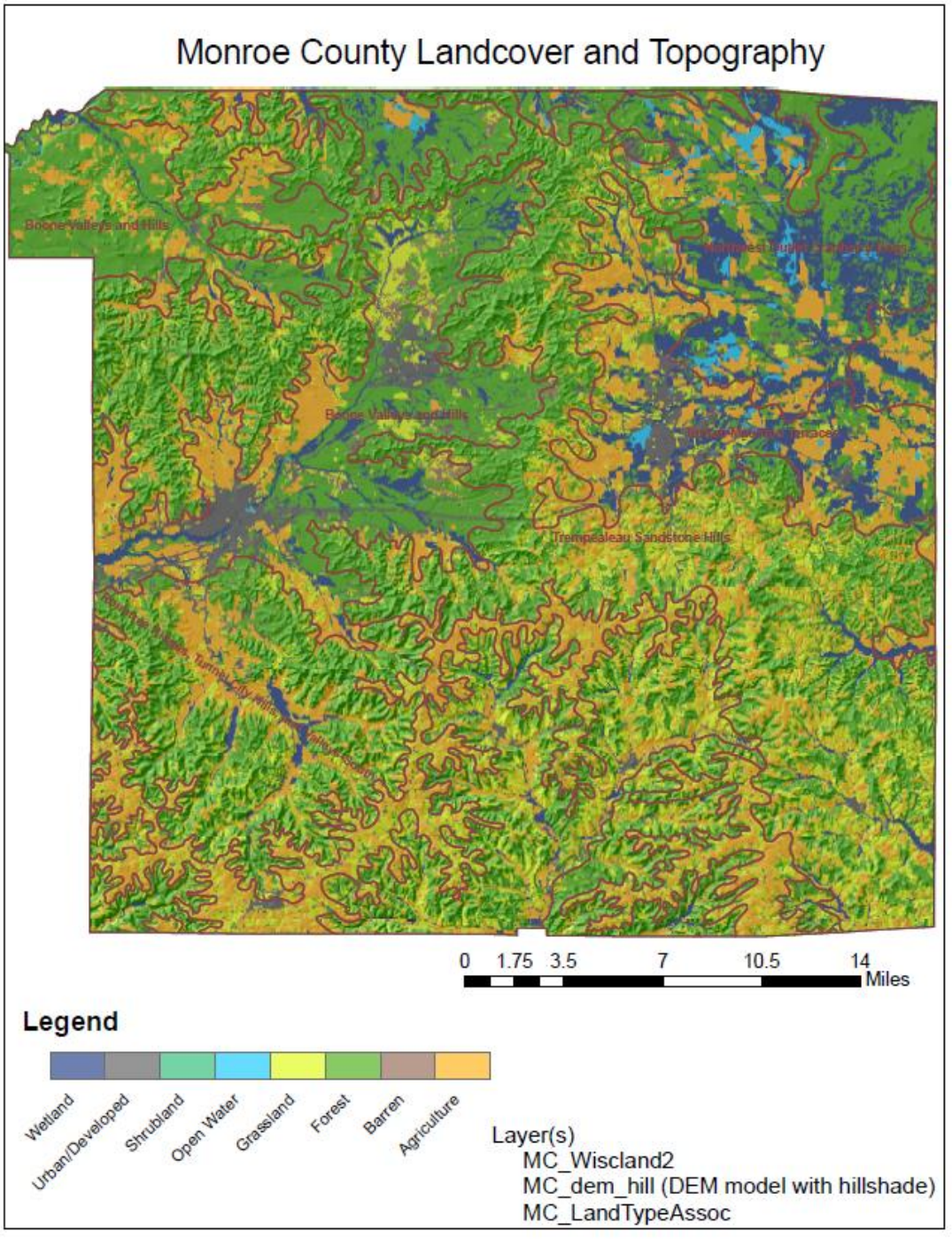
Topographic features that may impact flood risk, resiliency and more.

Administrative Boundaries

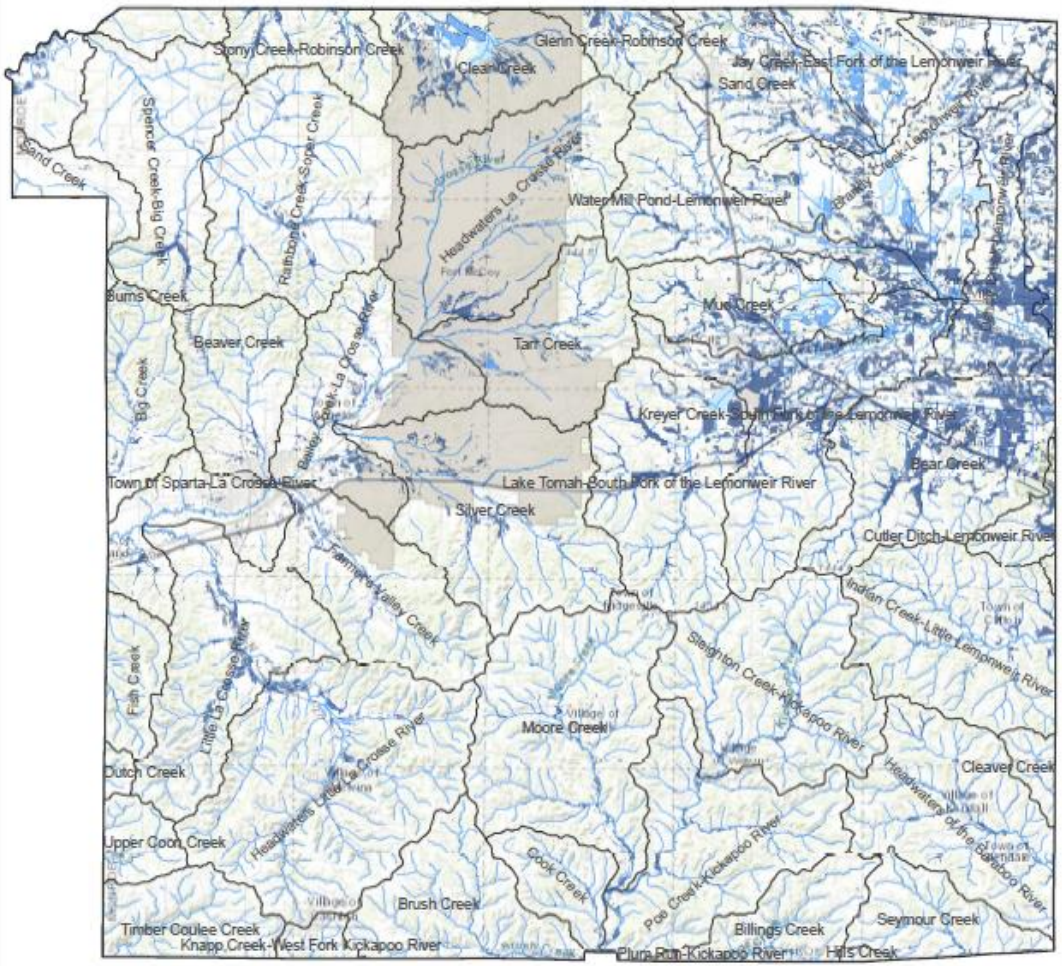
Protected lands boundaries, WDNR holdings, tribal holdings, Fort McCoy, etc.

Future Conditions

Use of “off-the-shelf” data models by USGS, US Dept of Energy, WICCI, TNC, and more to predict future conditions, stressors, and vulnerabilities, up


Monroe County Landcover and Topography
Boone Valleys and Hills
Boone Valleys and Hills
Trempealeau Sandstone Hills
0 1.75 3.5 7 10.5 14
Miles
Legend
Wetland
Urban/Developed
Shrubland
Open Water
Grassland
Forest
Barren
Agriculture
Layer(s)
MC_Wiscland2
MC_dem_hill (DEM model with hillshade)
MC_LandTypeAssoc

Monroe County Hydrography and Potential Restorable Wetlands

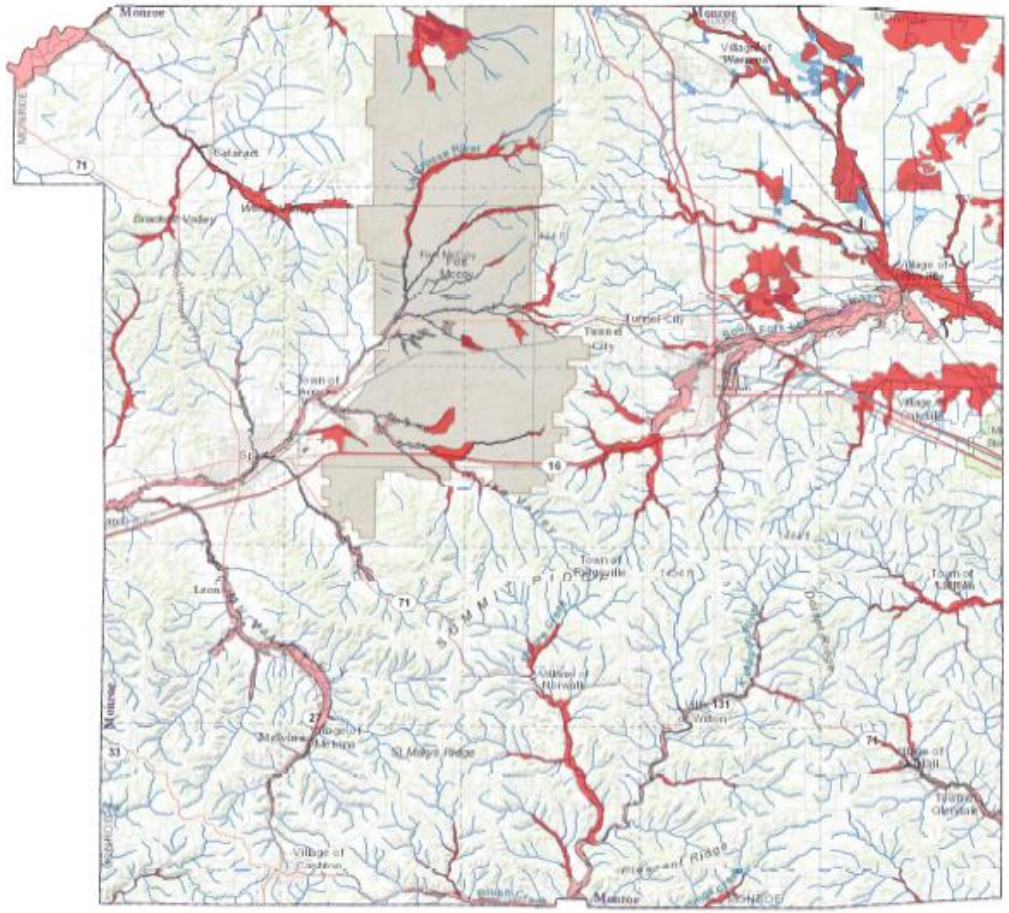


Legend

- MonroeCo_PRWs
- 24k_Hydro_Monroe
- Monroe_HUC12

Package or GDB Name(s):
WGF_Monroe_2021-06-13.gdb
Additional layer(s):
24k_Hydro_Monroe

Monroe County Hydrography and FEMA Flood Risk



0 1.75 3.5 7 10.5 14
Miles

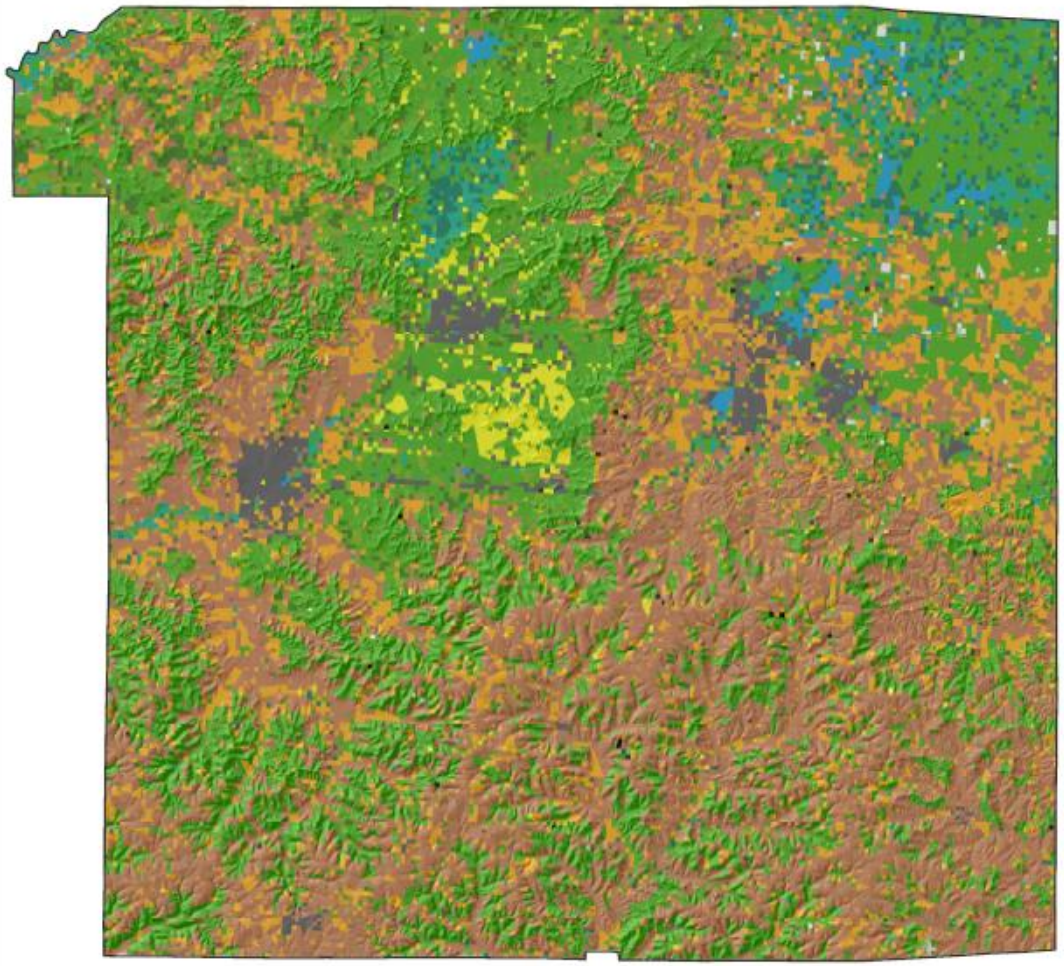
Legend

FEMA Flood Risk

- High Risk
- Base Floodplain
- Minimal Risk
- 24k_Hydro_Monroe

Additional layer(s):
FEMA_Fl_Rsk
24k_Hydro_Monroe

Monroe County Land Use Predictions
2050 under climate scenario A2 (BAU)



Legend

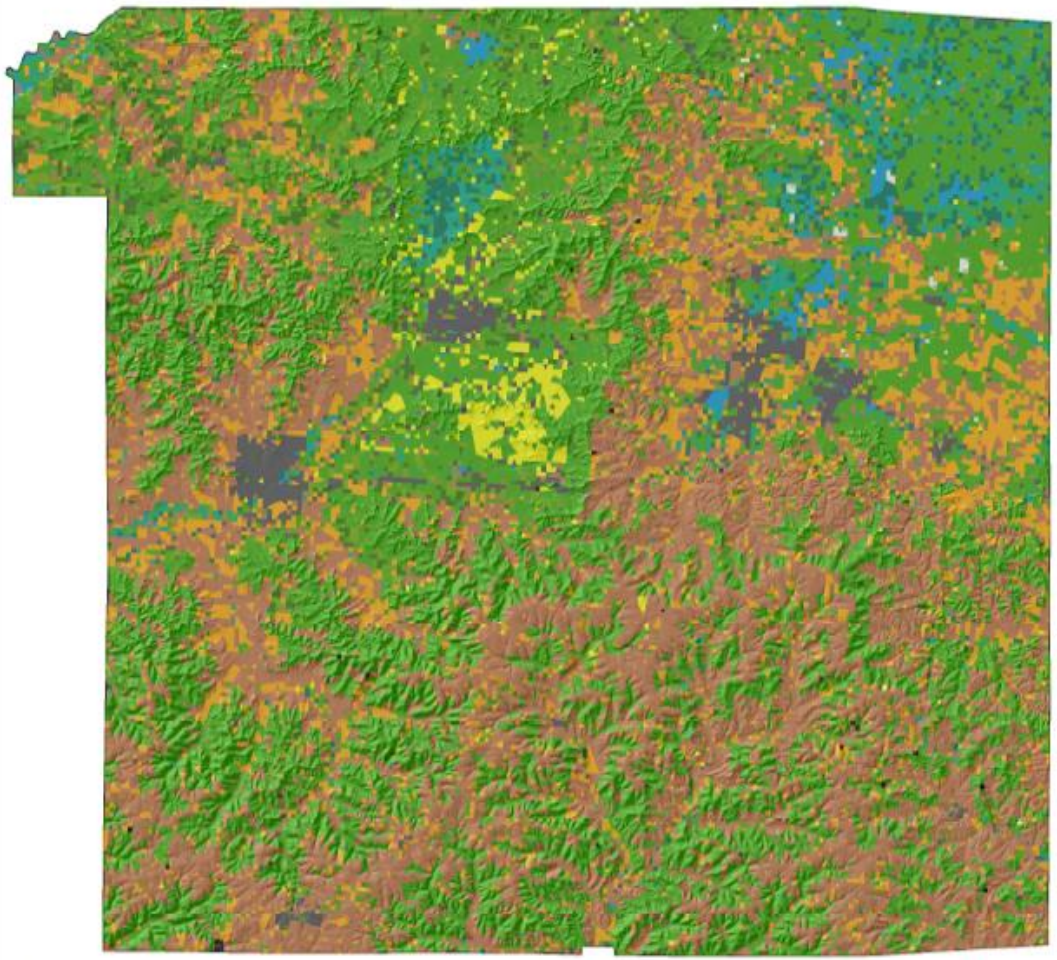
0 1.75 3.5 7 10.5 14
Miles

Cover Type

Water
Developed
Mech Dist Forest
Mining
Deciduous Forest
Coniferous Forest
Mixed Forest
Grassland
Agriculture
Hay/Pasture
Herbaceous Wetland
Woody Wetland

LandCarbon (Zhu et al. 2010), USGS

Monroe County Land Use Predictions
2050 under climate scenario B1 (ECO)



LandCarbon (Zhu et al. 2010), USGS

Climate & Hydrology

Flood Resilience & Infrastructure

Approach to climate and hydrology

- Use future horizon of ~ 2050 – 30 years in the future
- Focus on climate variables important to hydrologic response and future forest and cropland conditions
- Both flood potential and stream health (base flow, water yield, water quality)are important
- Develop overview models to “bracket” hydrologic response for discussion
- Refine analyses based on selected scenarios later this year

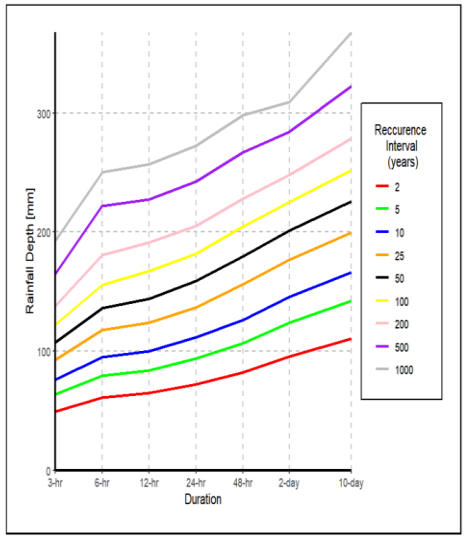
Climate data

- Rainfall
  - NOAA Atlas 14
  - Rainy Day
  - Climate model future statistics – 2050
- Growing season, temperature, soil moisture

RainyDay Precipitation Frequency Estimates for Monroe County *(in millimeters)*

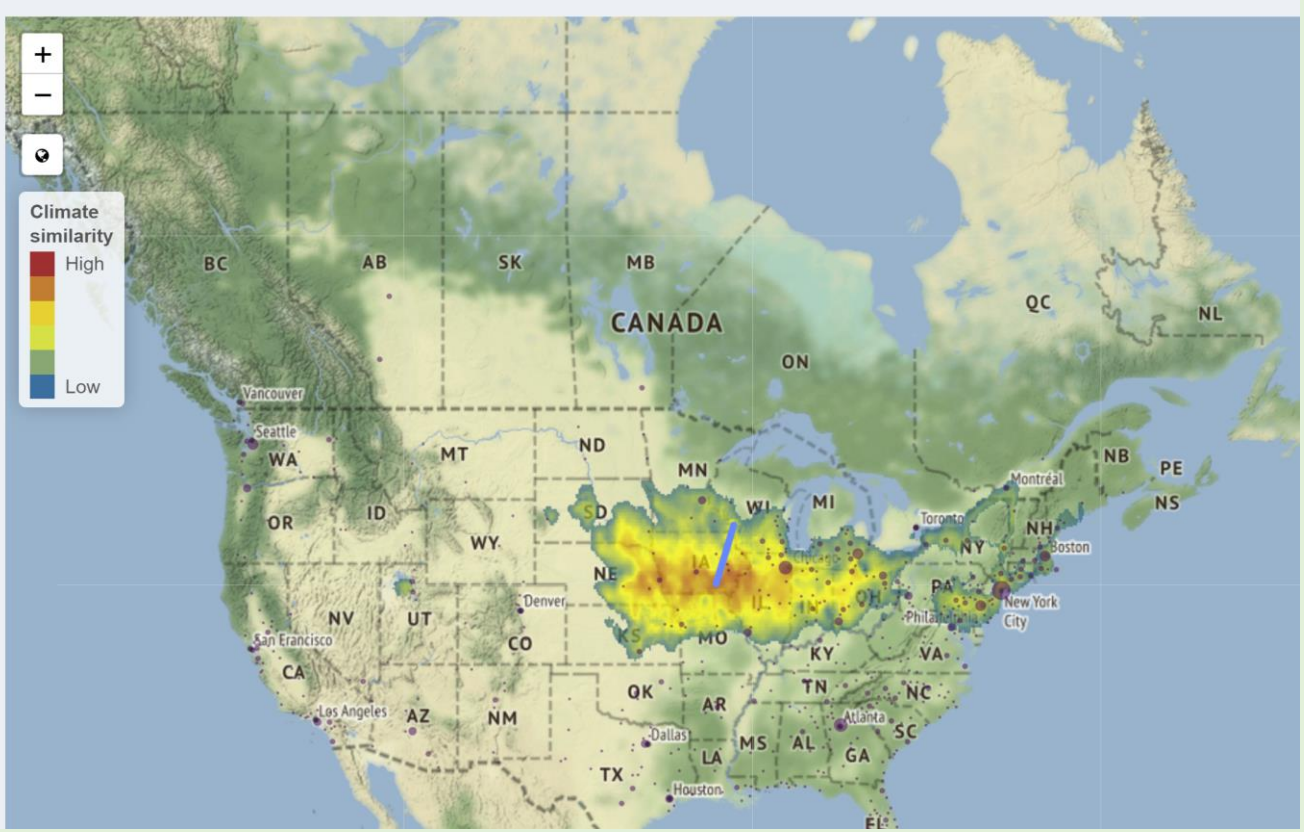
	Average Recurrence Interval								
Duration	2 years	5 years	10 years	25 years	50 years	100 years	200 years	500 years	1000 years
3-hr upper bound	48.2	62.1	72.9	87	99.3	110.9	123.9	136.2	143.9
3-hr average	49.4	63.9	75.9	93	107	122.2	137.8	164.8	192.3
3-hr lower bound	50.6	66.1	78.9	99.2	115.8	136.3	151.3	204.8	303.7
6-hr upper bound	59.8	76.6	91	111.1	127.6	141.5	155.7	170	193.5
6-hr average	61.1	79.2	95	117.7	136	155.5	180.7	221.9	250.1
6-hr lower bound	62.5	82.3	99.2	126	144.5	172.3	212.4	274.1	339.8
12-hr upper bound	63.5	81.2	94.9	115.4	133.8	148.7	168.2	188.6	195.5
12-hr average	64.8	83.9	100.2	124.1	144.1	167.1	191.4	227.5	256.8
12-hr lower bound	66.1	86.9	105.3	131.3	156.4	184.2	220.4	283.7	334.8
24-hr upper bound	70.3	90.6	107.6	129.3	147.3	167.3	184.1	202.4	211.7
24-hr average	71.9	93.8	111.6	136.9	158.8	181.7	205.1	242.5	272.5
24-hr lower bound	73.4	96.7	115.9	145.8	171.6	201.4	233.9	293.7	338.2
48-hr upper bound	80.4	102.6	121.3	146.8	168.2	187.4	202.6	223.7	256.1
48-hr average	82.2	106.4	126.3	156	179.3	204.7	227.9	266.9	298.1
48-hr lower bound	84.1	109.7	131.5	165.3	190.8	228.1	252.7	316.9	357
4-day upper bound	93.4	120.3	140.2	168.4	189.5	209.2	230.2	249.1	263.2
4-day average	95.3	124.1	145.8	177	201.5	225	248.3	284.1	309.3
4-day lower bound	97.8	128.8	150.6	186.8	216.2	242.8	271.1	327.4	361.3
10-day upper bound	108.5	138.2	160.6	190.5	212.5	231.6	253.9	279.4	292.8
10-day average	110.7	142.2	166.2	199.4	225.8	251.7	278.9	322.4	367.7
10-day lower bound	113.1	146.1	170.8	207.5	241.3	270.7	306.4	396.8	464.6

Depth-Duration-Frequency (DDF) Curves- *Monroe County*



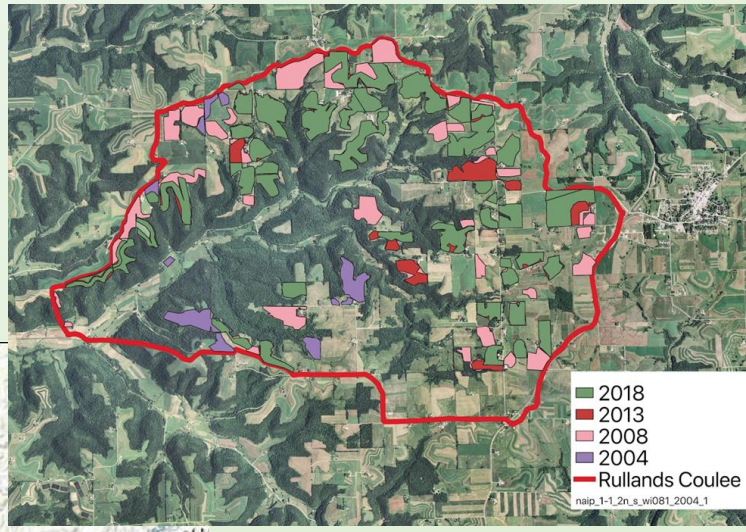
Other potential climate evaluations

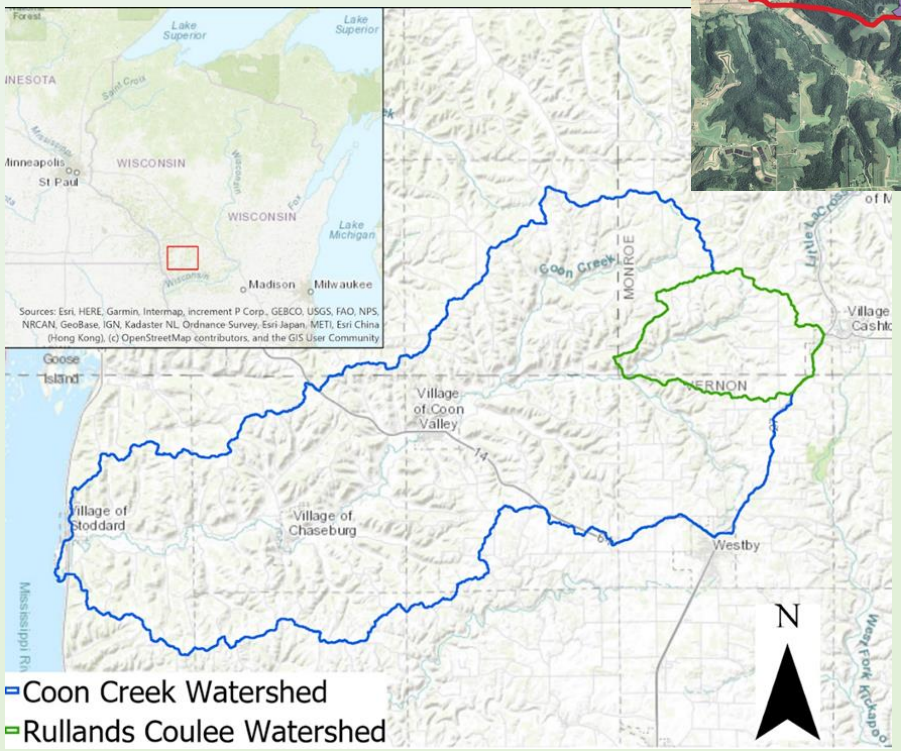
- Regions having current climate similar to what we expect for Monroe County



Hydrologic response ana

- Initial analysis: Use GIS/SCS-based methods developed by WRM project in the Coon Creek watershed

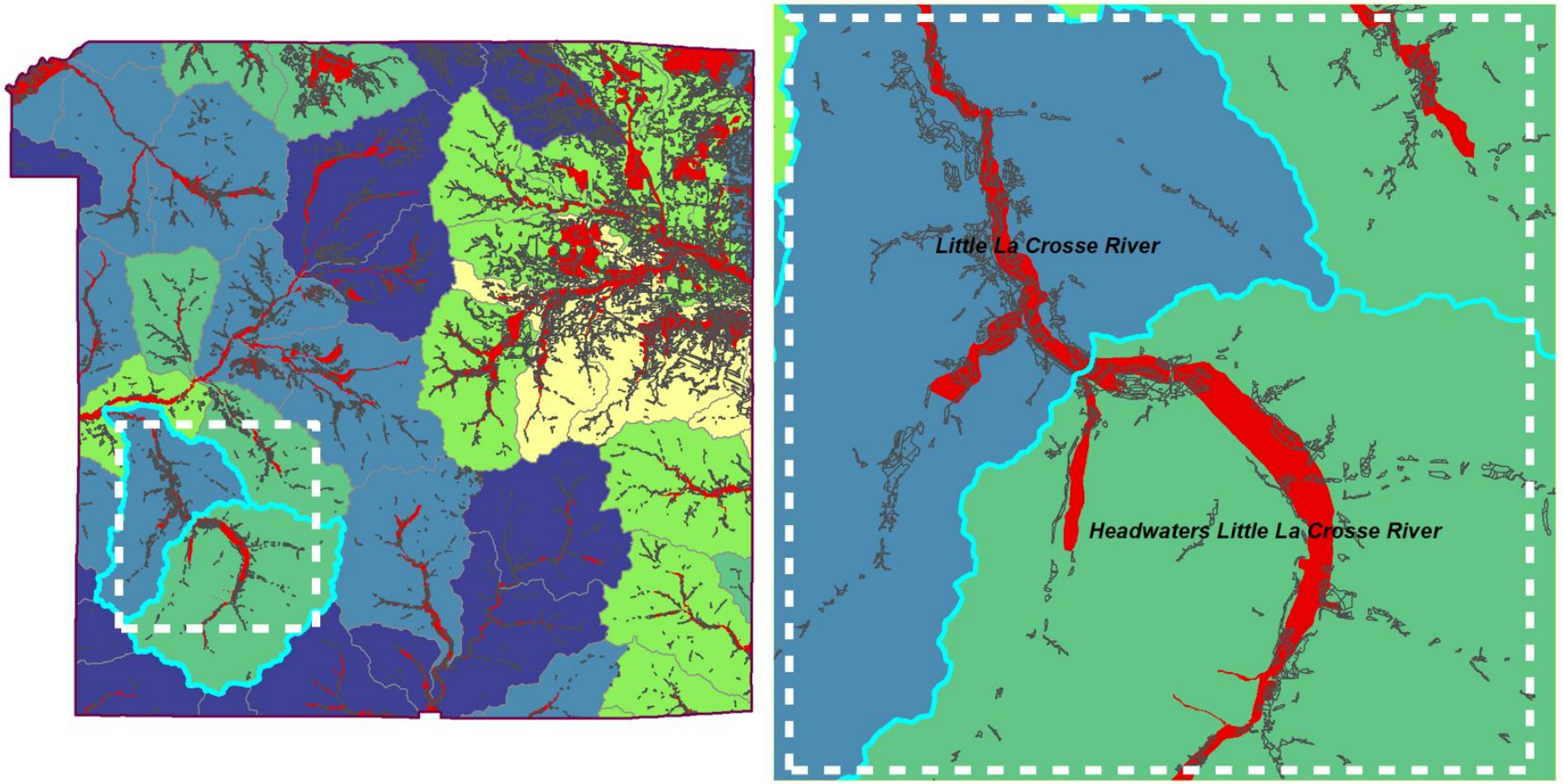




		% Urban		% Agriculture							% Grass/Shrub				
Watershed ID	Watershed Name	*High Intensity Urban/ Developed*	*Low Intensity Urban/ Developed*	*Cash Grain*	*Continuous Corn*	*Dairy Rotation*	*Potato/Vegetable*	*Cranberries*	*Hay (Forage)*	*Pasture (Forage)*	*Cool-season Grass*	*Warm-season Grass*	*Shrubland*	*Fir Spruce*	*Jac*
07040006020	Bailey Creek-La Crosse River	1.26	8.84	13.89	1.06	7.56	0.00	0.00	2.24	2.56	3.84	1.33	0.00	0.00	7
07070003160	Bear Creek	0.16	2.97	11.06	2.64	13.46	0.09	2.93	3.66	3.49	5.34	0.38	0.01	0.00	0
07040006030	Beaver Creek	1.46	4.83	9.94	5.56	12.89	0.00	0.00	4.30	7.23	2.52	0.00	0.00	0.00	0
07040006030	Big Creek	0.00	0.94	5.46	4.33	16.98	0.00	0.00	3.58	6.76	2.76	0.00	0.00	0.00	0
07070006030	Billings Creek	0.03	1.07	4.89	0.96	20.57	0.00	0.00	9.43	9.06	4.28	1.17	0.06	0.00	0
07070003150	Brandy Creek-Lemonweir River	0.02	1.02	2.86	0.09	2.20	0.00	5.26	0.42	0.23	0.78	0.03	0.01	0.00	5
07070006030	Brush Creek	0.28	2.28	0.97	2.58	21.28	0.00	0.00	17.07	14.67	1.52	1.02	0.00	0.00	0
07040006030	Burns Creek (only 19 acres in Monroe Co)														
07040007100	Clear Creek	0.04	0.90	0.00	0.00	0.00	0.00	4.15	0.27	0.00	2.47	0.13	0.00	0.00	1
07070004010	Cleaver Creek	0.00	1.27	0.55	0.00	8.01	0.00	0.00	14.50	13.77	12.82	6.96	0.00	0.00	0
07070006010	Cook Creek	0.07	1.34	0.00	0.69	11.27	0.00	0.00	11.12	23.52	2.58	1.63	0.00	0.00	0
07070003160	Cutler Ditch-Lemonweir River	0.00	1.42	16.85	1.21	10.63	0.00	0.00	3.26	2.47	1.82	0.92	0.00	0.00	1
07070003150	Dandy Creek-Lemonweir River	0.00	1.15	9.48	0.75	5.26	0.00	1.26	0.54	0.68	1.77	0.12	0.00	0.00	3
07040006030	Dutch Creek (906 ac in Monroe Co)	0.00	1.90	12.86	0.27	33.44	0.00	0.00	23.00	3.35	0.00	0.97	0.00	0.00	0
07070003140	Eagle Nest Flowage-Beaver Creek	0.00	0.72	4.68	0.00	1.20	0.00	0.00	0.09	0.32	0.27	0.12	0.00	0.00	6
07040006030	Farmer's Valley Creek	0.45	5.87	8.05	0.33	10.02	0.00	0.00	3.21	8.14	2.34	0.17	0.00	0.00	4
07040006030	Fish Creek	0.00	1.38	6.65	1.67	11.82	0.00	0.00	7.25	5.46	0.97	0.93	0.00	0.00	0
07070003160	Fountain Creek-Little Lemonweir River (257 ac in M	0.00	0.59	0.00	0.00	14.72	0.00	0.00	1.51	0.00	0.00	0.00	0.00	0.00	0
07040007100	Glenn Creek-Robinson Creek	0.00	3.07	0.00	0.00	1.78	0.00	5.79	0.48	0.87	1.62	0.00	0.00	0.00	4
07040006020	Headwaters La Crosse River	2.28	3.81	0.32	0.44	0.64	0.00	0.20	1.65	0.92	9.91	4.46	0.06	0.00	5

- GIS-based watershed and land cover data

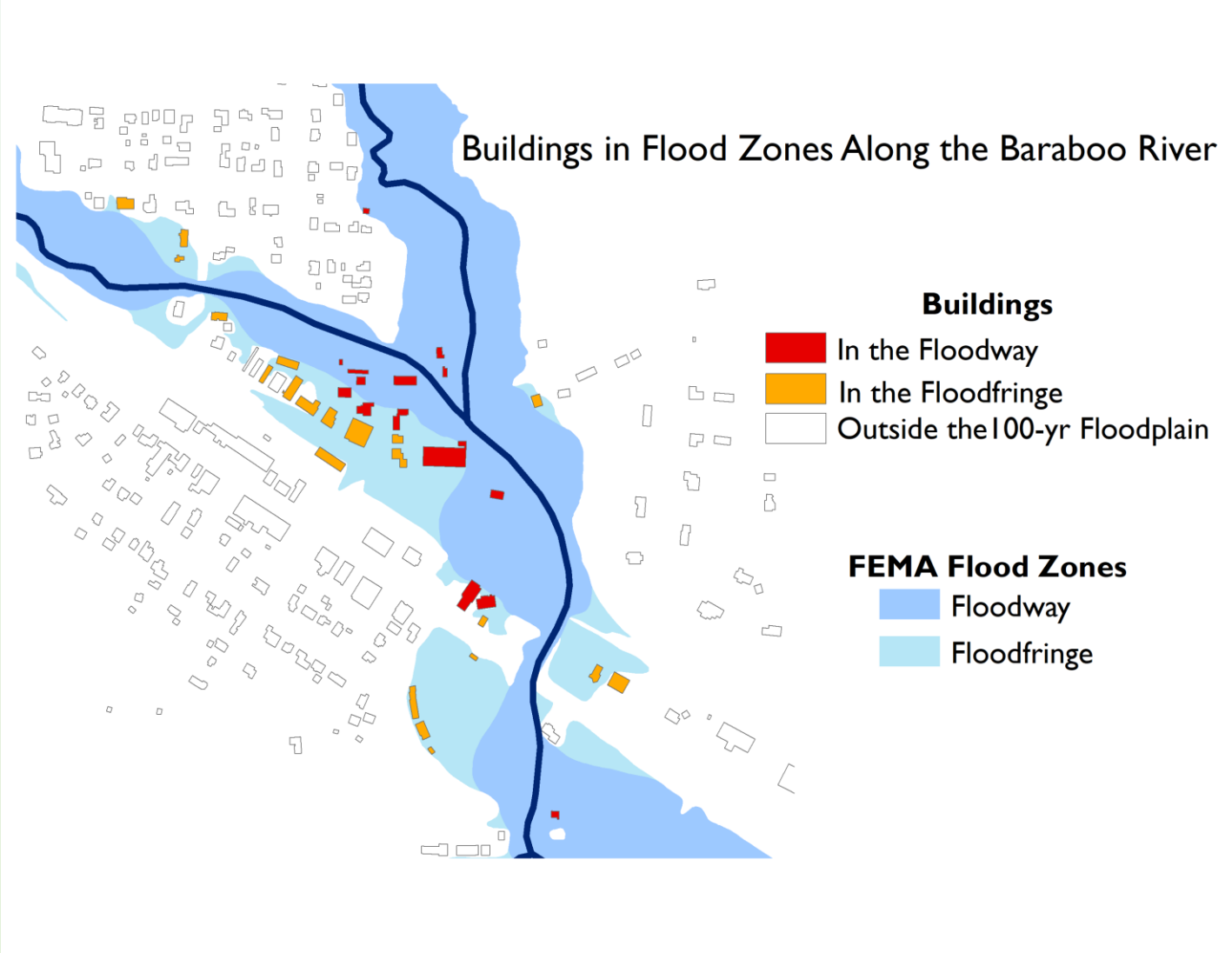
Watershed ID	Watershed Name	Ecological Index	Ecological Rank	Stressor Index	Stressor Rank	% Forest in WS (2016)	% Forest in RZ (2016)	% Wetlands in WS (2016)	Mean Aquatic Condition Score (2016)	PHWA Watershed Health Index, ER Percentile (2016)
07040006020	Tarr Creek	49.75	9	19.57	8	57.39	13.07	5.32	53.79	95.00
07040006020	Headwaters La Crosse River	59.58	4	10.82	4	51.34	11.26	9.22	67.67	99.14
07040006020	Silver Creek	44.46	11	25.44	11	55.02	9.47	5.95	52.42	97.07
07040006020	Bailey Creek-La Crosse River	42.99	13	32.21	17	39.84	10.83	7.85	61.12	92.76
07040006030	Farmer's Valley Creek	29.69	19	36.70	19	54.30	4.94	2.50	40.54	79.14
07040006030	Beaver Creek	17.99	34	46.35	28	46.94	1.71	0.63	33.70	38.10
07040006030	Headwaters Little La Crosse River	20.15	30	47.62	34	48.75	7.57	1.13	37.43	51.03
07040006030	Little La Crosse River	17.56	37	45.44	25	45.21	4.89	1.06	34.43	40.52
07040006030	Big Creek	17.79	35	48.30	37	50.98	4.13	0.31	39.58	47.59
07040006030	Town of Sparta-La Crosse River	17.48	38	33.79	18	28.39	2.44	7.74	58.73	52.76
07040006030	Fish Creek	23.45	22	48.32	38	57.43	7.67	0.31	38.03	63.97
07040006030	Dutch Creek	23.32	23	46.97	30	54.11	7.42	0.06	39.85	65.52
07040006030	Burns Creek	20.23	29	47.57	33	51.74	4.90	0.13	34.51	53.62
07040007100	Clear Creek	62.36	2	9.08	3	67.09	18.35	12.95	64.22	99.31
07040007100	Glenn Creek-Robinson Creek	66.36	1	5.98	1	71.94	21.53	16.29	59.60	98.79
07040007100	Stony Creek-Robinson Creek	58.21	5	20.29	9	63.17	17.80	10.80	59.94	100.00
07040007120	Rathbone Creek-Soper Creek	39.45	16	29.15	16	61.67	9.72	2.72	45.51	85.17



Floodplain Zones (Red) & Potentially RestorableWetlands for Flood Abatement (Gray)

Structures and flood risk areas

- Recent GIS analysis
- To be refined to address County priorities
- Will emphasize flooding "hotspot" areas



Flood Resilience & Infrastructure initial objectives

- Vulnerabilities – current condition risk assessment for buildings & roads plus biodiversity/habitat connectivity (and the aquatic connectivity that they'll hear about from others)
- A window into future runoff conditions using the WRM method (and maybe effects of other climate drivers like baseflow)
- Invite viewpoints re: land use changes that keep water on the ground longer need to be part of the response – i.e. we can't 100% engineer or buy our way out of this.

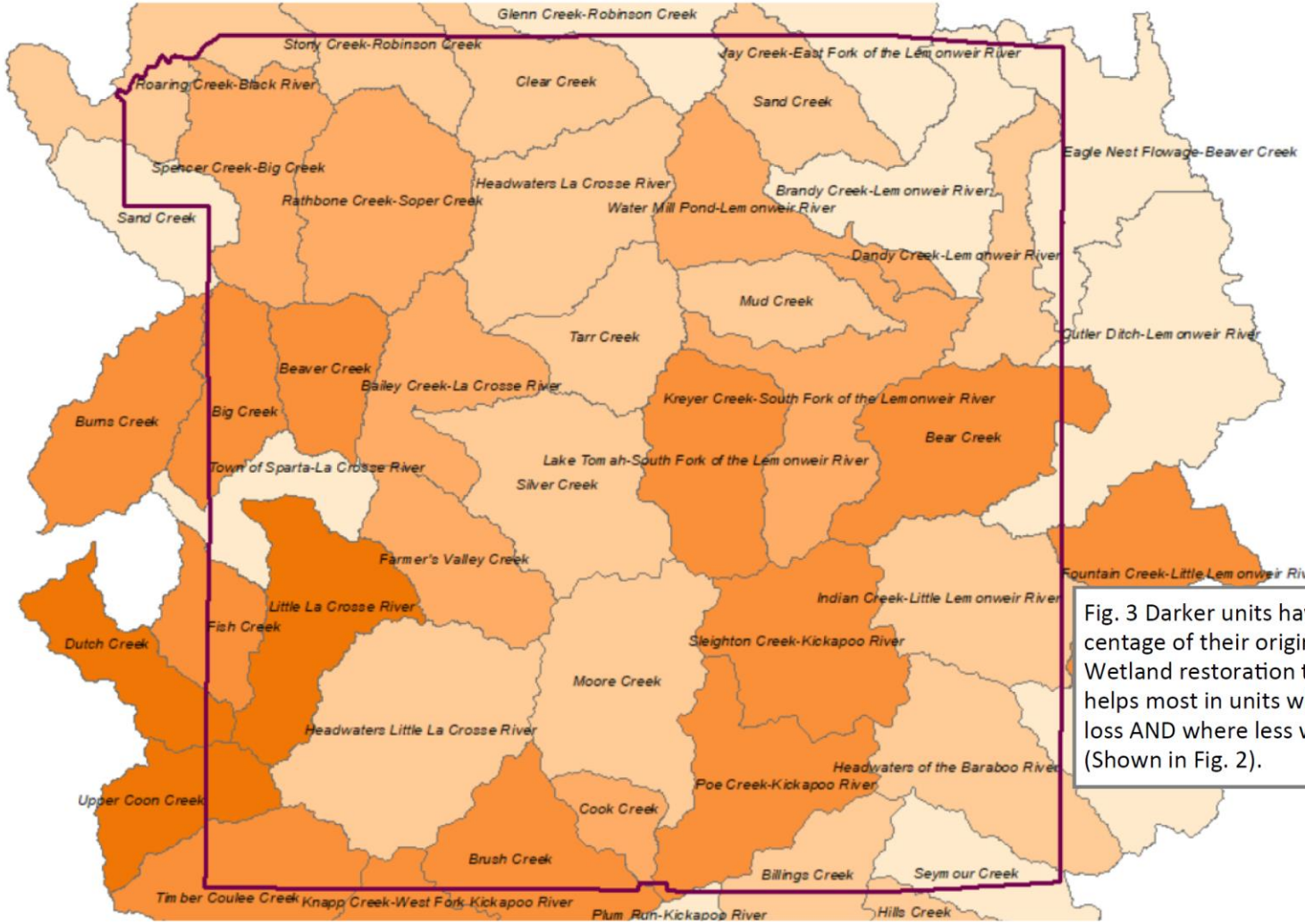
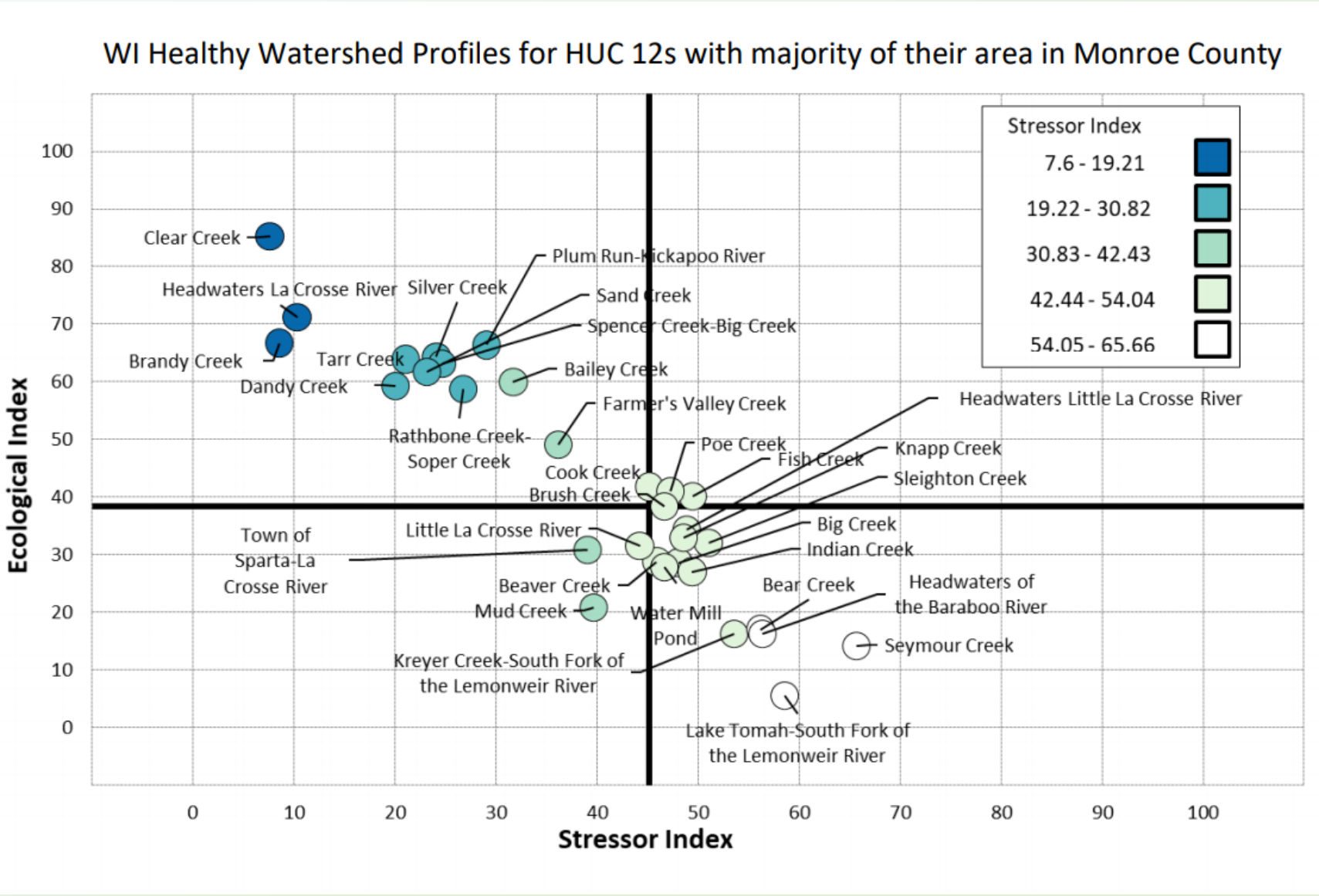


Fig. 3 Darker units have lost a greater percentage of their original wetland area. Wetland restoration to store floodwater helps most in units with the most wetland loss AND where less wetland area remains (Shown in Fig. 2).


WI Healthy Watershed Profiles for HUC 12s with majority of their area in Monroe County
Ecological Index
Stressor Index
Stressor Index
7.6 - 19.21
19.22 - 30.82
30.83 - 42.43
42.44 - 54.04
54.05 - 65.66
Clear Creek
Headwaters La Crosse River
Brandy Creek
Dandy Creek
Tarr Creek
Silver Creek
Plum Run-Kickapoo River
Sand Creek
Spencer Creek-Big Creek
Bailey Creek
Farmer's Valley Creek
Rathbone Creek-Soper Creek
Cook Creek
Brush Creek
Poe Creek
Fish Creek
Headwaters Little La Crosse River
Knapp Creek
Sleighton Creek
Big Creek
Indian Creek
Little La Crosse River
Town of Sparta-La Crosse River
Beaver Creek
Mud Creek
Water Mill Pond
Bear Creek
Headwaters of the Baraboo River
Seymour Creek
Kreyer Creek-South Fork of the Lemonweir River
Lake Tomah-South Fork of the Lemonweir River
0
10
20
30
40
50
60
70
80
90
100

Some observations

- Land use and land cover changes in the future – not just increased rainfall –will be critically important in understanding watershed response

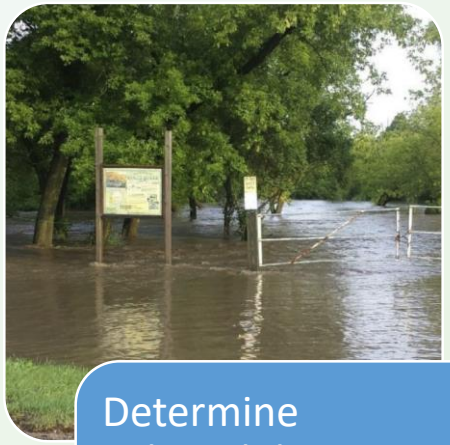
- Work so far suggests that watershed practices that are already defined will be a very important part of the response plan to mitigate watershed impacts and improve resilience


Agriculture and Climate

Assessing Climate Impacts in Agriculture

- Increase in extreme flooding events
- Swings in temperature
- Shifts in planting dates, shortened windows
- Arrival of new pests, invasives, disease

Assessment Plan

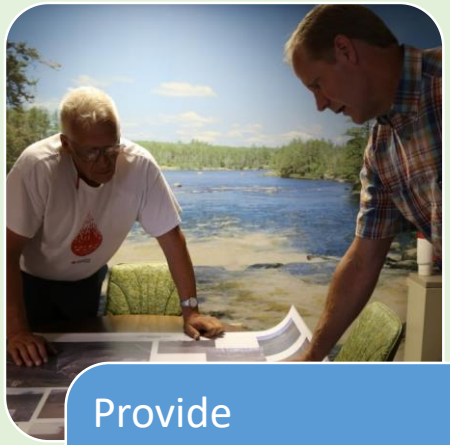


Determine vulnerability

- Feedback from statewide reports
- Community input

Prioritize adaptation strategies

- Identify classic and innovative conservation practices
- Toolbox of strategies for farm and county scale



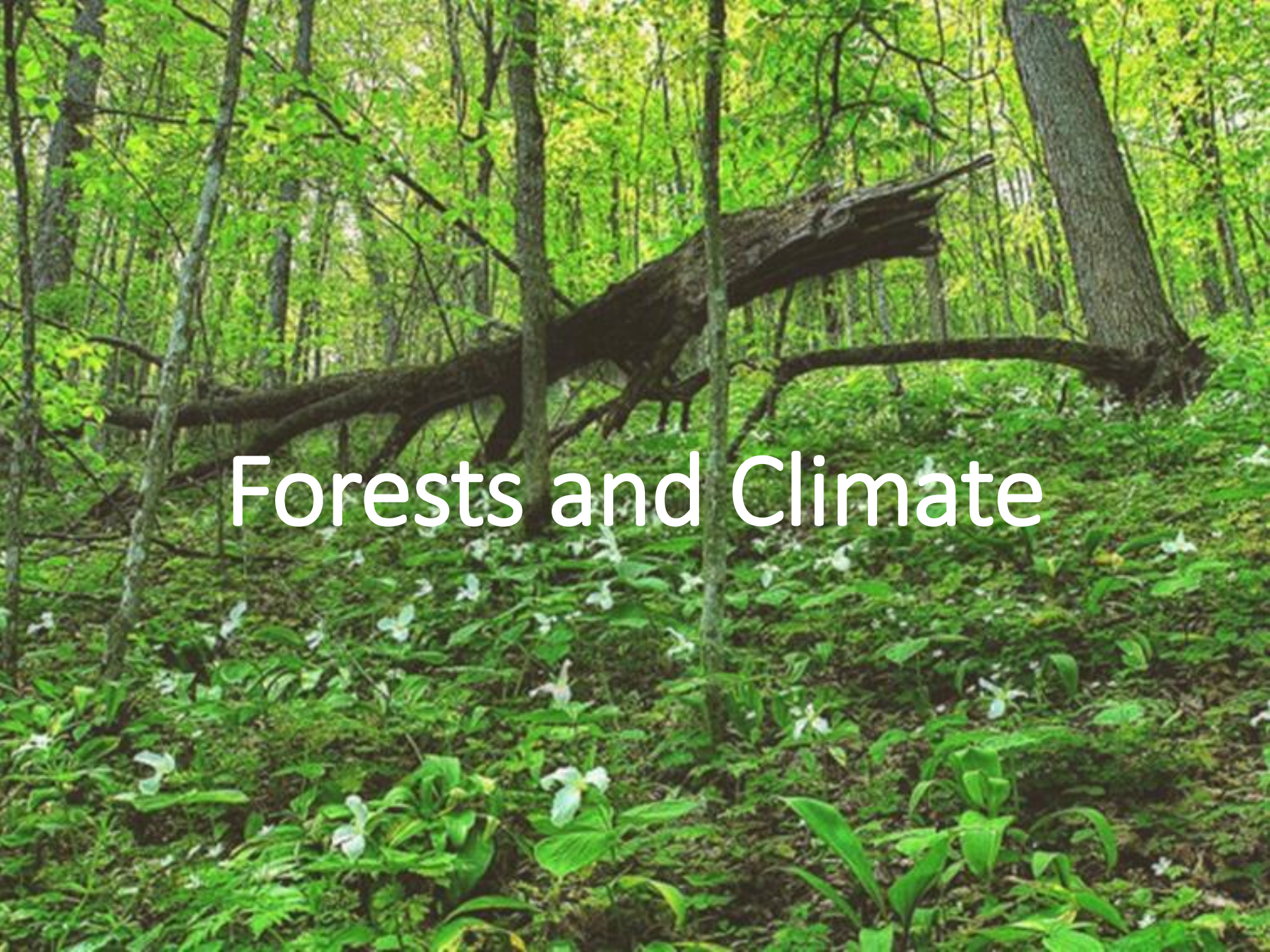
Provide recommendations for implementation

- Develop educational resources
- Demonstrate practices
- Consider opportunities to overcome barriers

Share your thoughts

- What are you observing as you walk the land? Any changes? How are you already adapting?
- Do you have innovative practices you'd like to ensure we include in our BMP assessment?
- What are the barriers to implementing conservation practices? Ideas on overcoming them? (incentives, policy change, funding?)
- Are you interested in reimagining your farm through a carbon/resilient soils lens? Developing a plan to assess soil organic carbon capture/GHG reductions?
- Do you have a story to tell?

Christina Anderson – Christina@wisconsinlandwater.org


Forests and Climate

Assessing Forest Climate Impacts

- Warmer winter low temps = increase in invasive species, higher deer populations, forest regeneration impacts.
- Shorter window of frozen ground affects forestry operations.
- Sensitive (northern) species decline, southern species increase.

Forest Carbon / Forest Conservation

- Keep Forests In Forest
- Improved Forest Management
- Reforestation / Afforestation
- Forested Watersheds

Community Engagement

Public Open House
Sparta
Mid September

Community Listening Sessions (3x)
Late September

Tomah?
Cashton?
Kendall?
Warrens?

Questions?

What have we missed?

Who should we hear from?

What outcomes do you most hope to see from this effort?