Investigating Paths to Increased Flood Resilience in the Coon Creek Watershed

Lead Advisor:

Eric Booth

Associate Scientist

Students:

Rajpreet Grewal, Cathryn Herlihey, Jackson Parr, Robert Rosner, Rachael Sodeman, Kayla Wandsnider

Advisory Committee:

Caroline Gottschalk-Druschke, Adena Rissman, Stephen Ventura

Rainfall Analysis Team: Daniel Wright, Zhe Li

Nelson Institute for Environmental Studies
UNIVERSITY OF WISCONSIN–MADISON

WATER RESOURCES M.S. MANAGEMENT

Department of Agronomy
UNIVERSITY OF WISCONSIN–MADISON

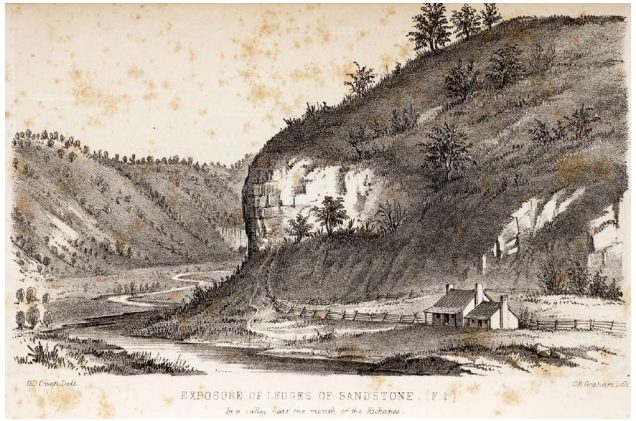
DEPARTMENT OF Civil and Environmental Engineering
UNIVERSITY OF WISCONSIN–MADISON

Partners / Collaborators

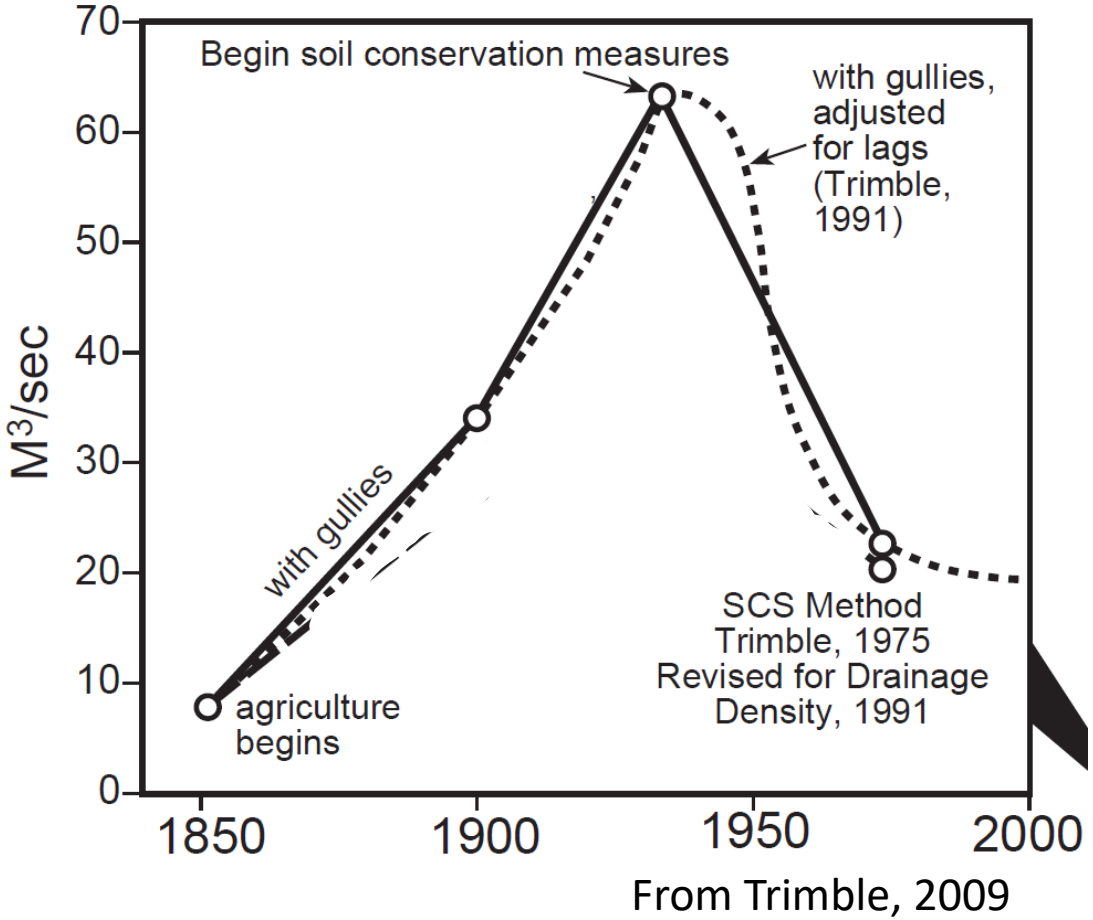
USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

- Complementing the existing PLAN-EIS project

Quick History of Flooding in Coon Creek

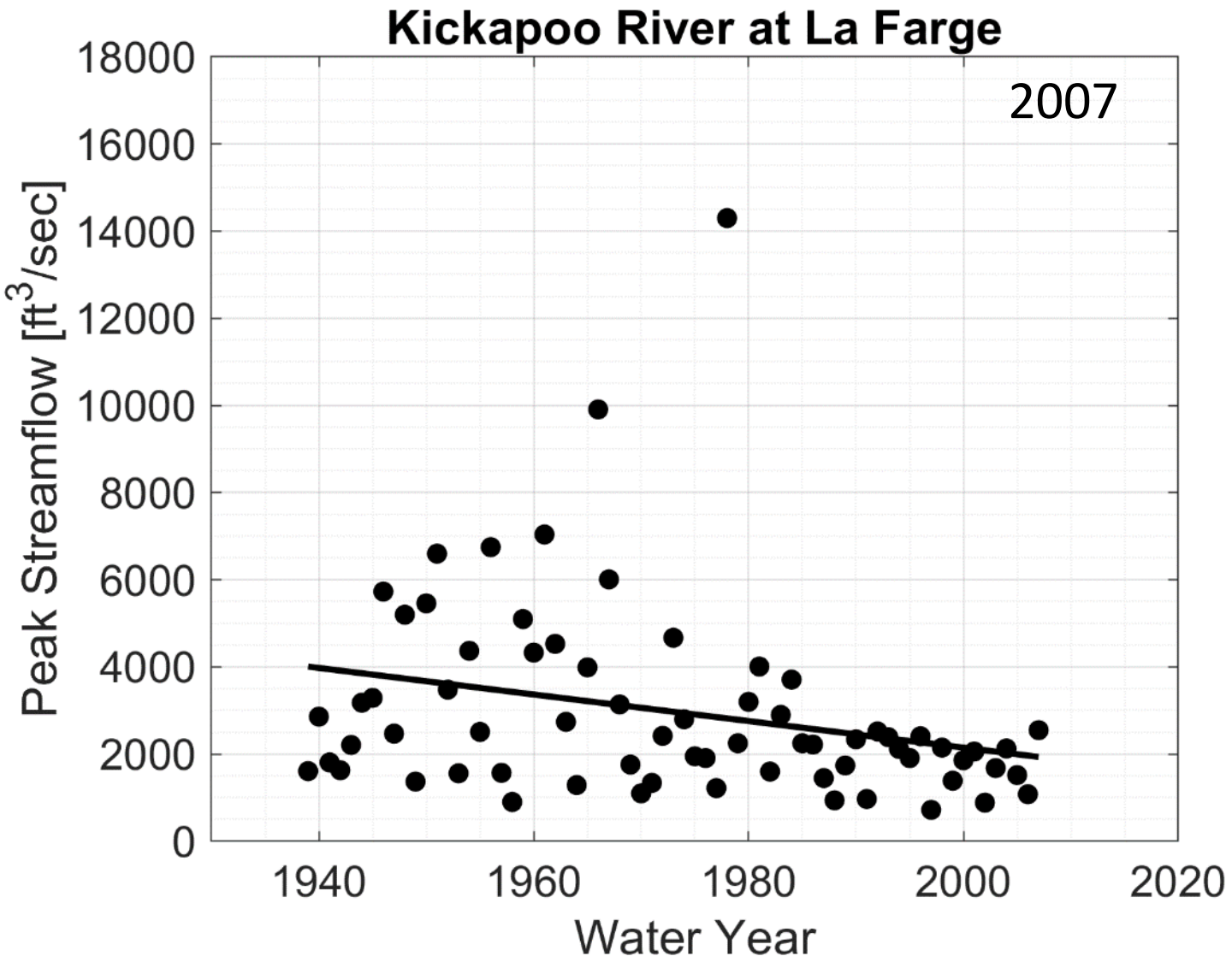


Estimated Stream Discharge
from 5 inch, 24 hour storm
Timber Coulee, 5.7 km²



From Trimble, 2009

BUT THEN…THE FLOODS CAME BACK



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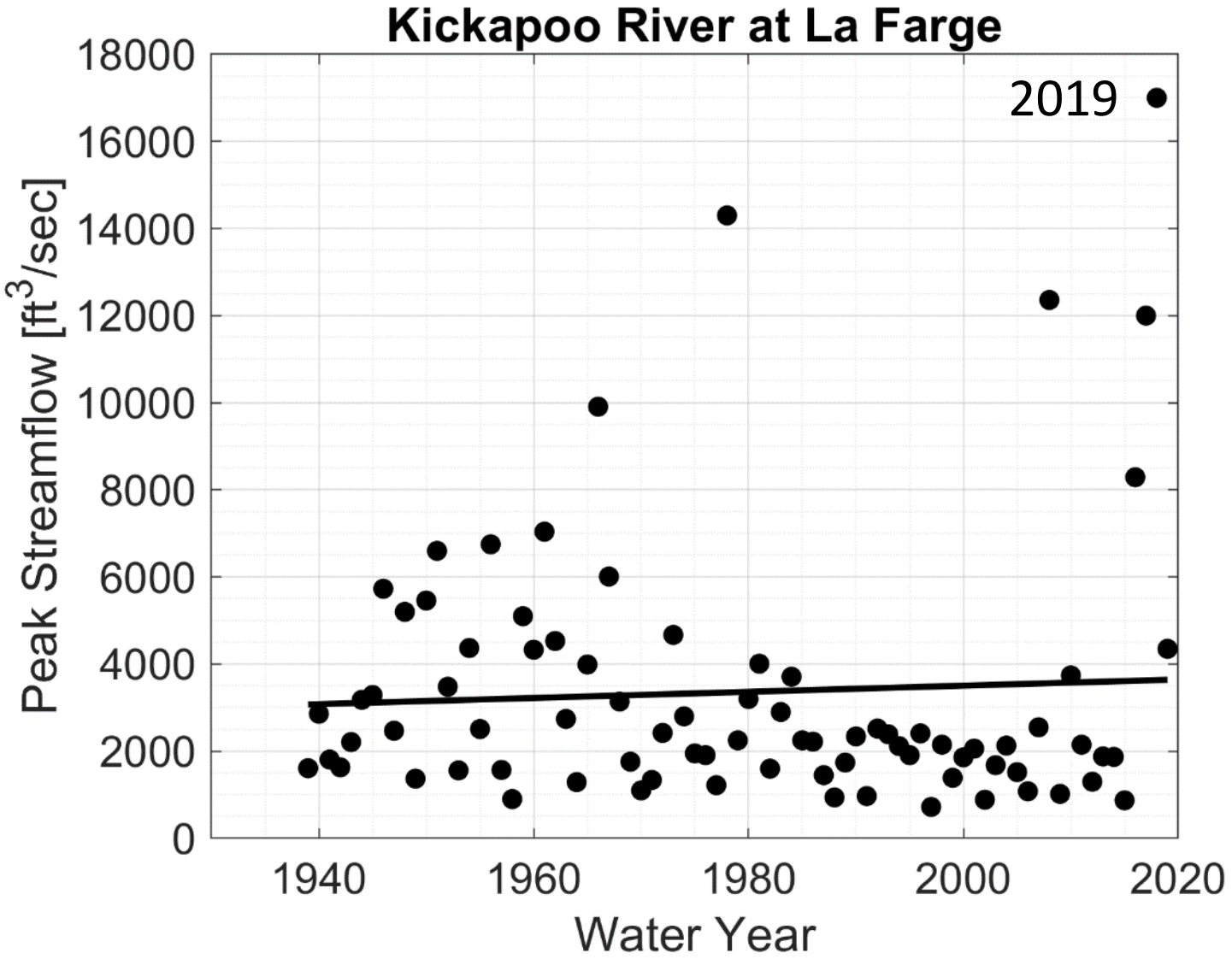

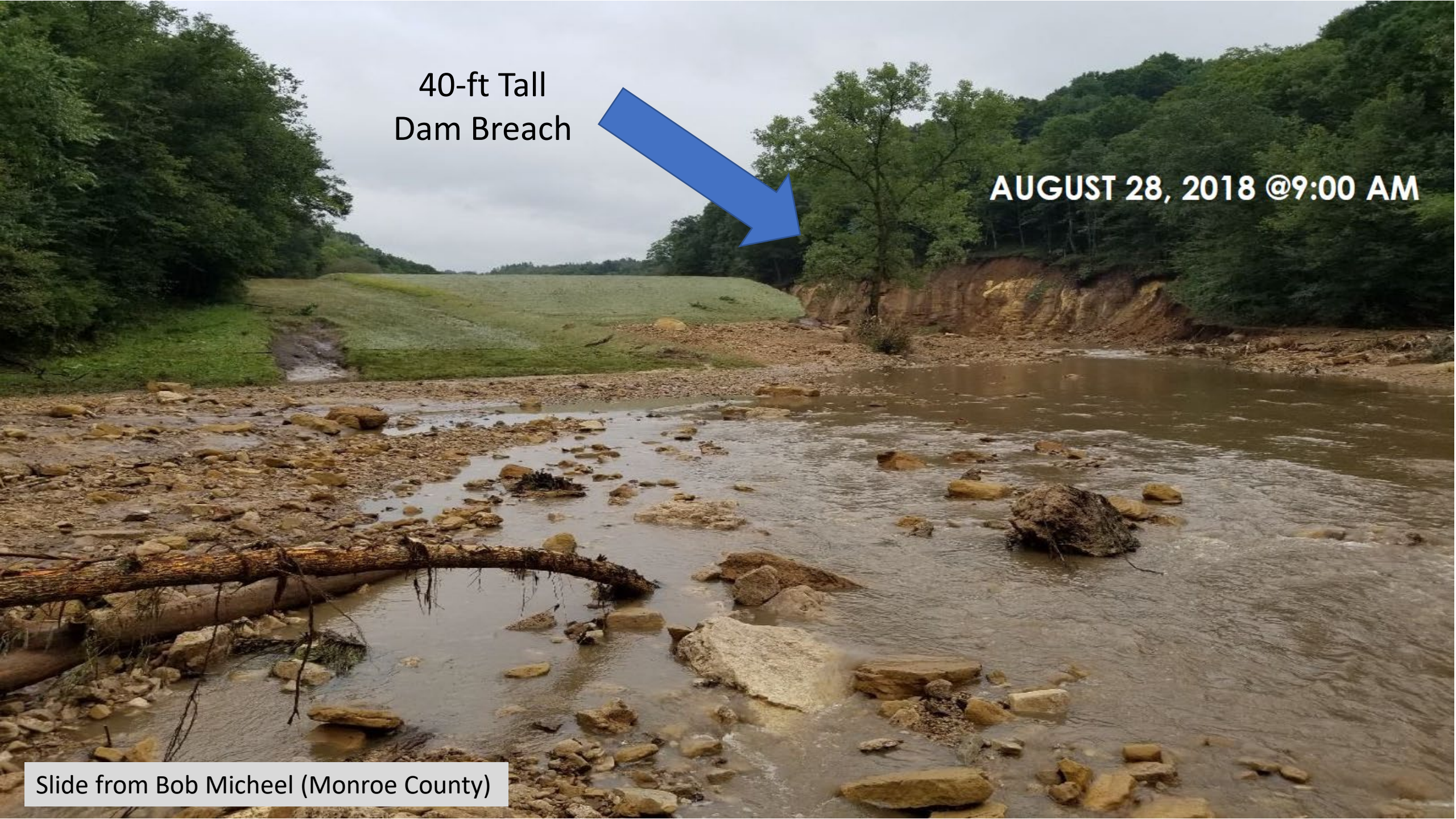

Slide from Bob Micheel (Monroe County)

How did we get here? What just happened?

Chaseburg, August 28, 2018.
Mark Hoffman, Milwaukee Journal Sentinel

Between Chaseburg & Coon Valley, August 28, 2018.
Randy Humfeld

UW-Madison Flood Resilience Research

- Pathways to Increasing Flood Resilience
  - Enhancing Infiltration
  - Including Diverse Public Perspectives
  - Improving Flood Management Institutions
  - Examining Flood Adaptation Strategies
- Rainfall Analysis
- Other Related Projects

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Enhancing Infiltration

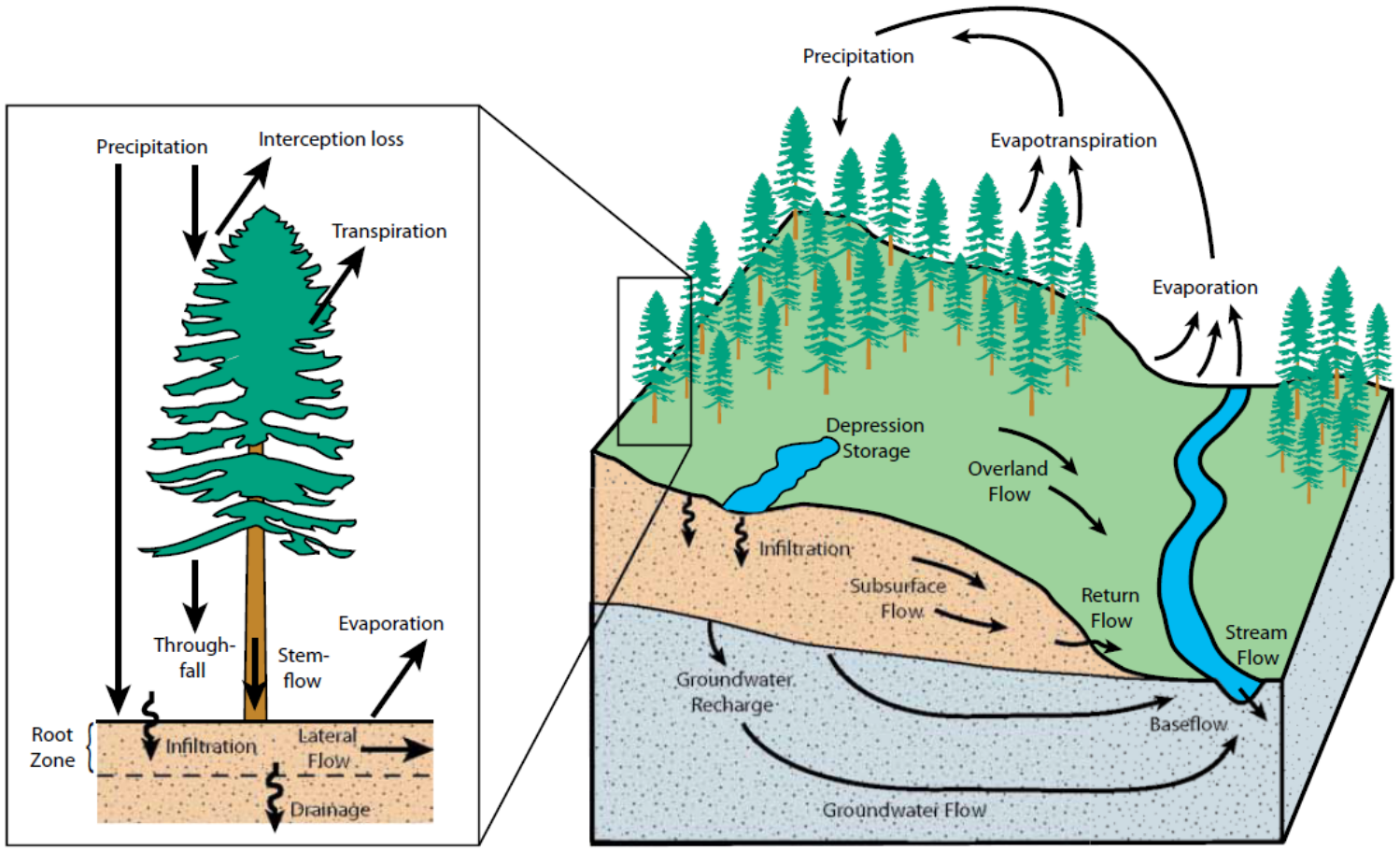
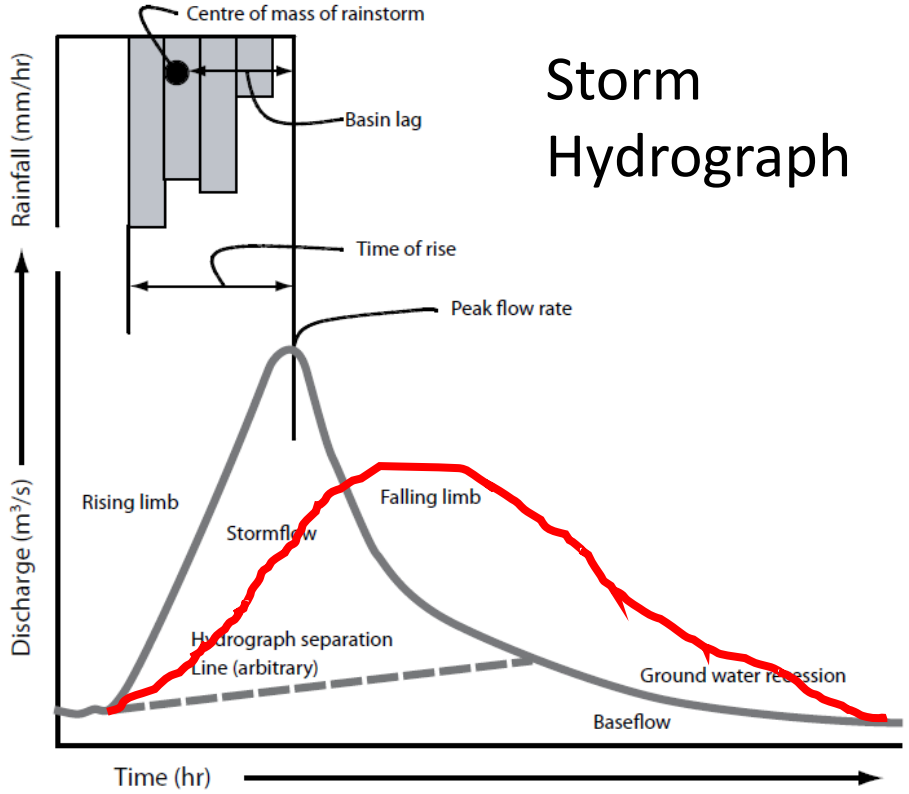


FIGURE 6.1 *The hillslope hydrologic cycle and stand water balance.*



Storm Hydrograph

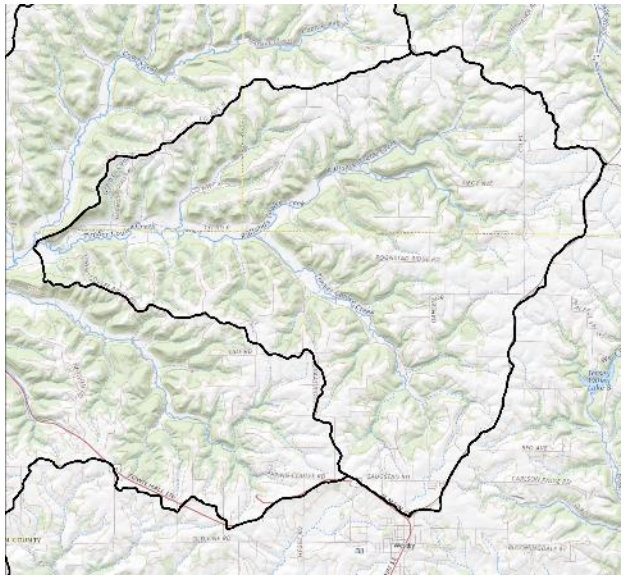
- Flood Mitigation
  - Increase infiltration
  - Increase storage
  - Slow the flow
  - Reduce flood peak

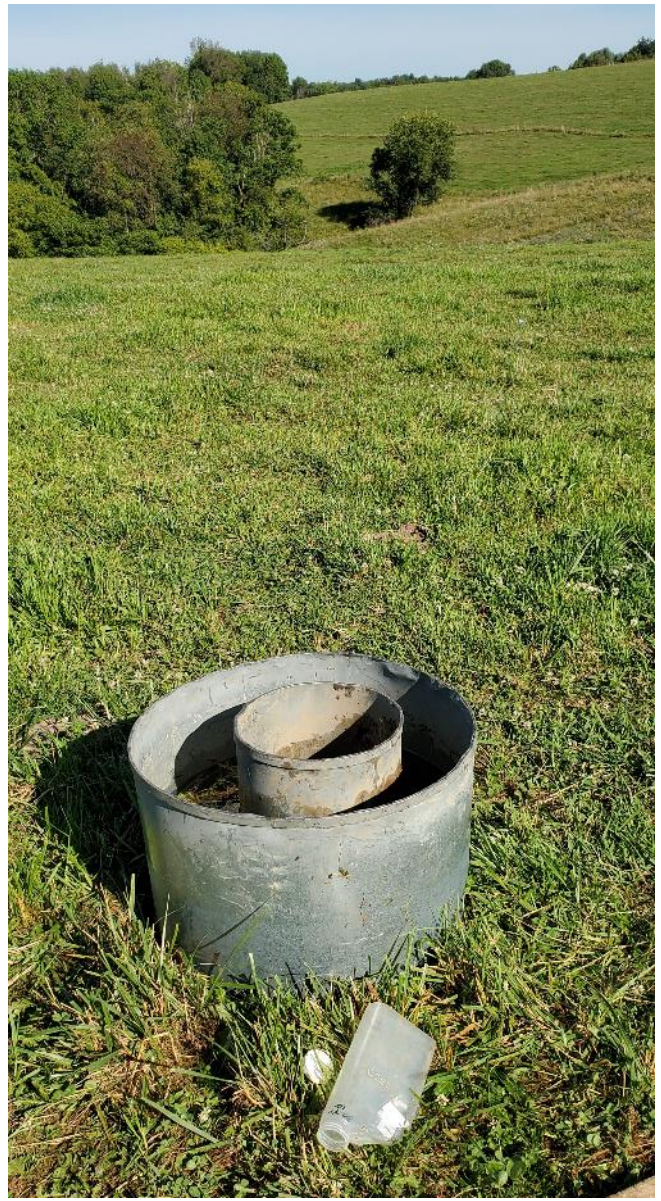
Enhancing Infiltration
Through Land Use & Land Management

- Literature Review
  - Cropland management: contour strips, buffer strips, prairie strips, and no-till can all increase infiltration
  - Land use: forest, prairie, well-managed pasture (perennials) can all increase infiltration relative to cropland
- Trend analysis
  - Land management: aerial photo analysis revealed a 28% decrease in area devoted to contour strips in Rullands Coulee watershed (2004-2018)
  - Land use: agricultural census data shows shift from dairy rotations to corn-soy (less opportunity for contour strips)

Enhancing Infiltration
Through Land Use & Land Management

- Field work : infiltration tests on ridge-top
  - Double-ring infiltrometer across different land uses and management
  - Buffer strips and grass waterways have high infiltration rates
  - Well-managed pasture has slightly higher infiltration rates than tilled corn and alfalfa





Enhancing Infiltration
Through Land Use & Land Management

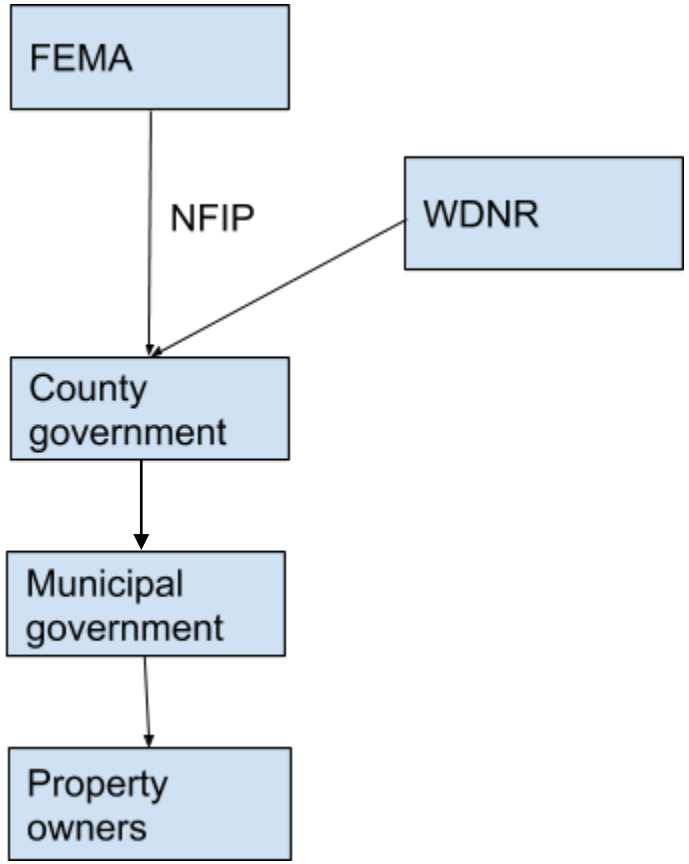
- Next steps
  - Converting recent land trends into changes in runoff
  - Further analyzing and visualizing land trends

Including Diverse Public Perspectives

- 18 interviews so far
- Residents and managers accept flooding as a reality of living in the watershed, but how can impacts be decreased?
- Reducing the impacts of flooding requires collective action of everyone in the watershed (i.e., there is no "one" person/group that is responsible)
- Documented frustration with the FEMA recovery process and mixed opinions on the usefulness of dams
- Next steps:
  - Analyze and summarize perspectives and attitudes
  - Highlight areas of agreement and disagreement
  - Propose ideas for navigating conflict

Improving Flood Management Institutions

- Institutional mapping
  - Tool to learn and illustrate the roles of the many institutional "actors" involved in flood management and recovery from the national to local level
  - Describe and organize complex processes of flood management and recovery
  - Discover, describe, and illustrate the barriers to successful institutional flood management and recovery
- Next steps
  - Develop maps for specific events
  - Develop map for the full flood management “cycle”
  - Get feedback from community members



Examining Flood Adaptation Strategies

- Managed retreat
- Property buy-out programs
- Flood early-warning systems
- Other examples nationally and internationally

Timeline

- First draft of final report by end of calendar year
- Final report by May 2021

Updated Rainfall Analysis

- Stochastic storm transposition
- Uses radar-derived rainfall data

6 hour storms

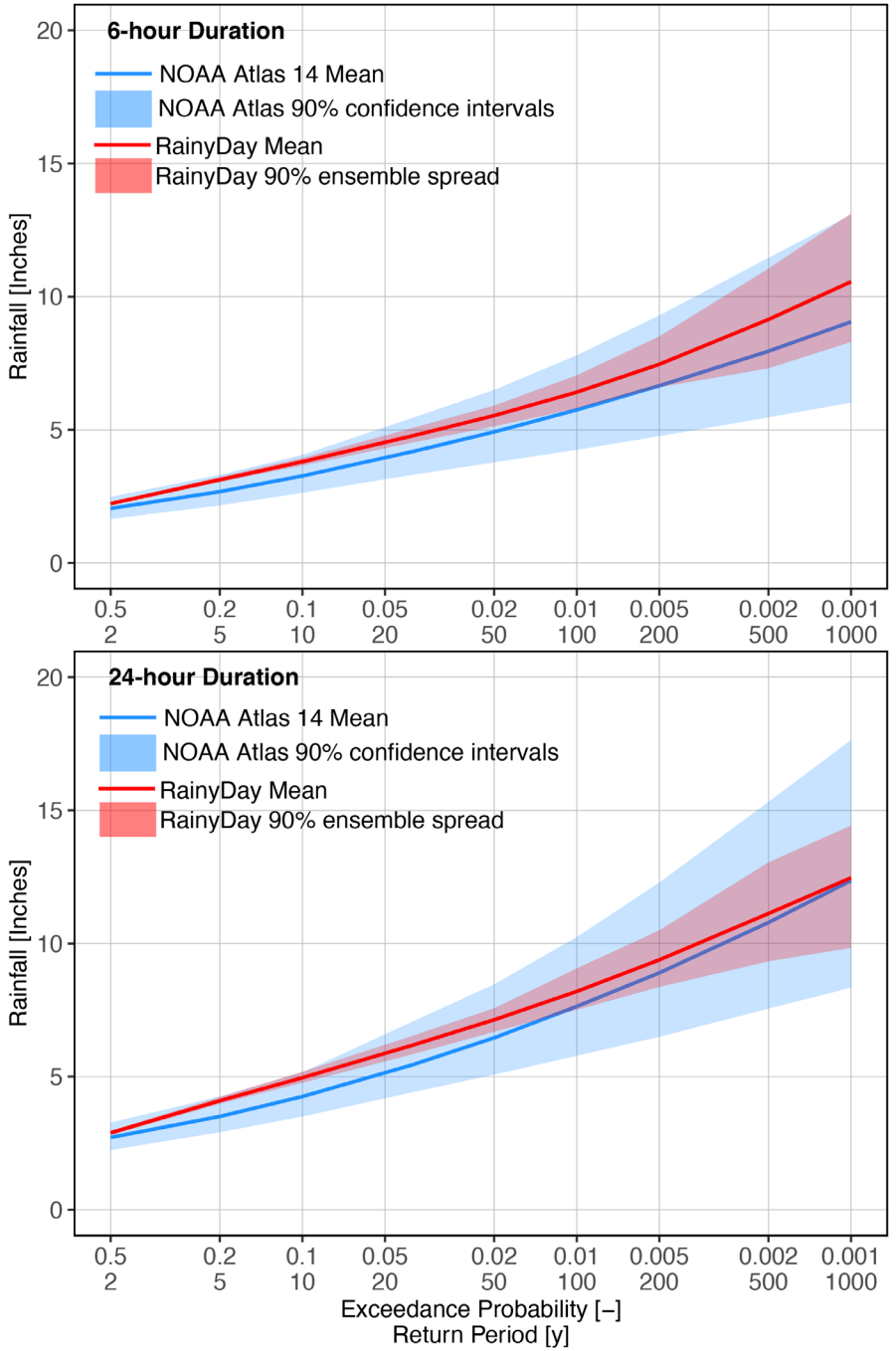
Table 1: 6-hour duration IDF statistics for point rainfall generated using RainyDay SST software. Atlas 14 statistics for the same location (see Figure 1) are provided.

exceedance probability	Return Period	Atlas 14	lower bound	Mean	upper bound
[-]	[yrs]	[inches]	[inches]	[inches]	[inches]
0.5	2	2.0	2.2	2.2	2.3
0.2	5	2.7	3.0	3.1	3.2
0.1	10	3.3	3.7	3.8	3.9
0.04	25	4.2	4.5	4.8	5.1
0.02	50	4.9	5.1	5.5	5.9
0.01	100	5.7	5.8	6.4	7.0
0.005	200	6.7	6.6	7.5	8.5
0.002	500	8.0	7.3	9.1	11.1
0.001	1000	9.1	8.3	10.6	13.1

24 hour storms

Table 2: 24-hour duration IDF statistics generated using RainyDay SST software. Atlas 14 statistics for the same location (see Figure 1) are provided.

exceedance probability	Return Period	Atlas 14	lower bound	Mean	upper bound
[-]	[yrs]	[inches]	[inches]	[inches]	[inches]
0.5	2	2.7	2.8	2.9	3.0
0.2	5	3.5	4.0	4.1	4.2
0.1	10	4.3	4.8	5.0	5.2
0.04	25	5.4	5.8	6.2	6.5
0.02	50	6.5	6.7	7.1	7.6
0.01	100	7.6	7.5	8.2	9.1
0.005	200	8.9	8.4	9.4	10.5
0.002	500	10.8	9.3	11.1	13.0
0.001	1000	12.4	9.8	12.5	14.4

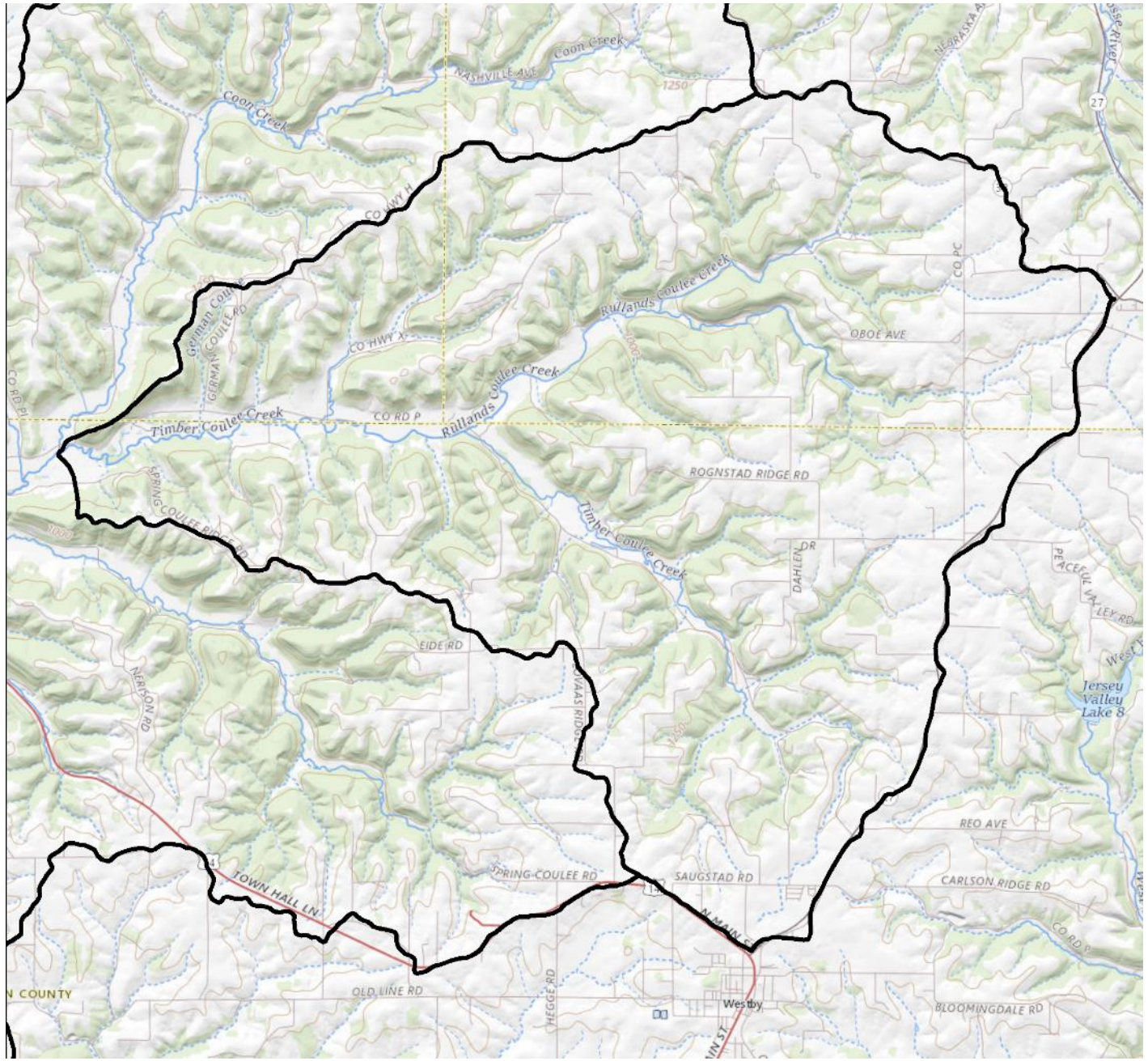


Other Related Projects

Interactive Dynamics of Stream Restoration and Flood Resilience in a Changing Climate

Grassland 2.0 - Agroecological transformation to perennial grassland agriculture

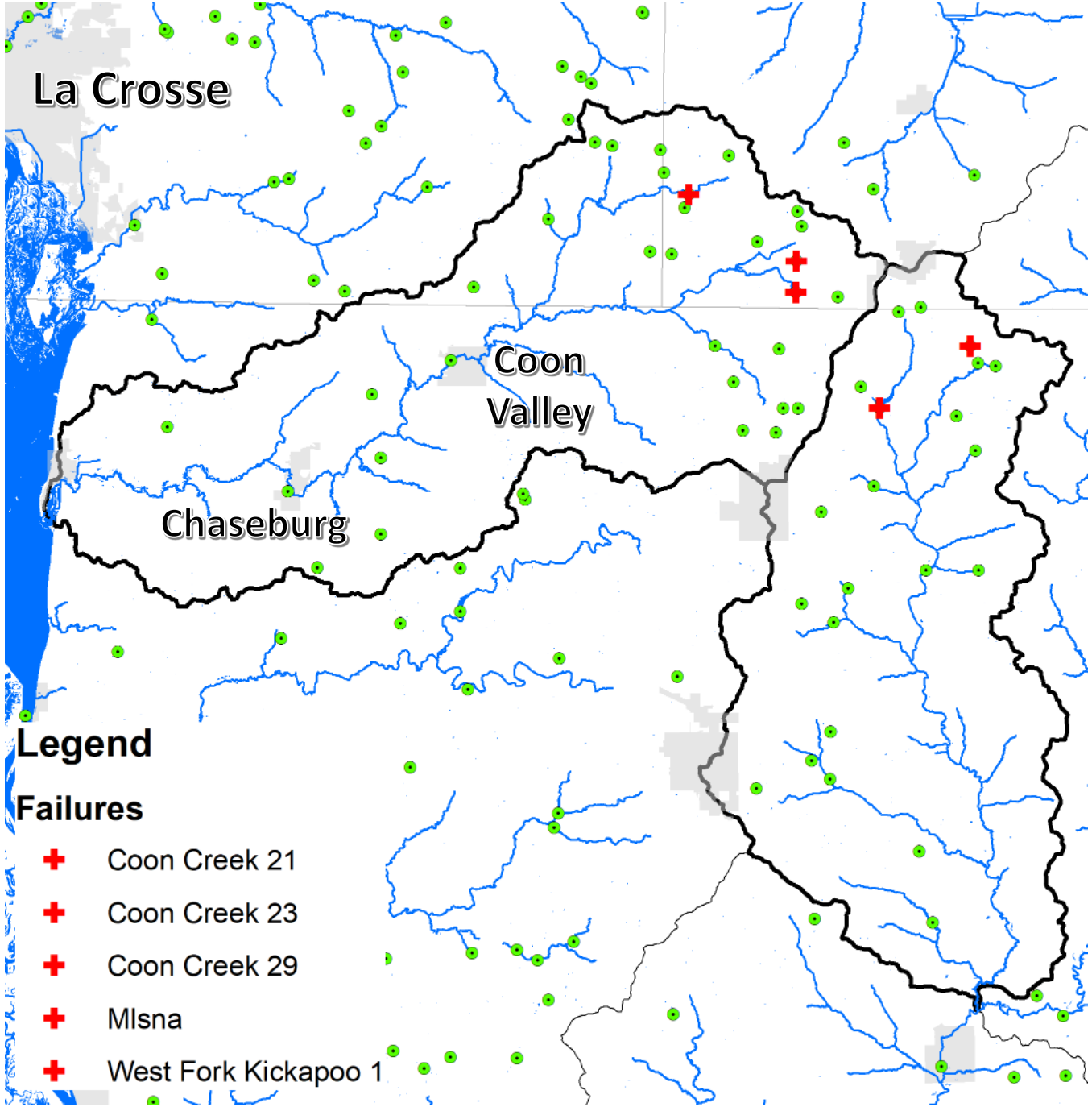
grassLAND 2.0


Coon Creek
NASHVILLE AVE
Coon Creek
1250
CO HWY H
Rutlands Coulee Creek
CO PC
OBOE AVE
CO HWY X
Rutlands Coulee Creek
CO RD P
Timber Coulee Creek
ROGNSTAD RIDGE RD
Timber Coulee Creek
DAHLEN DR
PEACEFUL VALLEY RD
EIDE RD
NERISON RD
Jersey Valley Lake 8
REO AVE
SPRING COULEE RD
SAUGSTAD RD
CARLSON RIDGE RD
TOWN HALL LN
OLD LINE RD
HEGGE RD
Westby
BLOOMINGDALE RD

Breaching of flood control structures

- Coon Creek
  - 3 failures
- W Fork Kickapoo
  - 2 failures

- $10M+ in damages downstream



Climate as the main driver

- La Crosse weather station