Factors affecting suspended sediment in 10 tributaries to the Ashokan Reservoir

Jason Siemion[1], Michael R. McHale[1], and Danyelle Davis[2]

[1] U.S. Geological Survey, New York Water Science Center, 425 Jordan Rd., Troy, New York 12180

[2]New York City Department of Environmental Protection Stream Management Program, 1 Smith Avenue, Kingston, NY 12401

U.S. Department of the Interior
U.S. Geological Survey

Where are we?

Ashokan Watershed

NY State

NYC WOH

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The Problem

- **Elevated levels of suspended sediment and turbidity contributed to Ashokan by the upper Esopus Creek and its tributaries**

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Why is this important?

- > 5 NTU may interfere with disinfection of drinking water supplies LeChevallier et al. 1981
- Filtration Avoidance Determination

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Why is this important?

- **May negatively affect stream habitat**
  Henley et al. 2000, Ryan 1991

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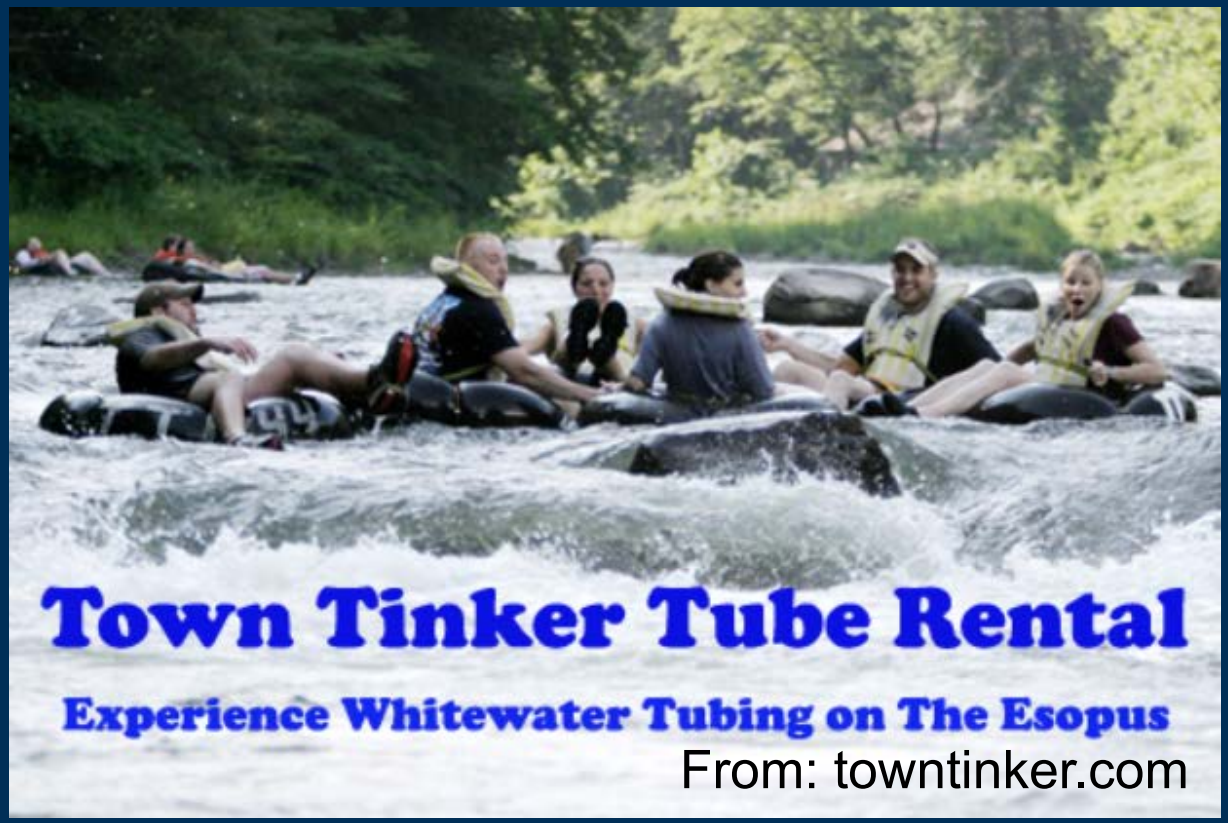
Why is this important?

- **May decrease the aesthetic quality of streams and the quality of recreational activities**
  Pflüger et al. 2010



From: towntinker.com

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Mukundan hypothesized 6 factors control turbidity and SSC in the upper Esopus Creek watershed: Mukundan and others (2013)

- Season
- Spatial patterns in precipitation
- Antecedent soil moisture
- Stream power during storm events
- Geologic sources of sediment
- Flow regime

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- Season
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The purpose of this study was to:

- Quantify concentrations of suspended sediment and turbidity levels in tributaries to and along the main channel of the upper Esopus Creek
- Examine how flow conditions affect suspended sediment concentrations, loads, and yields and associated turbidity
- Identify the principal source areas of sediment and turbidity in the watershed

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Why this focus?

- Identify primary tributary contributors of suspended sediment and turbidity

- Targeting of resources to these streams for suspended sediment and turbidity reduction projects

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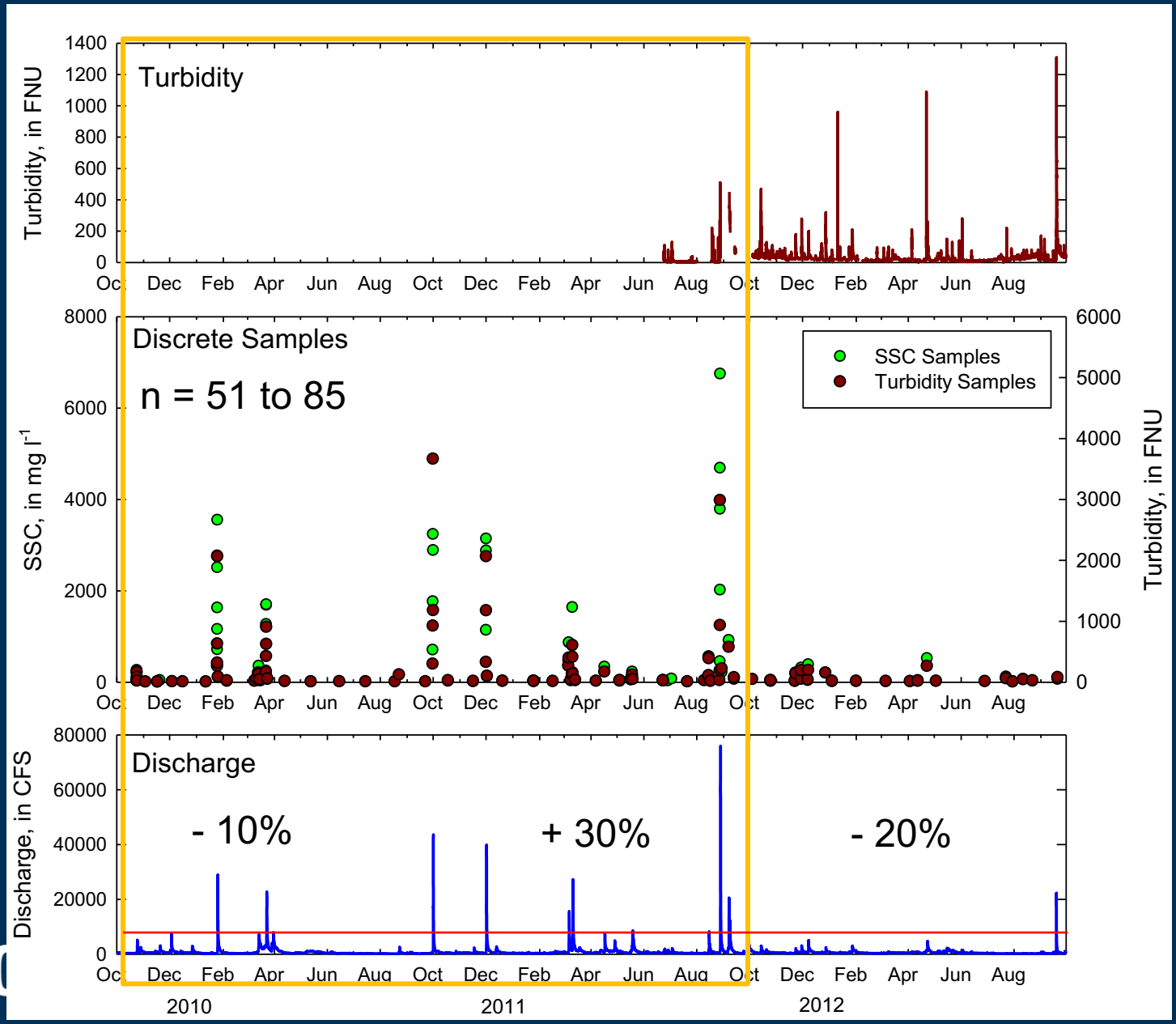
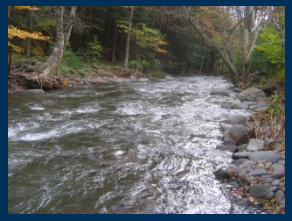
Data Collection and Flow Regime



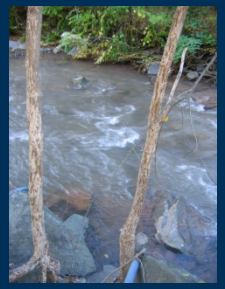
Esopus Creek at Coldbrook

Which tributaries contribute the most suspended sediment to the Esopus?

Bushnellsville

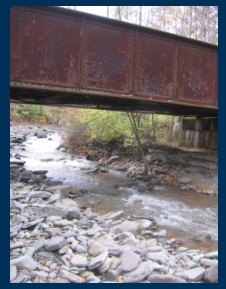


Birch

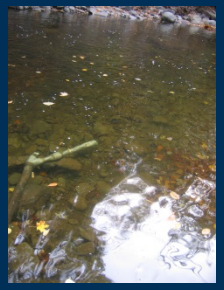


Broadstreet

Fox



Little Beaverkill



Stony Clove

Peck

Woodland

Beaverkill

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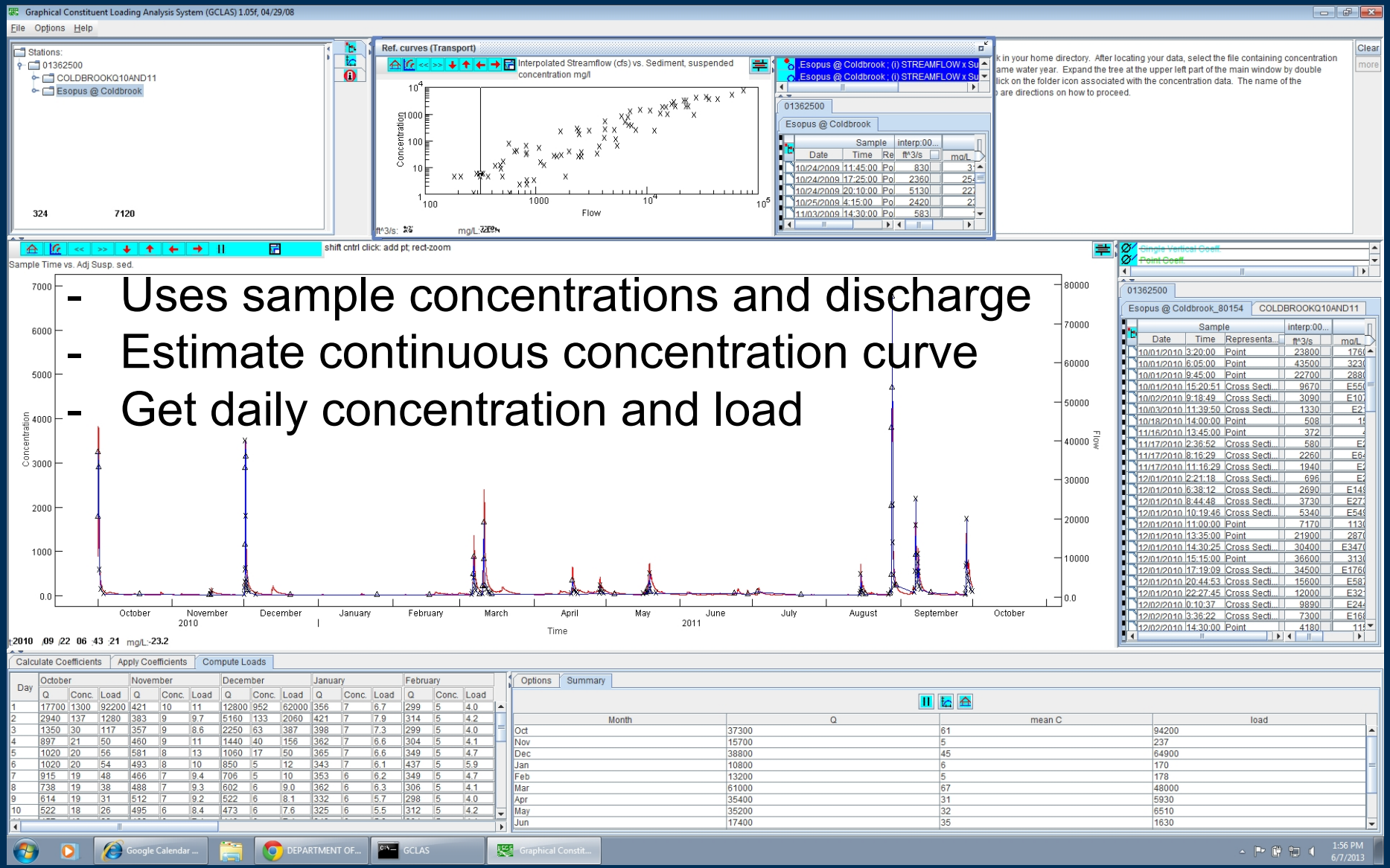
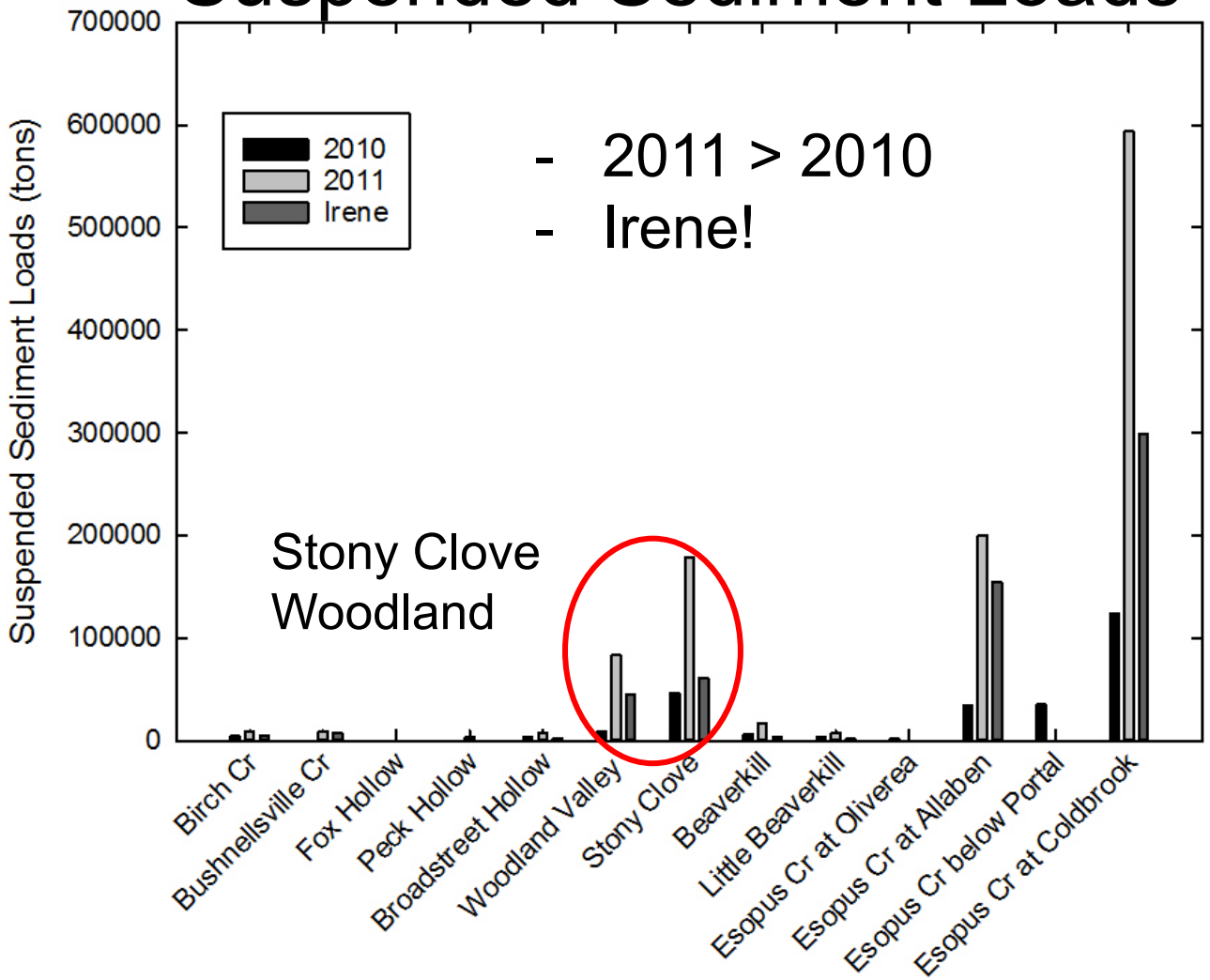
Loads Calculated Using GCLAS



Suspended Sediment Loads



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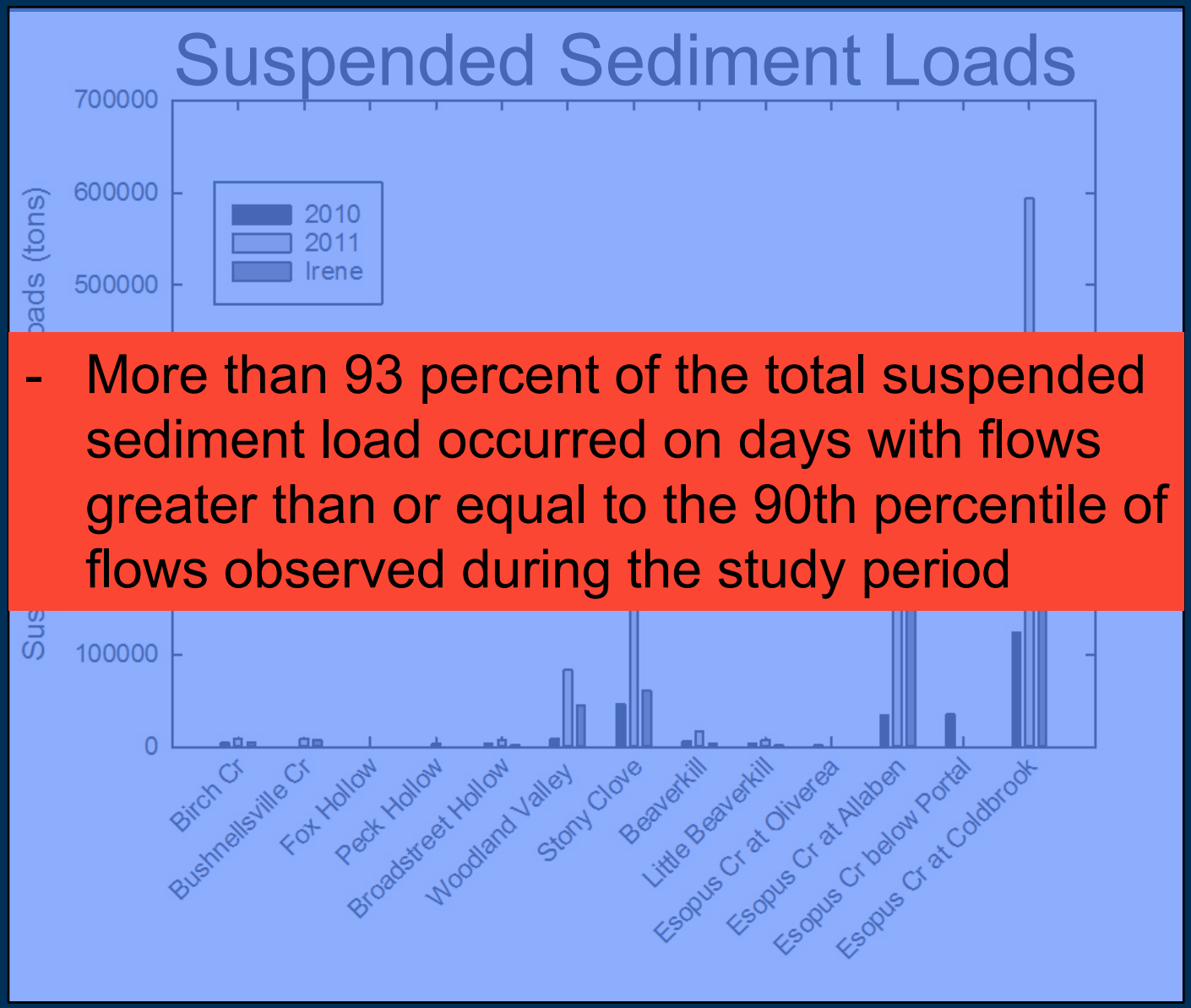

- More than 93 percent of the total suspended sediment load occurred on days with flows greater than or equal to the 90th percentile of flows observed during the study period

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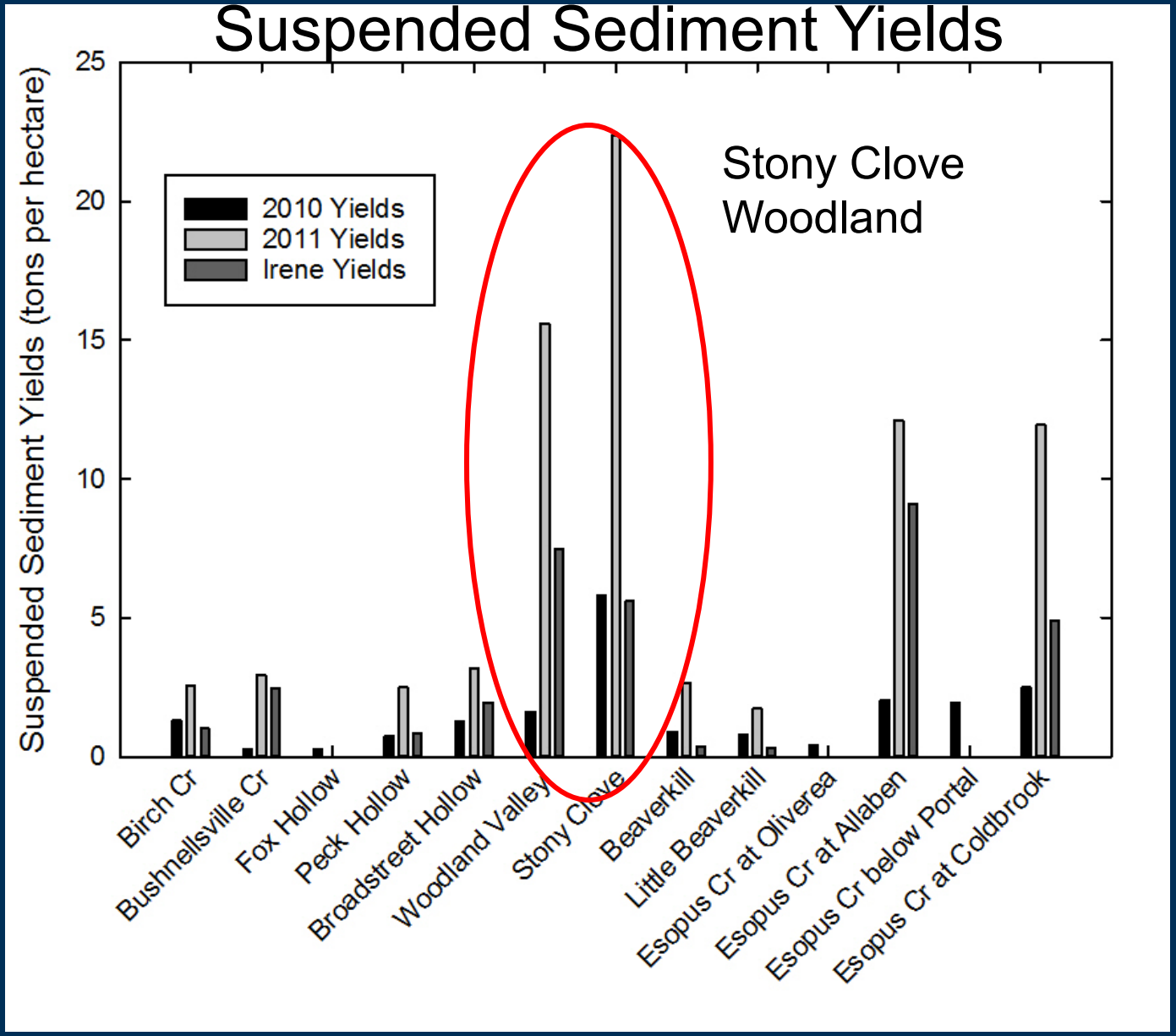
Suspended Sediment Yields



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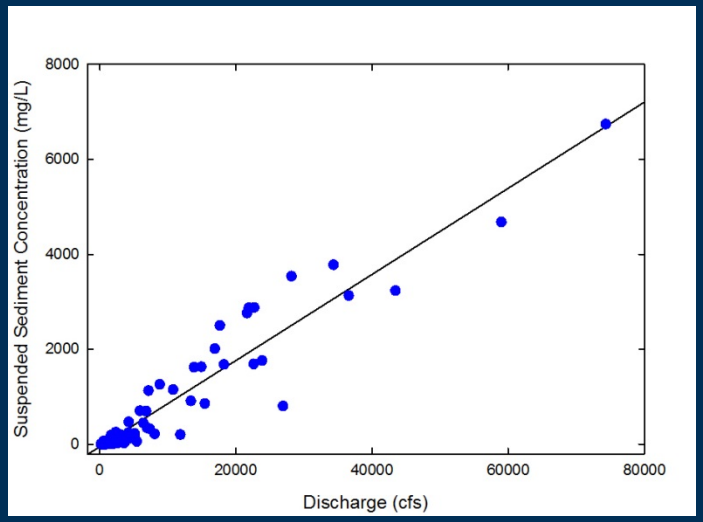
Effects of Flow Regime on Suspended Sediment

- Concentrations increase with increasing discharge at all tributaries



- "All tributaries look turbid at high flows"
- Are the increases in concentrations uniform across tributaries?

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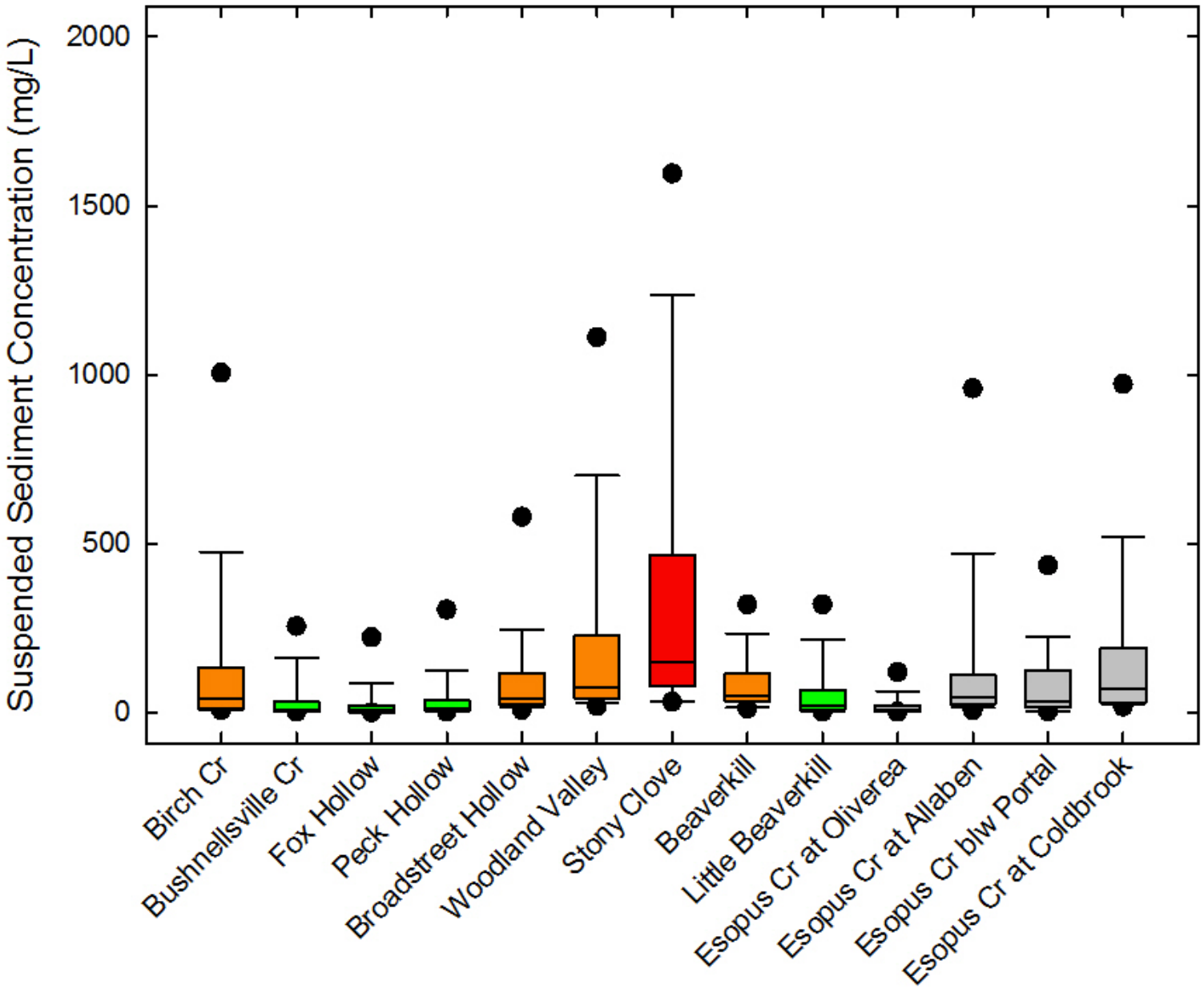
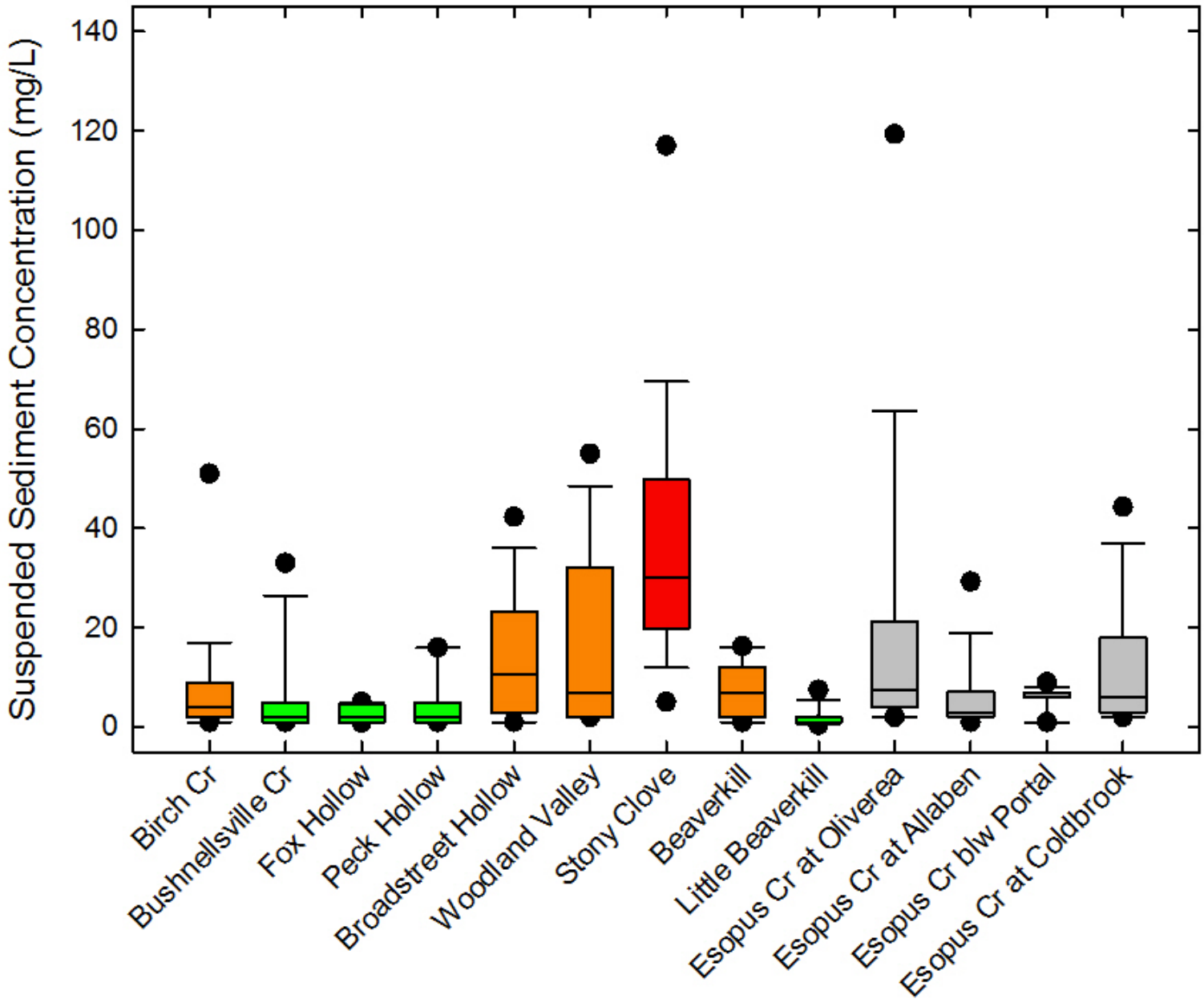
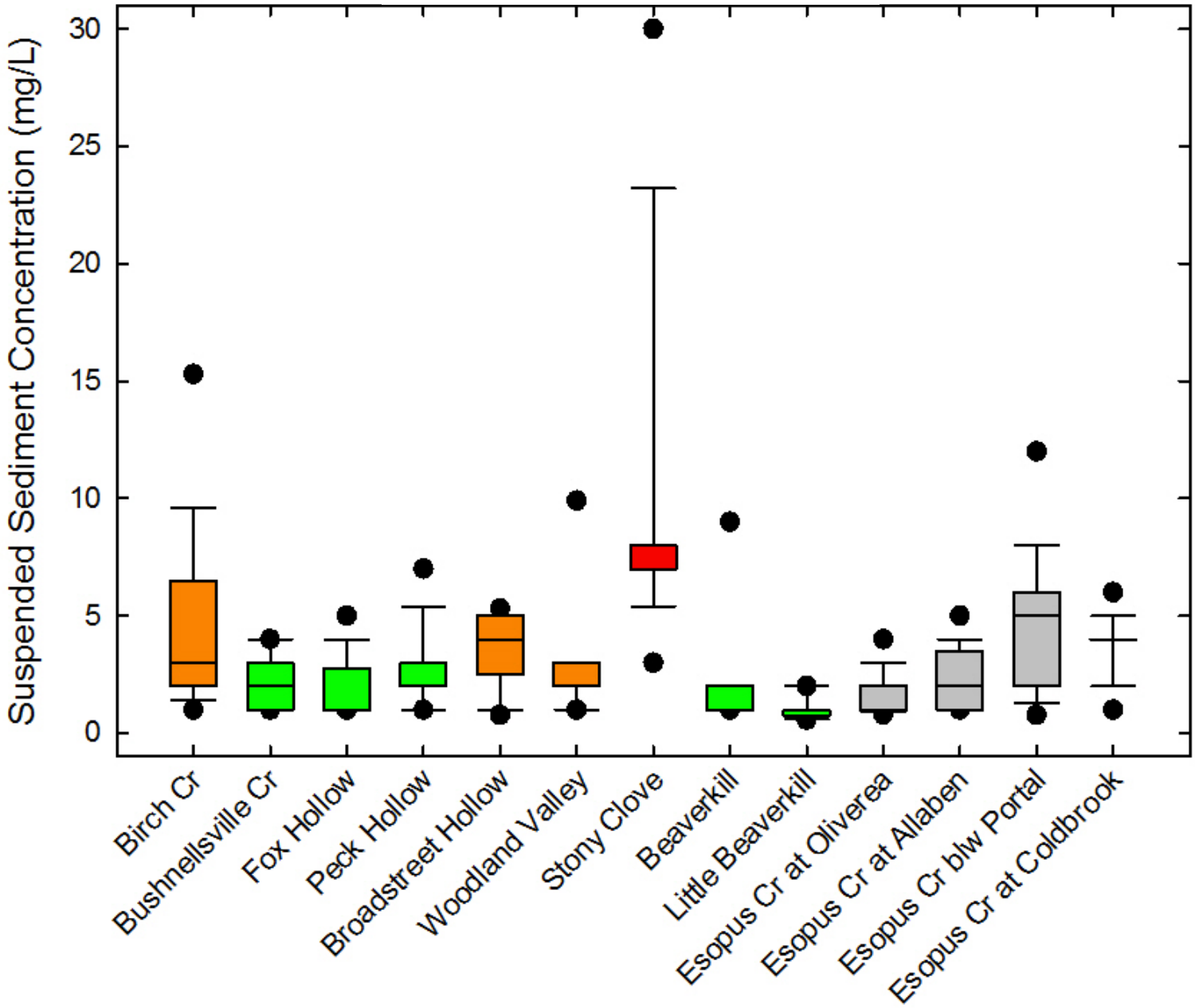
Flows greater than Q10



Flows between Q45 and Q55



Flows less than Q90



What accounts for these patterns?

- More bankfull discharge events?
- Basin or channel slope?
- Basin surficial geology?
- Other physical characteristics?

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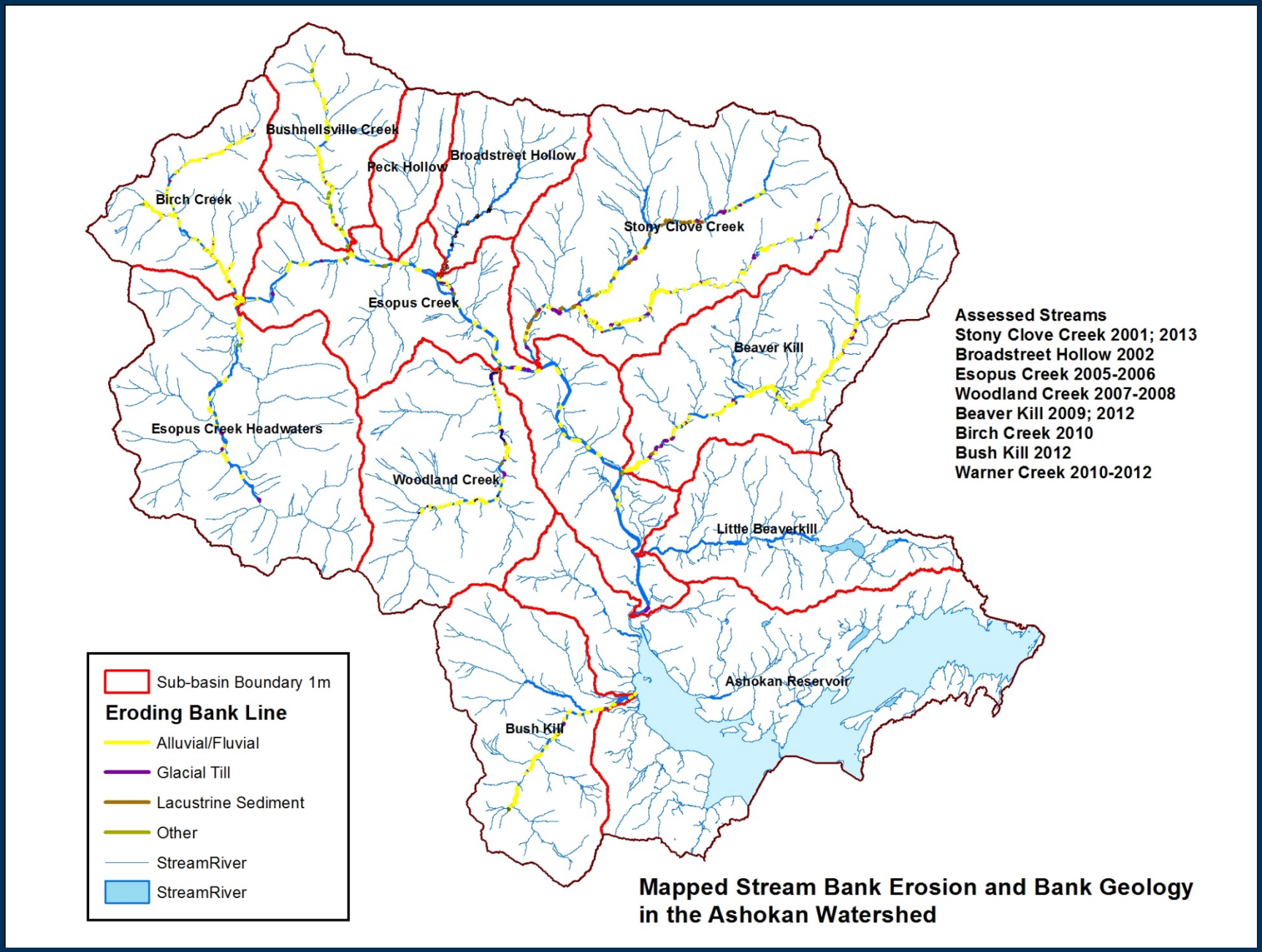
Stream Feature Inventories from AWSMP



Site Name	Channel Bank Erosion (ft)	Channel Contact With Fine Sediment Source (ft)	Percent Bank Erosion With Fine Sediment Source	Dominant Fine Sediment Geology	Date of SFI
Esopus Cr @ Oliverea	NA	NA	NA	NA	NA
Birch Cr @ Big Indian	8,939	794	9	Lacustrine	2011
Bushnellsville Cr @ Shandaken	8.657	2,135	25	Lacustrine/Till	2013
Fox Hollow Cr @ Allaben	NA	NA	NA	NA	NA
Peck Hollow Cr @ Allaben	NA	NA	NA	NA	NA
Broadstreet Hollow Br @ Allaben	4,678	647	14	Lacustrine	2001
Woodland Cr @ Phonecia	11,249	2,594	23	Lacustrine	2008
Stony Clove Cr @ Chichester	11, 980	6,535	54	Lacustrine	2013
Beaver Kill @ Mt Tremper	26,174	7,580	28	Till	2009
Little Beaver Kill @ Beechford	NA	NA	NA	NA	NA

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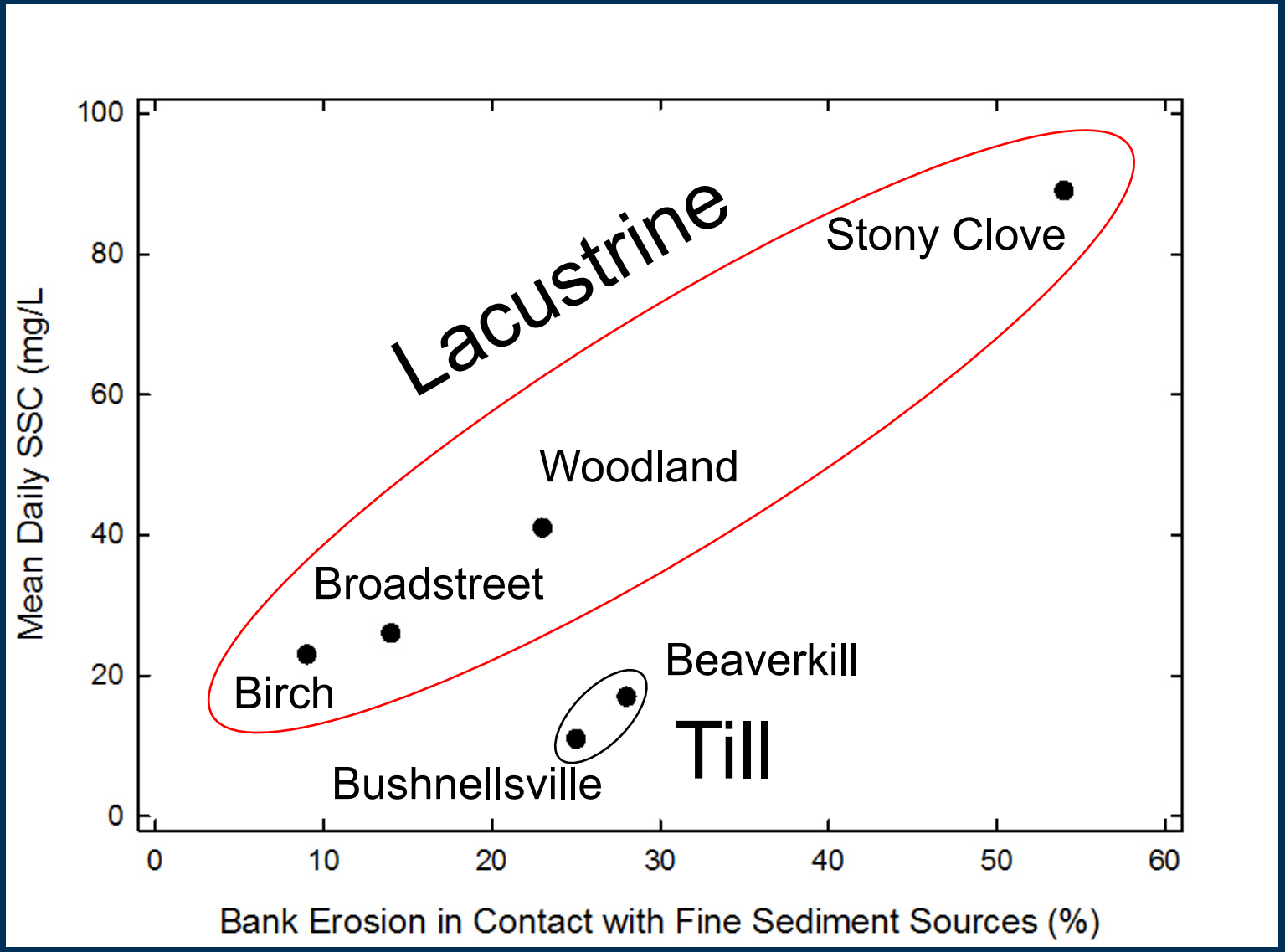
Lacustrine
Stony Clove
Woodland
Broadstreet
Birch
Beaverkill
Till
Bushnellsville
Mean Daily SSC (mg/L
Bank Erosion in Contact with Fine Sediment Sources (%)
0
20
40
60
80
100
0
10
20
30
40
50
60

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Beaverkill

USGS

Stony Clove

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Fine Grained Deposits

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Targeting Locations Where Streams are Eroding into Lacustrine Deposits

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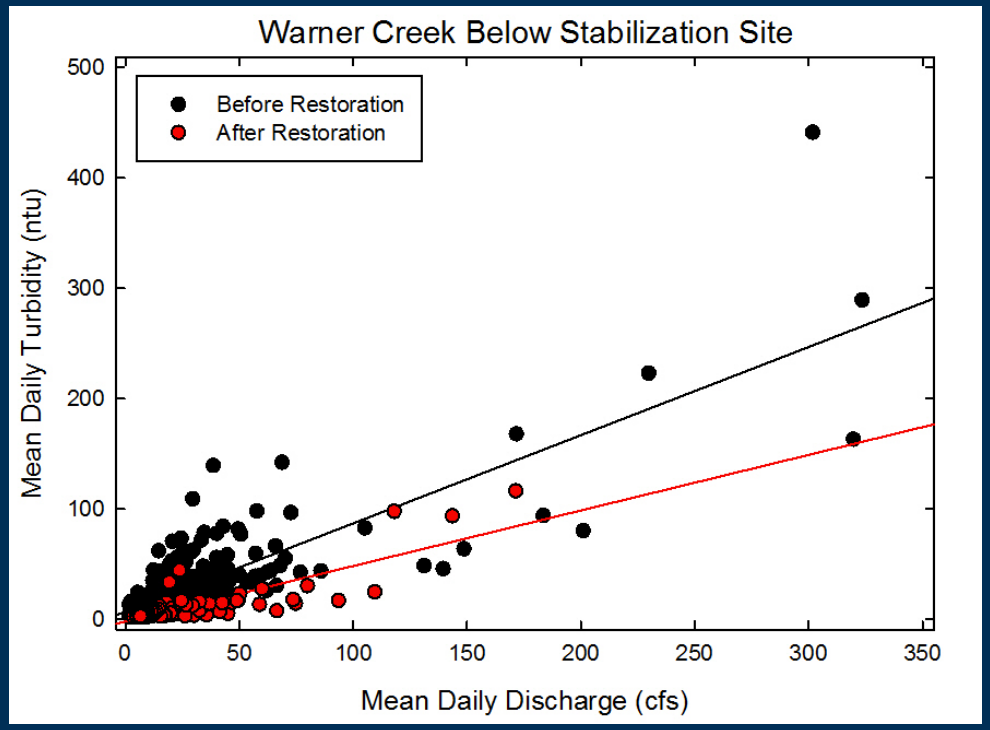
Moving Forward…

- Monitoring suspended sediment and turbidity before and after hill-slope stabilization projects



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Missing Pieces….

- Collaborative effort of water quality monitoring coinciding with stream feature inventories

- Linking intensive water quality monitoring at hill slope failures with geologic studies (such as the work of SUNY New Paltz students)

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Summary of Findings:

- > 90% of suspended sediment load on days when highest 10% of flows occur
- 3 distinct tributary groups in terms of suspended sediment concentrations
- Stony Clove greatest contributor of suspended sediment
- Eroding banks in contact with fine grained lacustrine deposits are important factor in suspended sediment contributions

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