Dissolved & suspended sediment transport dynamics in two agriculturally dominated watersheds, McLean County, IL

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Presentation Overview

- Background
- Project Objectives
- Study Sites
- Methods
- Results
- Future research

Background

- In 2000, the U.S. EPA identified agriculture as the leading source of impairment for sediment to rivers in the U.S (EPA, 2000).

- Increased sediment levels can lead to
  - reduced aquatic biodiversity
  - degraded water quality
  - impeded recreational usage
  - reduced reservoir volume

- In the Midwestern USA, total suspended sediment is significantly higher in agriculture watersheds compared to urban watersheds during base flow, but similar during storm flow (Miller et al, 2011).

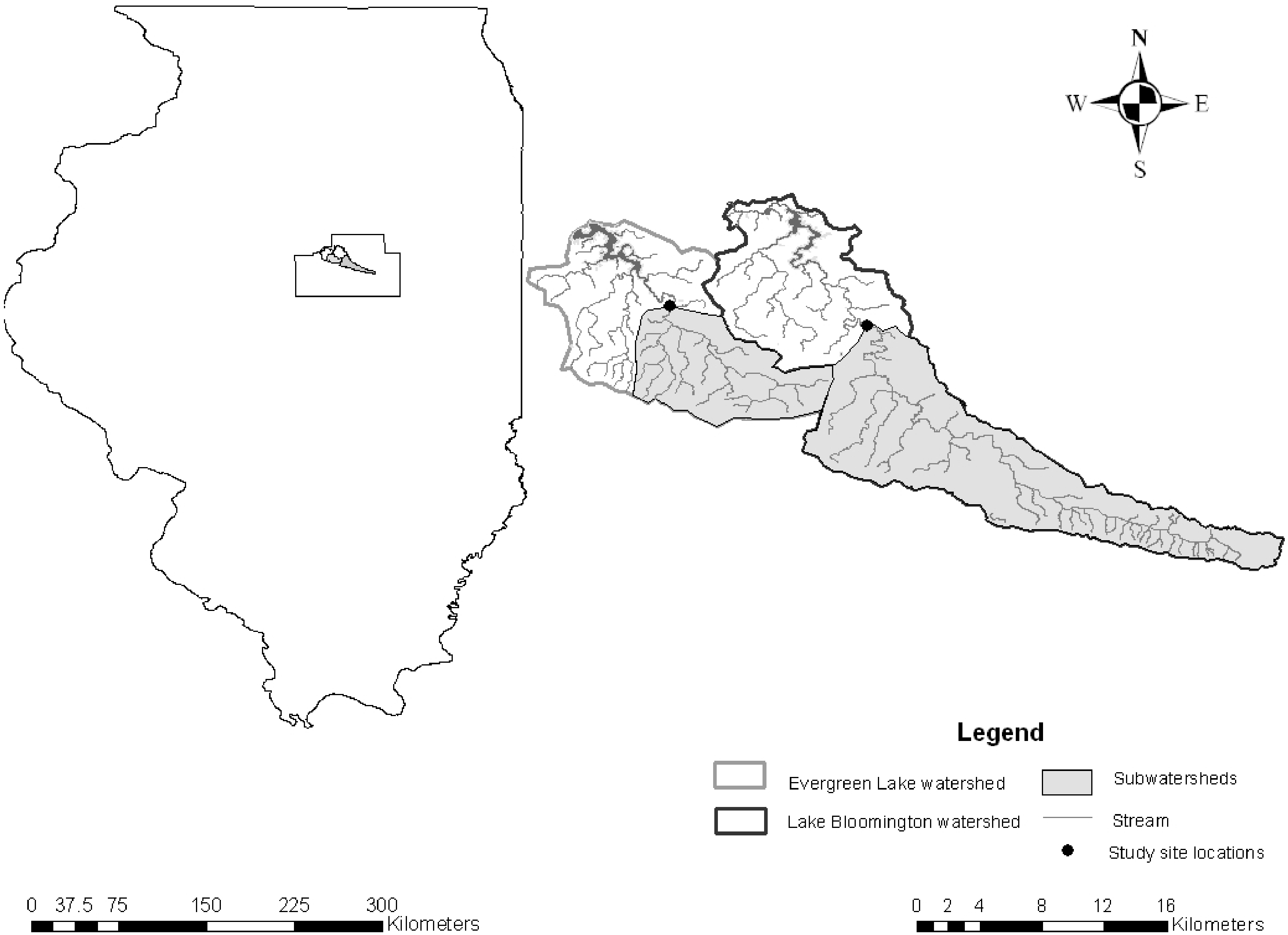
- Water availability (drought, storm events)

Project Objective

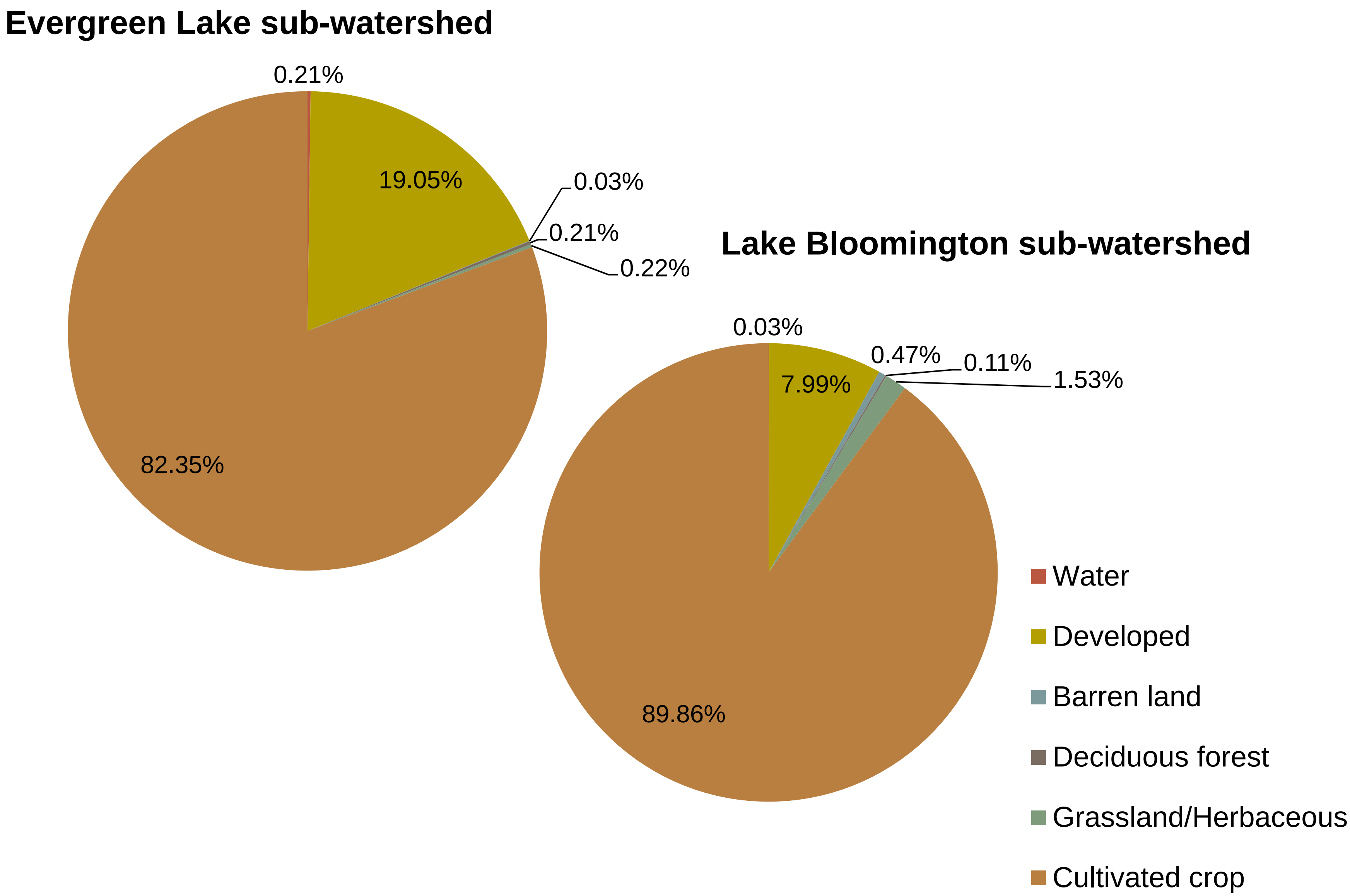
What is the rate of suspended and dissolved sediment transport in the Lake Evergreen and the Bloomington Lake watersheds during a drought year?

Study Sites

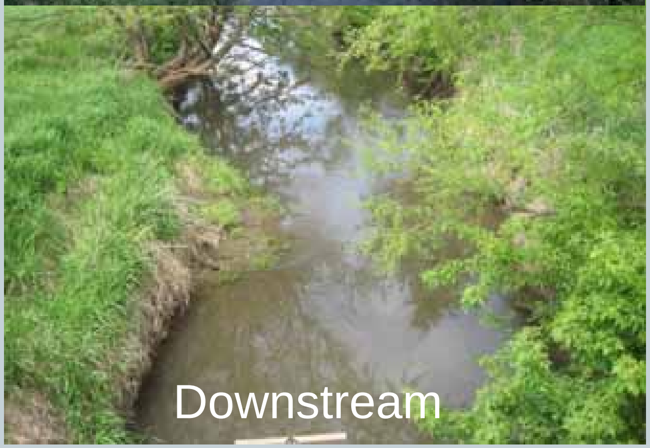
Evergreen and Bloomington watersheds and subwatersheds, McLean County, IL



Sub-watershed land use



Six Mile Creek



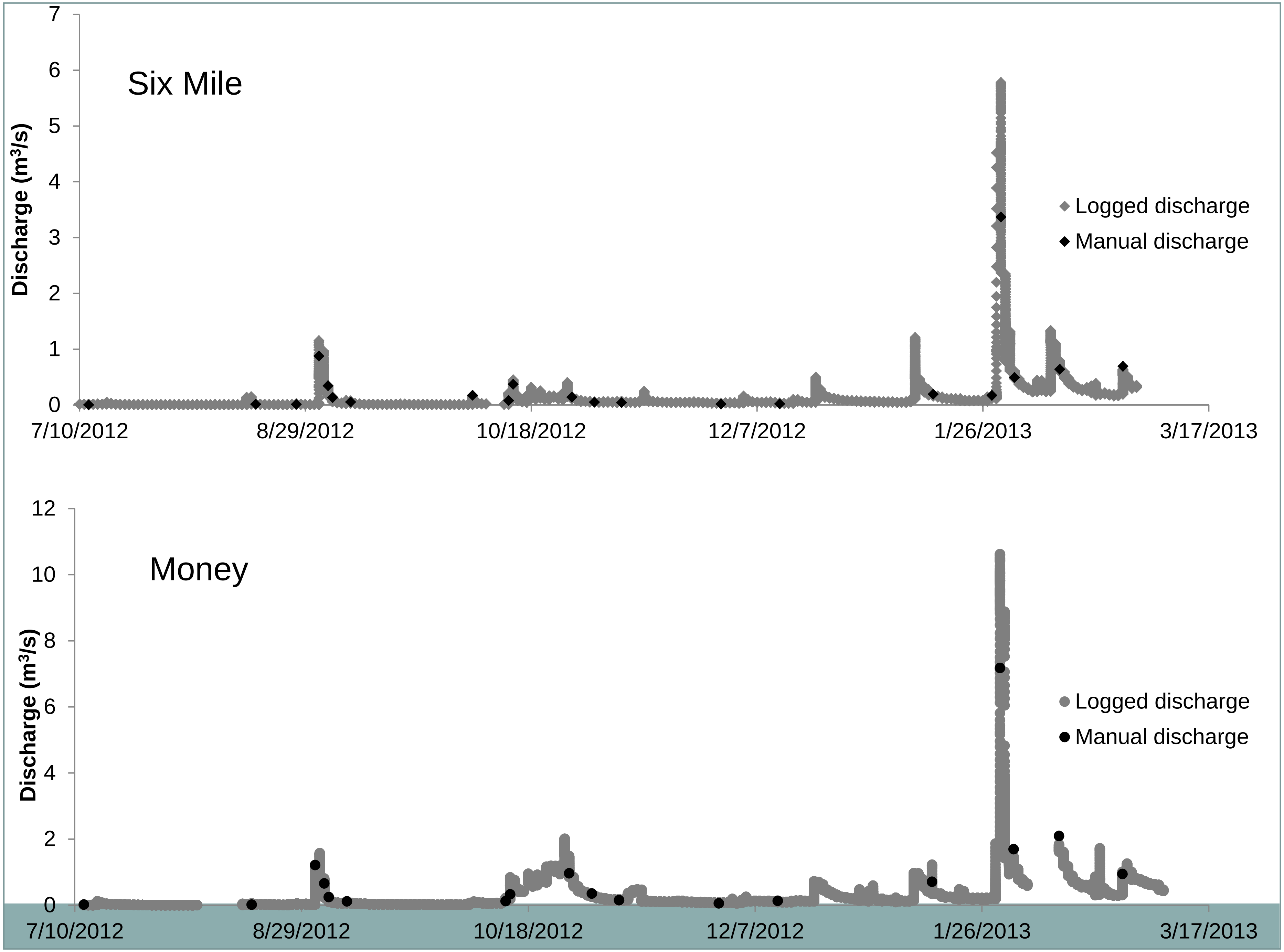
Money Creek

Anticipated Results

Parameter	Six Mile	Money
Suspended sediment	Higher	Lower
Discharge	Higher	Lower
Nutrients	Lower	Higher

Methods

Monitoring
- Continuous data logging (stage)
- Base flow conditions (biweekly)
- Storm flow conditions
  -water samples for suspended sediment and nutrient analysis



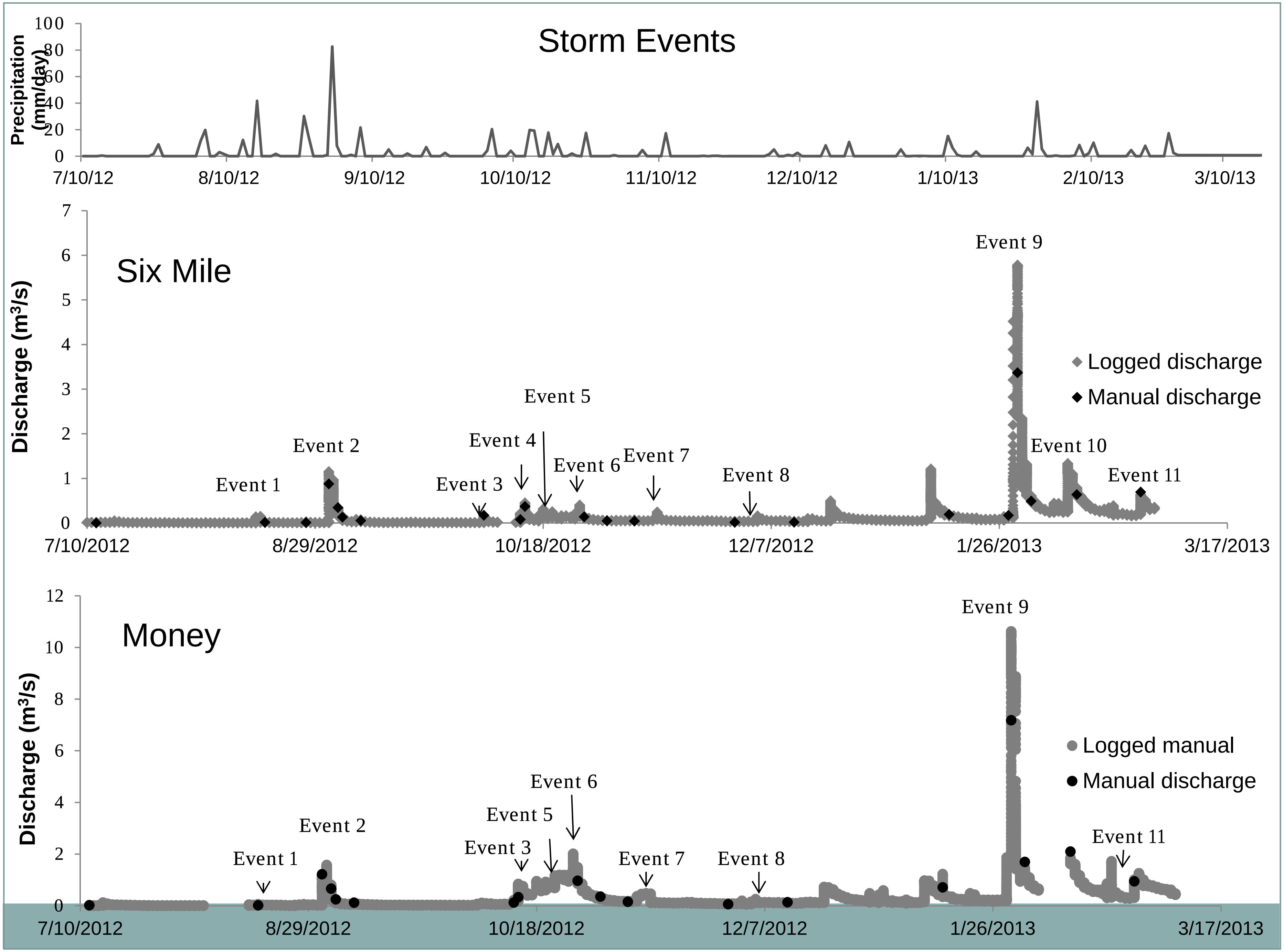
Six Mile
Discharge (m³/s)
7
6
5
4
3
2
1
0
7/10/2012
8/29/2012
10/18/2012
12/7/2012
1/26/2013
3/17/2013
Logged discharge
Manual discharge
Money
Discharge (m³/s)
12
10
8
6
4
2
0
7/10/2012
8/29/2012
10/18/2012
12/7/2012
1/26/2013
3/17/2013
Logged discharge
Manual discharge

Mean base flow conditions

	Six Mile	Money	Units
Stage	0.29 (±0.12)	0.25 (±0.13)	m
	0.94 (±0.38)	0.81 (±0.44)	ft
Discharge *	0.052 (±0.14)	0.12 (±0.16)	m3/s
	1.84 (±4.98)	4.08 (±5.63)	ft3/s
Turbidity	14.65 (±28.59)	36.36 (±48.2)	NTU
Total suspended sediment	11.21 (±12.54)	25.42 (±27.59)	mg/L
Organic sediment concentration	2.90 (±3.83)	6.47 (±6.38)	mg/L
Inorganic sediment concentration	8.3 (±11.11)	18.83 (±8.43)	mg/L
Suspended sediment load *	7.41 (±5.05)	50.86 (±36.34)	ton/year
* = p<0.05, t-test			

Table 1: Mean of baseflow conditions on SMC and MC (July 12, 2012-March 28, 2013)

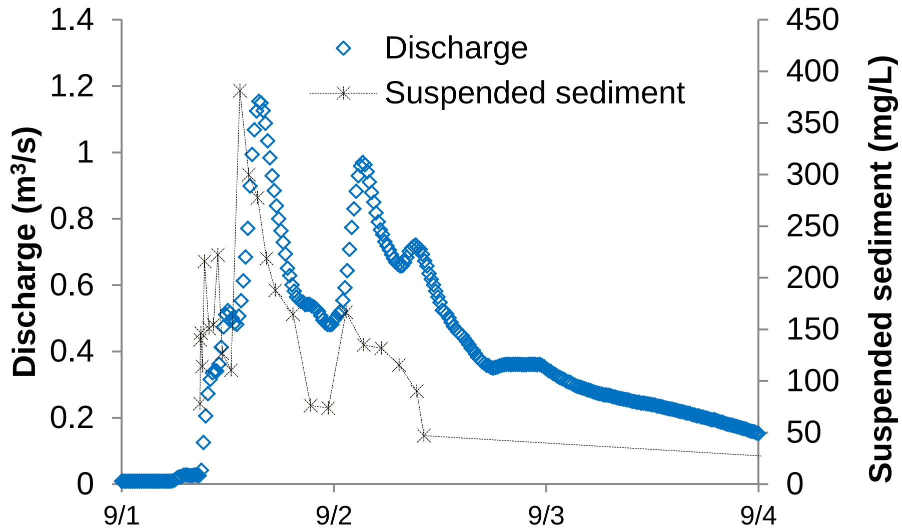
Mean nutrient base flow conditions			
Parameter	Six Mile	Money	Units
$N0_3$-N concentration	1.19	2.59	mg/L
$N0_3$-N load	0.07	0.16	ton/year
Cl^- concentration	48.96	57.04	mg/L
Cl^- load	2.81	3.31	ton/year

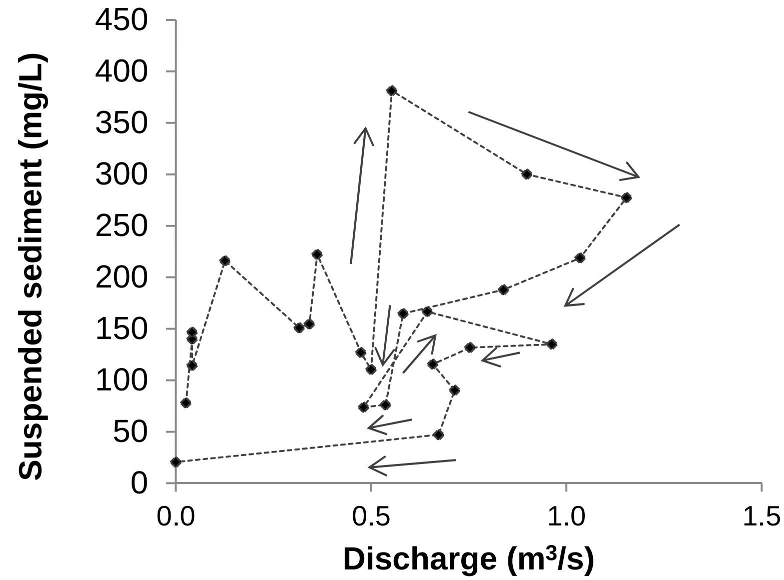


Storm Events
Precipitation (mm/day)
100
80
60
40
20
0
7/10/12
8/10/12
9/10/12
10/10/12
11/10/12
12/10/12
1/10/13
2/10/13
3/10/13
Six Mile
Discharge (m³/s)
Event 1
Event 2
Event 3
Event 4
Event 5
Event 6
Event 7
Event 8
Event 9
Event 10
Event 11
Logged discharge
Manual discharge
7/10/2012
8/29/2012
10/18/2012
12/7/2012
1/26/2013
3/17/2013
Money
Discharge (m³/s)
Event 1
Event 2
Event 3
Event 5
Event 6
Event 7
Event 8
Event 9
Event 11
Logged manual
Manual discharge
7/10/2012
8/29/2012
10/18/2012
12/7/2012
1/26/2013
3/17/2013

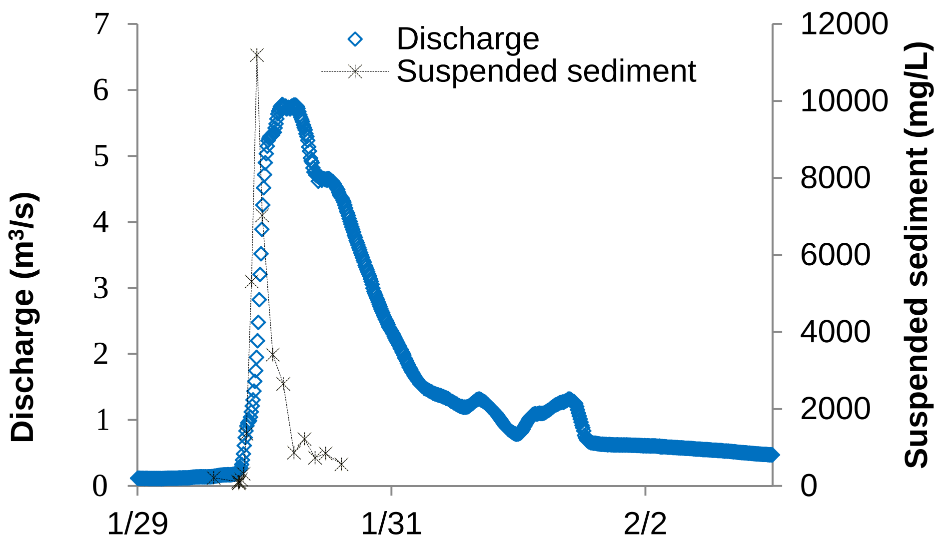
Hysteresis patterns

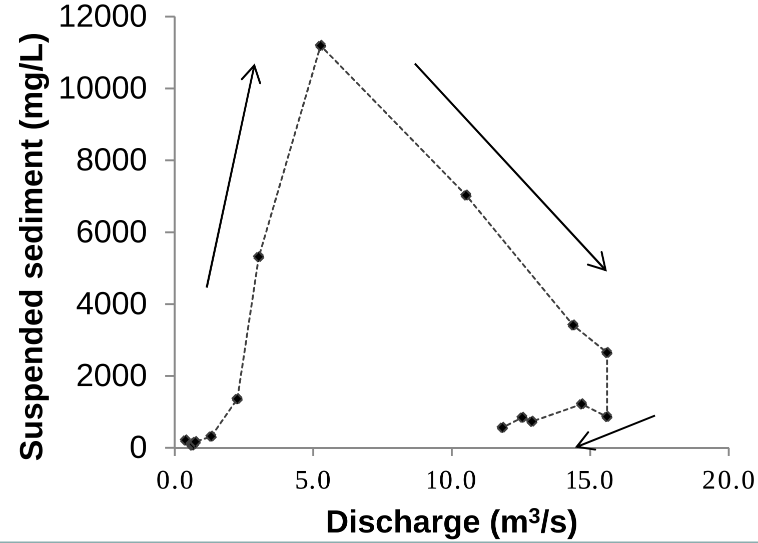
Event 2, 9/1-4/2012





Event 9, 1/28-31/2013





Summing it all up

			Six Mile 47.27 km^2	Money 112.56 km^2	Units
Suspended sediment	Total suspended sediment load	Baseflow*	7.41	50.86	ton/year
		Storm flow	1804.61	12.72	ton/year
Q	Peak Q	Baseflow (3/21/2013)	0.39	0.4	m^3/s
		Storm flow (1/28-31/2013)	5.76	10.6	m^3/s
Nutrients	$N0_3$-N[ ]	Baseflow	1.19	2.59	mg/L
	Cl^- [ ]	Baseflow	48.96	57.04	mg/L
	$N0_3$-N [ ]	Storm flow	1.02	1.94	mg/L
	Cl^- [ ]	Storm flow	59.55	56.22	mg/L

* = $p<0.05$, t-test

Conclusions

Parameter	Six Mile	Money
Suspended sediment	Higher	
Discharge		**HIGHER**
Nutrients		Higher

Future Work

- **Continued storm event monitoring**
- **Seasonal variations**
- **Annual load (sediment and nutrient)**
- **Bathymetric mapping**

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Thank you.

Questions?