

Sediment Movement in the Illinois River Basin

by

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Illinois State Water Survey

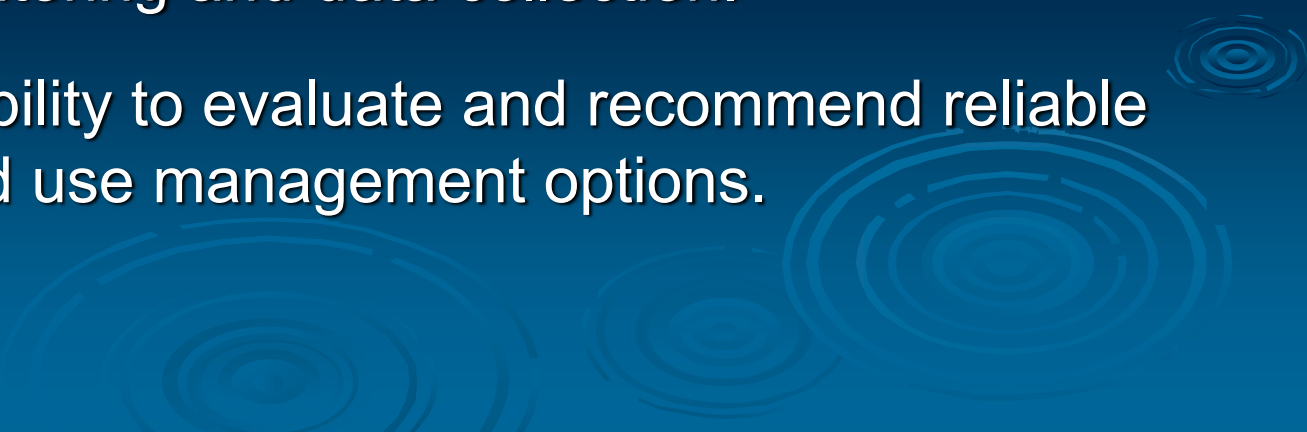
Institute of Natural Resource Sustainability

University of Illinois

Champaign, IL



Integrated Management Plan for the Illinois River Watershed

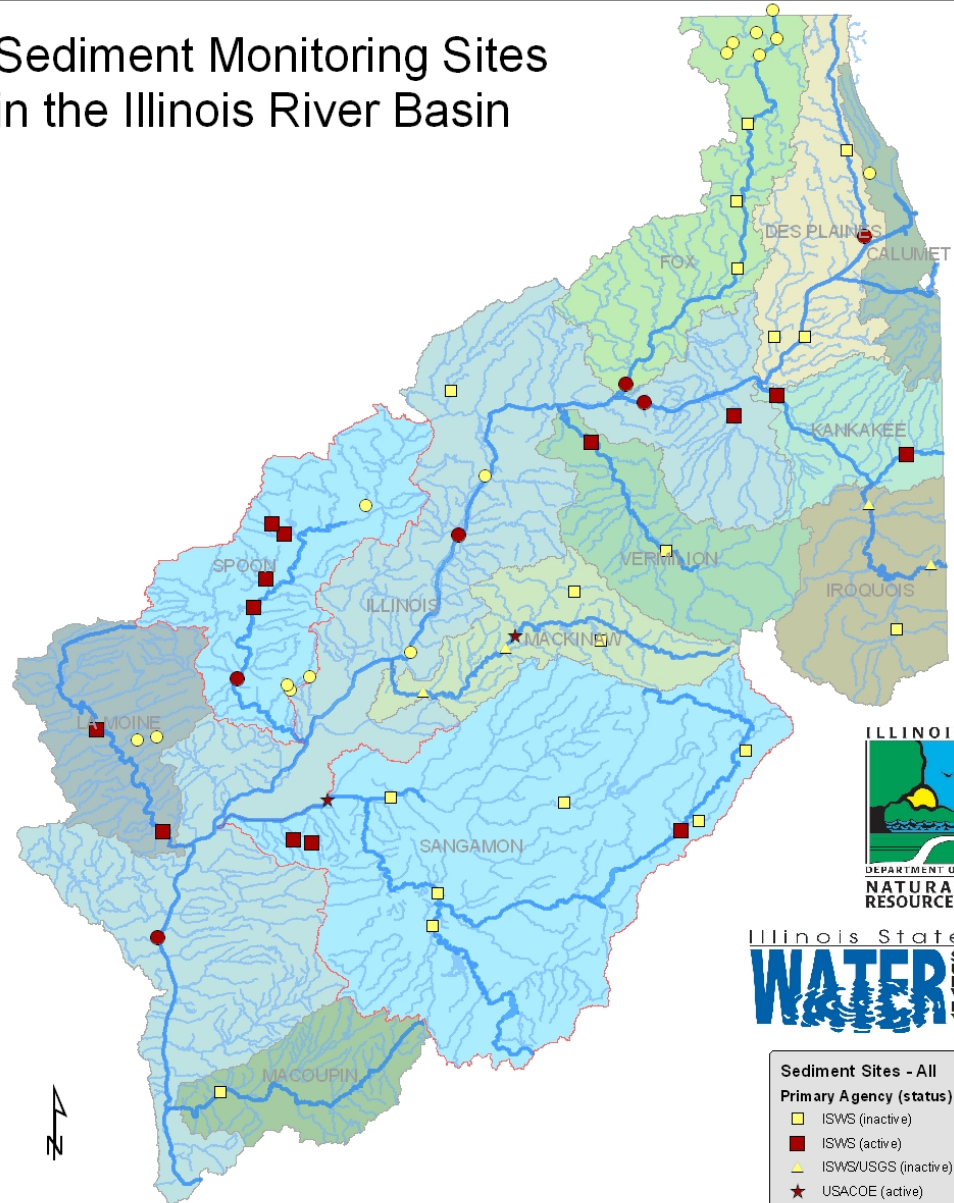
- **Recommendation 12 - Improve monitoring of water and sediment of Illinois streams:**
 - Involve units of local, state, and federal governments that need water and sediment data.
 - Evaluate the quality and locations of current water and sediment monitoring and data collection.
 - Improve the ability to evaluate and recommend reliable water and land use management options.
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Data Sets Evaluated

- USGS – Sediment Budget
- Benchmark Sediment Network – long term trend
- Illinois River CREP – targeted small watersheds monitoring



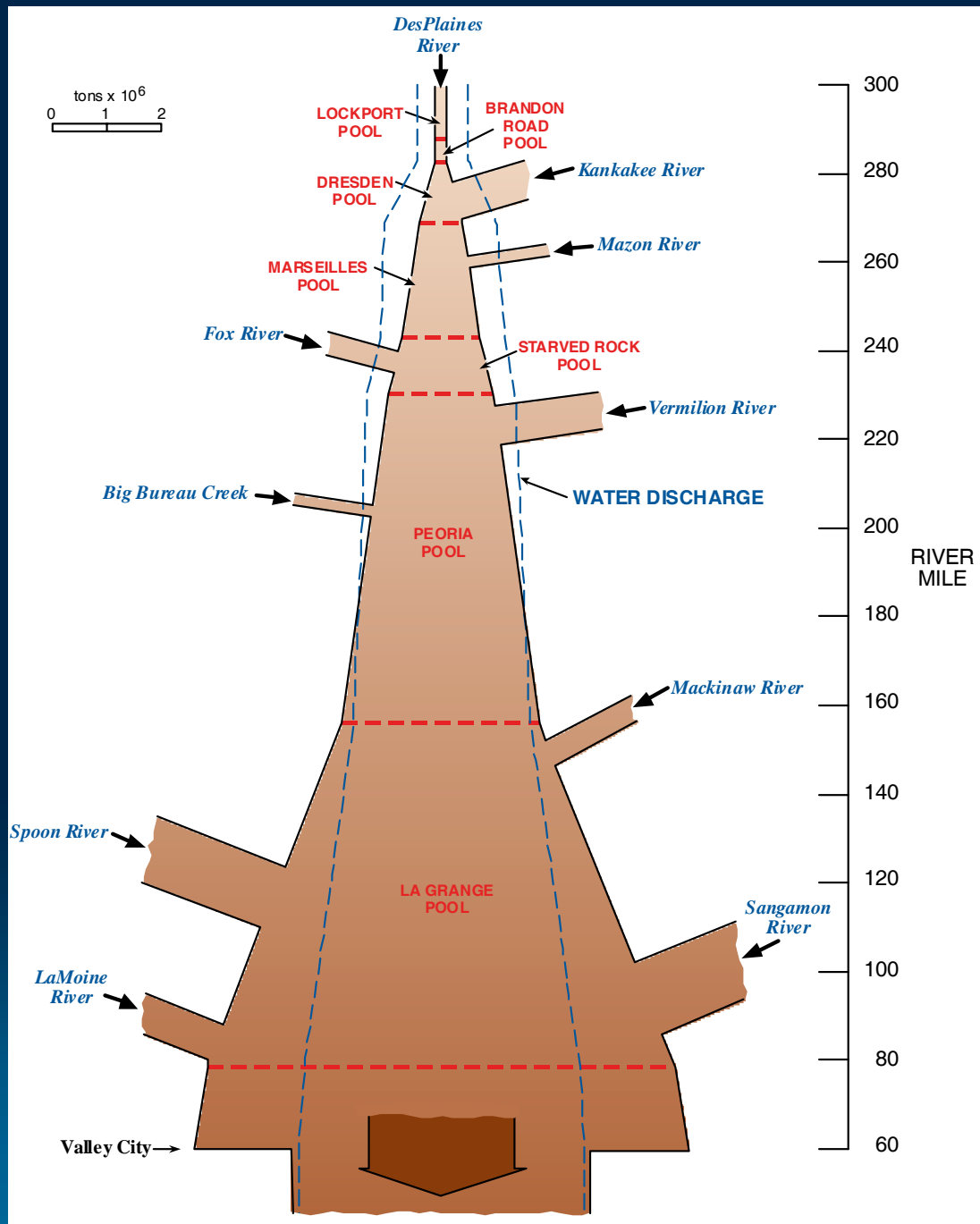
Sediment Monitoring Sites in the Illinois River Basin



- Sediment Sites - All Primary Agency (status)**
- ISWS (inactive)
 - ISWS (active)
 - ▲ ISWS/USGS (inactive)
 - ★ USACOE (active)
 - USGS (inactive)
 - USGS (active)
 - Major Rivers
 - Tributaries

Scale 1:1,879,996
0 5 10 20 30 40 Miles
12/16/03 - J.C.J.

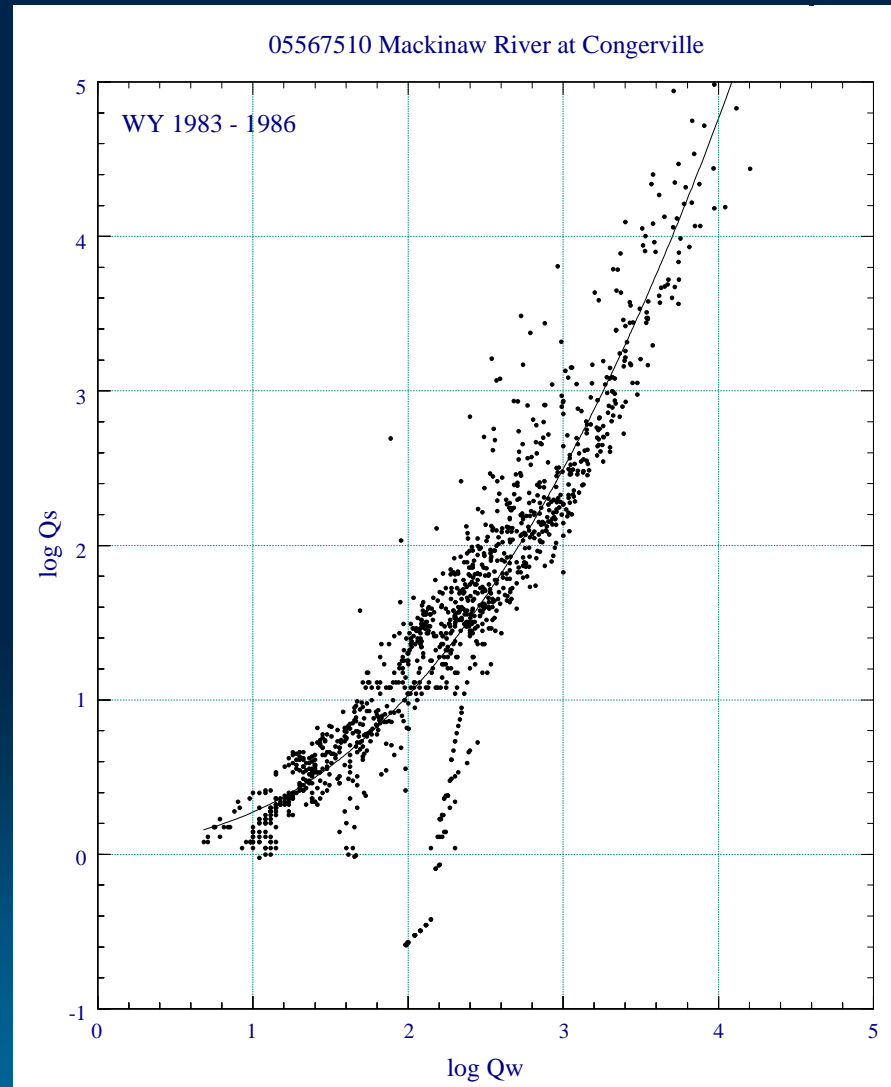




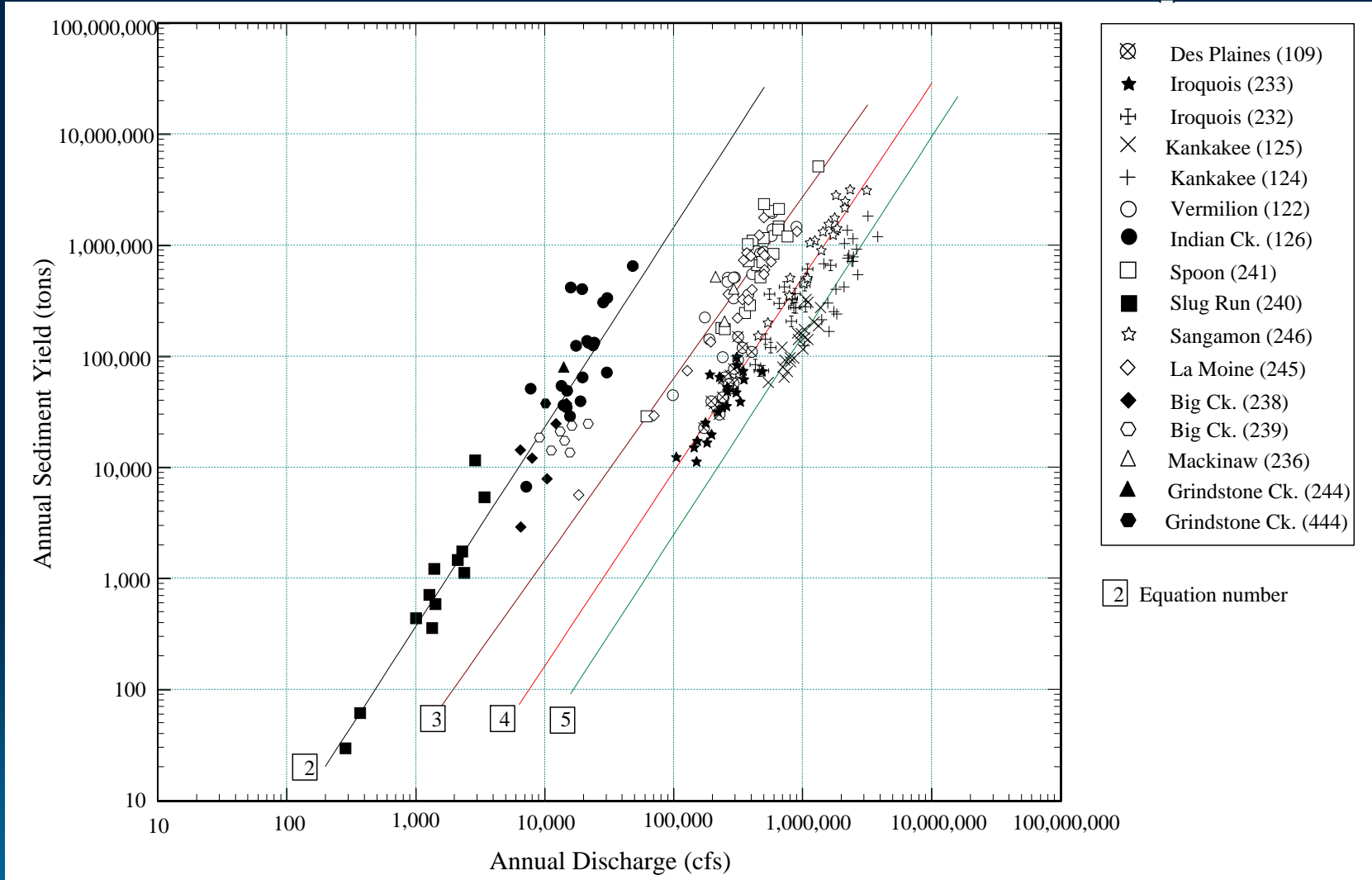
Sediment Budget of the Illinois River



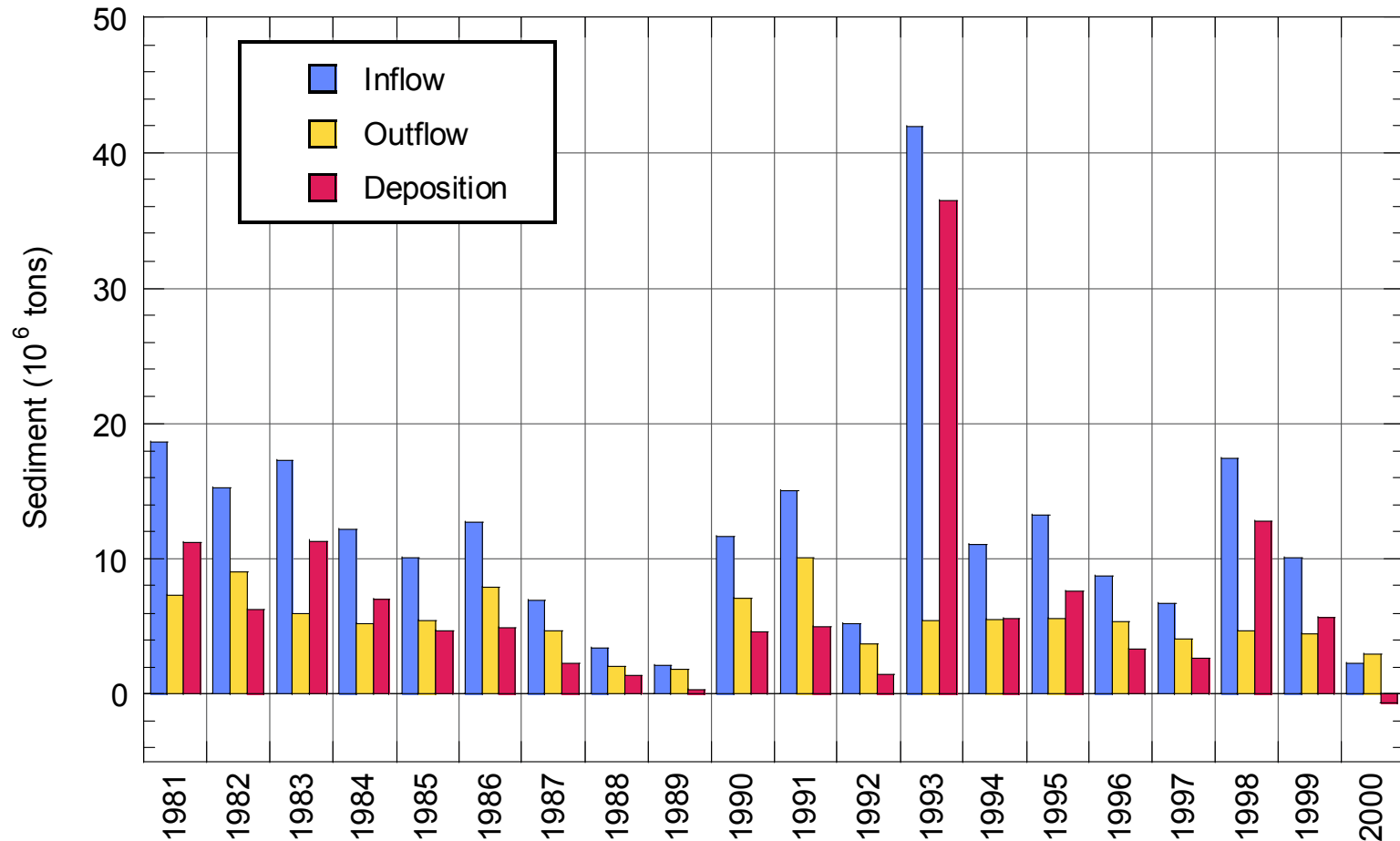
Sediment Rating Curve for Mackinaw River at Congerville



Annual Sediment Yield Equations for Tributary Streams in the Illinois River Valley



Sediment Inflow, Outflow, and Deposition



Sediment Budget of the Illinois River Valley

Sediment Input:
12.1 million tons
per year

Sediment Deposition
within the Illinois
River Valley:
6.7 million tons
per year

Sediment
Outflow
at Valley City:
5.4 million
tons per year

Illinois River Sediment Budget Summary

- Average annual sediment delivery to the Illinois River valley – **12.1 million tons**
- Average annual sediment discharge at Valley City – **5.4 million tons**
- Average annual sedimentation – **6.7 million tons**
- Percent deposited – **55 percent**
- The Spoon and La Moine Rivers had the highest sediment yield rates for the period of analysis.
- The sediment budget for the 1980-2000 period will serve as a basis for measuring our progress towards reducing the sediment delivery to the Illinois River valley.



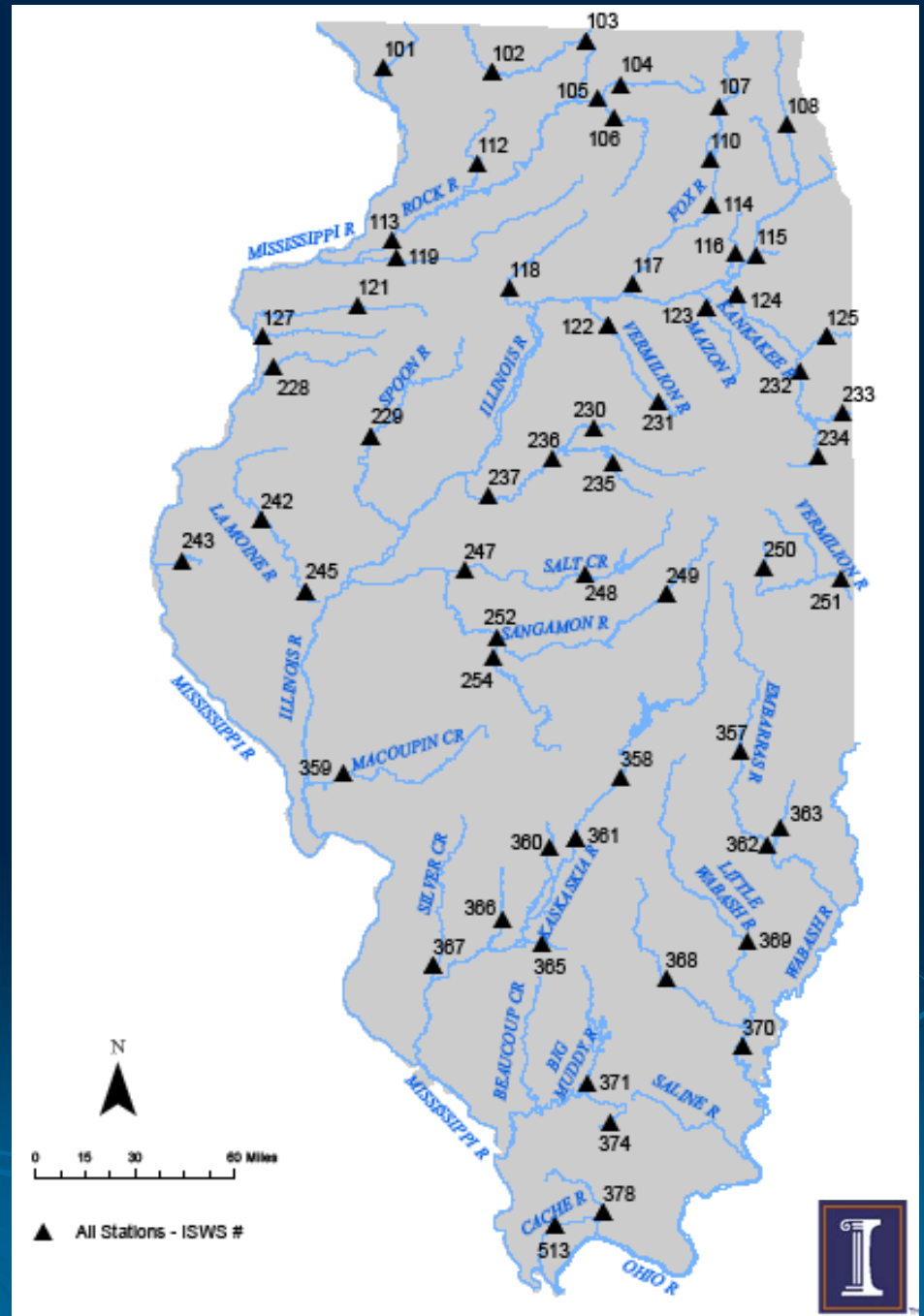
ISWS

Benchmark Sediment Monitoring Program (BSMP)

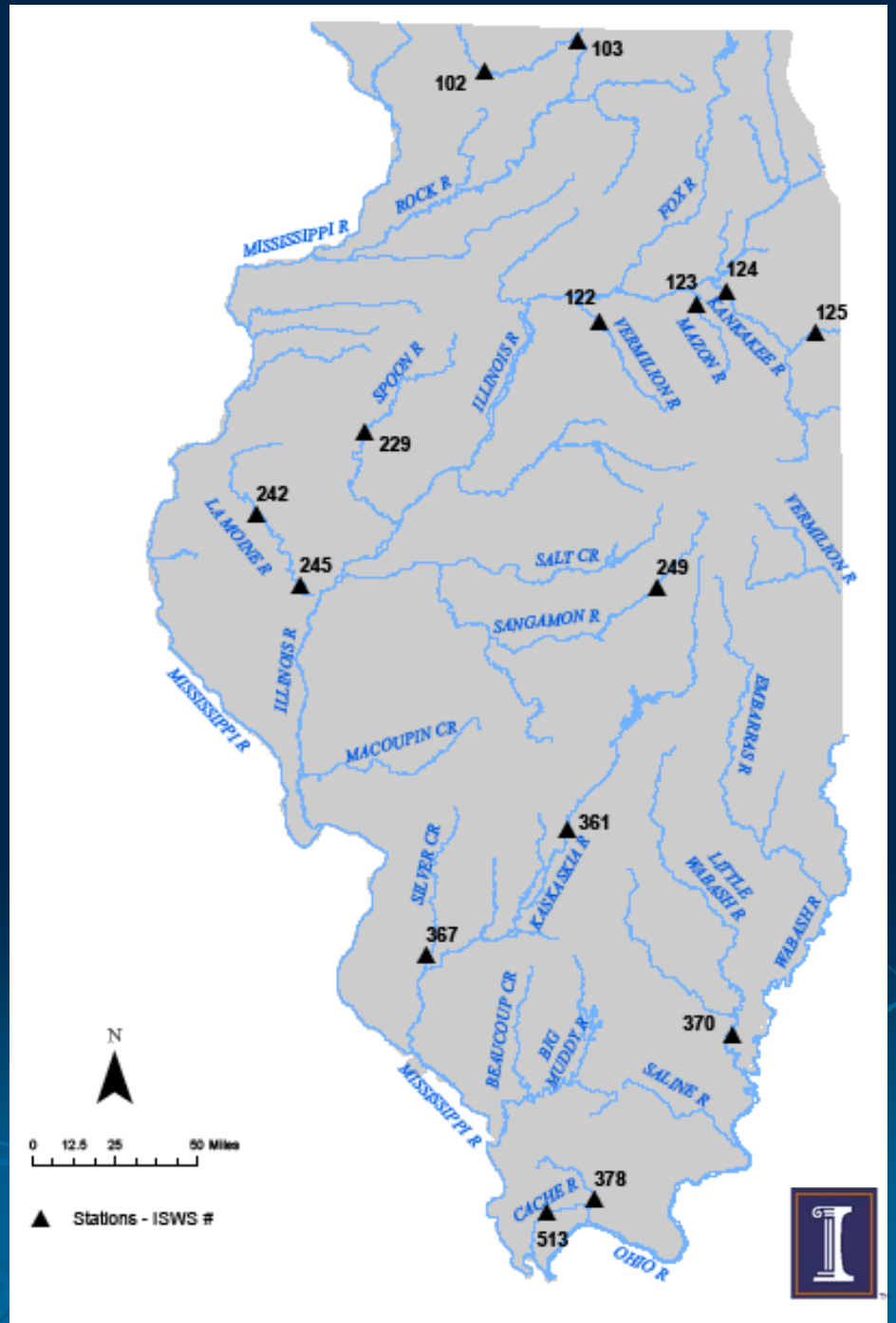
- 1980 - ISWS established the Illinois Benchmark Sediment Monitoring Network (BSMN) consisting of 50 monitoring stations throughout Illinois
- Currently there are 15 active monitoring stations
 - *Goal: Develop comprehensive, long-term database of suspended sediment transport to provide a means for investigating and quantifying long-term trends that may be occurring in Illinois watersheds.*



Original 1980 Stations (The Grand Plan)



Current Stations

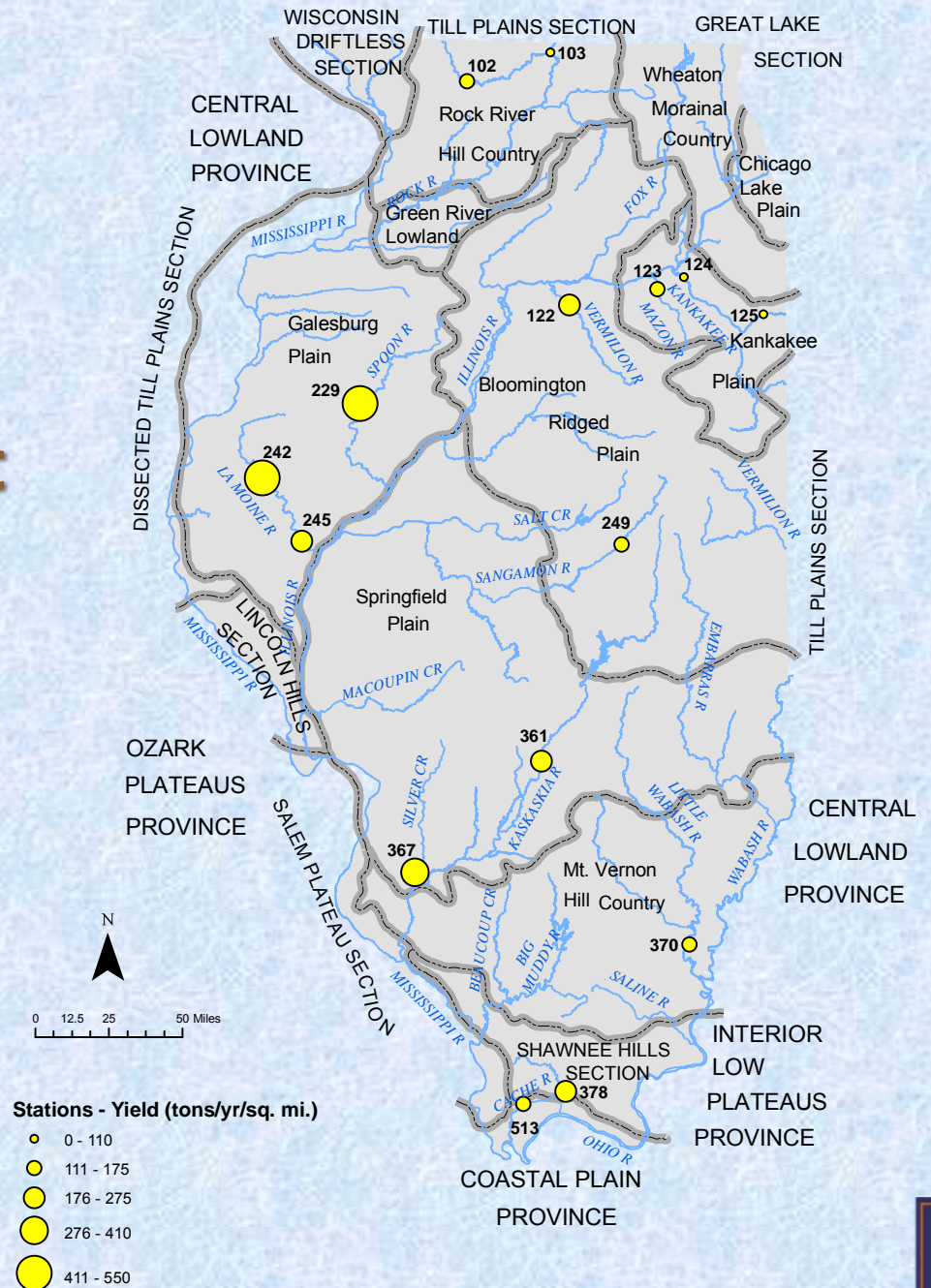


Illinois Benchmark Sediment Network Stations

<i>ISWS number</i>	<i>USGS number</i>	<i>Station name</i>	<i>Period of record</i>	<i>Water years</i>
102	05435500	Pecatonica River at Freeport	1981, 1982, 1984-2005	24
103	05437500	Rock River at Rockton	1981-2005	25
122	05555300	Vermilion River near Leonore	1984-2005	22
123	05542000	Mazon River near Coal City	1981-1997, 2002-2005	21
124	05527500	Kankakee River near Wilmington	1983-2005	23
125	05520500	Kankakee River at Momence	1982-1985, 1987, 1988, 1991, 1993-2005	20
229	05569500	Spoon River at London Mills	1981-1987, 1992, 1994-2005	20
242	05584500	La Moine River at Colmar	1981-1988, 1993-2005	21
245	05585000	La Moine River at Ripley	1984-1990, 1993-2005	20
249	05572000	Sangamon River at Monticello	1981-2005	25
361	05592500	Kaskaskia River at Vandalia	1981-1988, 1990-2005	24
367	05594800	Silver Creek near Freeburg	1981, 1982, 1984-1988, 1990- 2005	23
370	03381500	Little Wabash River at Carmi	1981-1985, 1993-2005	18
378	03612000	Cache River at Forman	1981-2005	25
513	NA	Cache River at Ullin	1995-2005	11



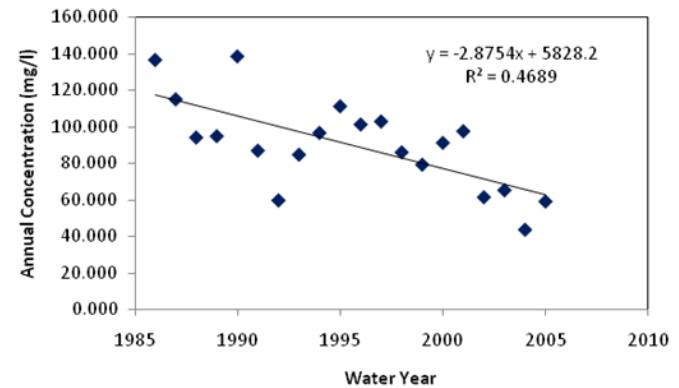
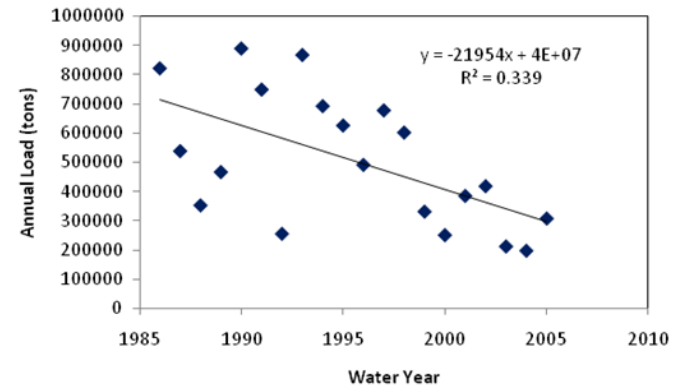
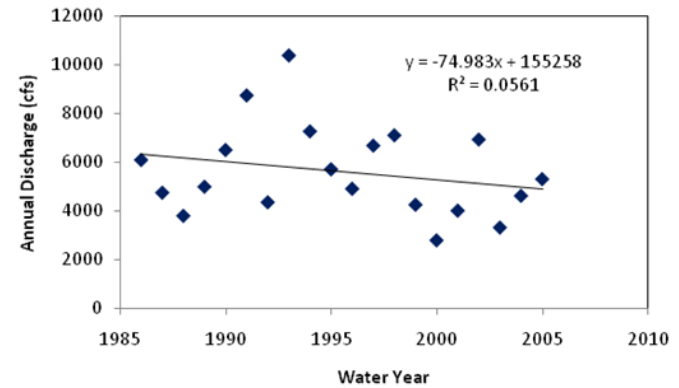
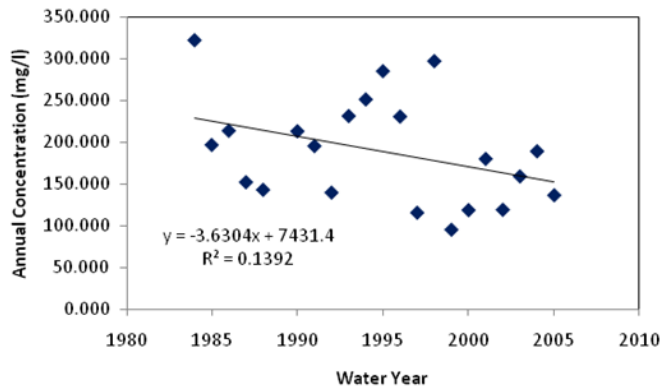
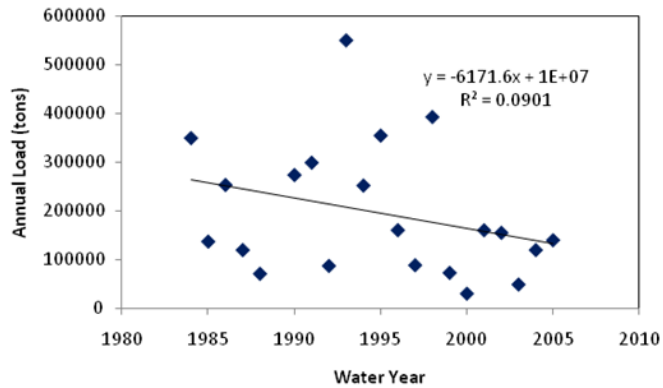
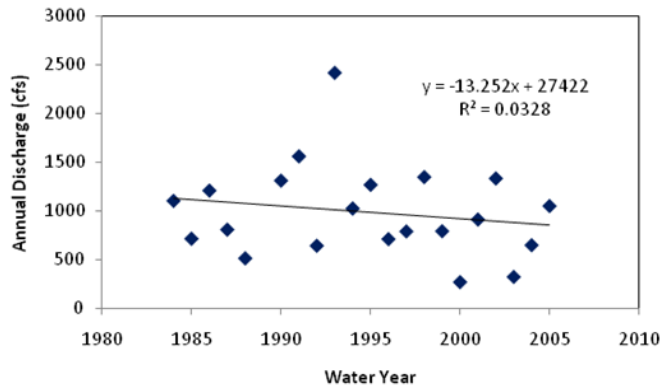
BSMN Station 25-Year Mean Suspended Sediment Yield (tons/mi²)



Trends Analysis

- The objective was to investigate any trends in suspended sediment transport that may have occurred in Illinois streams based on 25 years of data collection in the Illinois Benchmark Sediment Monitoring Network.
- Trend analyses were conducted for annual mean discharge, annual sediment load, and annual mean sediment concentration.

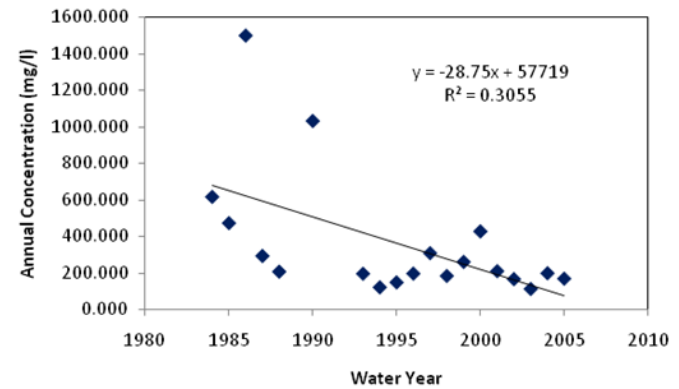
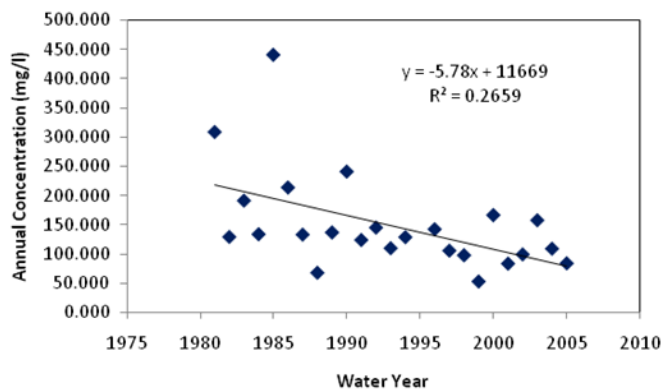
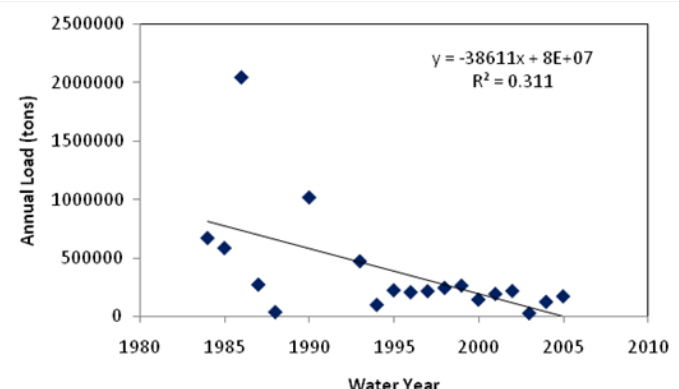
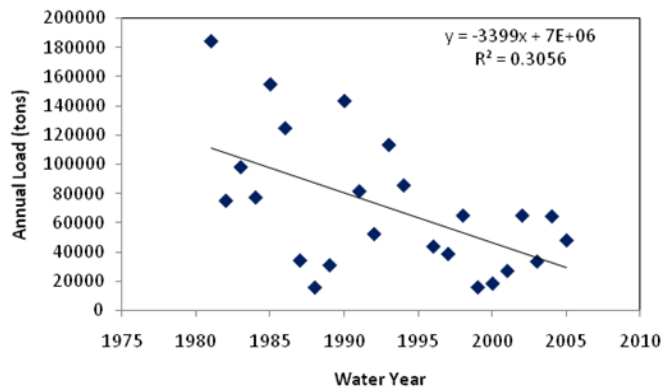
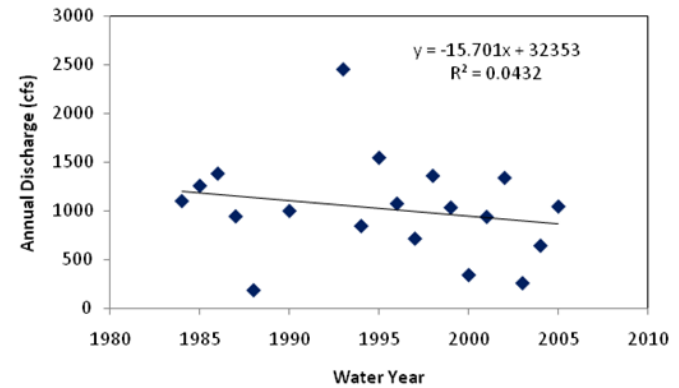
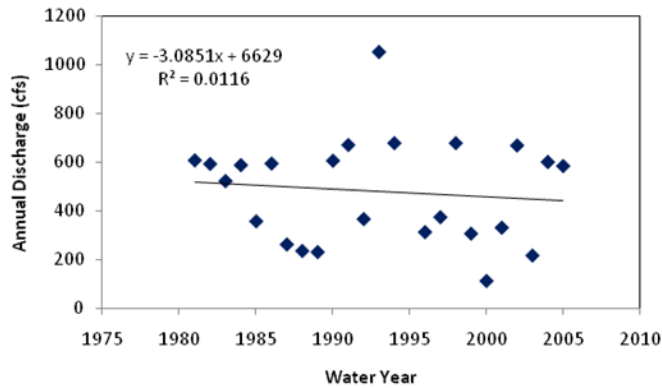




**ISWS# 122: Vermilion River
near Leonore, IL**

**ISWS #124: Kankakee River
near Wilmington, IL**

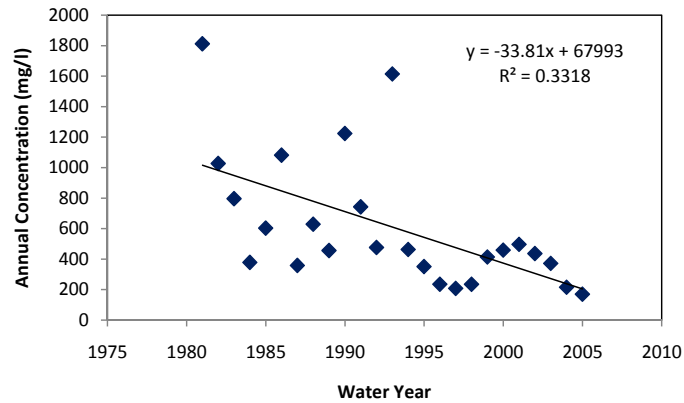
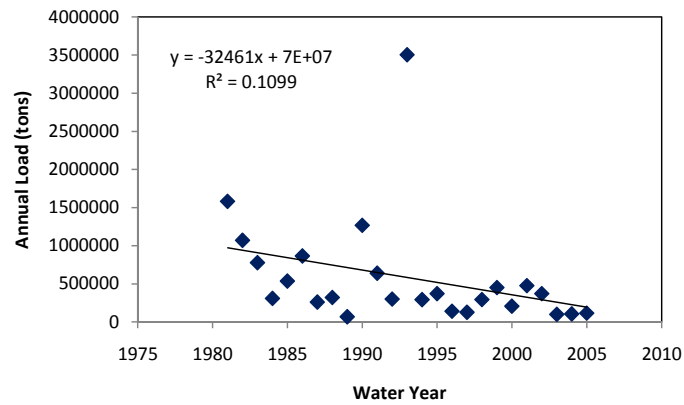
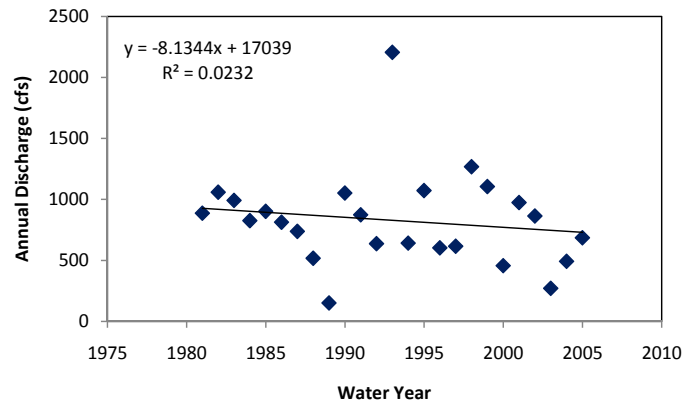




**ISWS #249: Sangamon
at Monticello, IL**

**ISWS #245: La Moine River
at Ripley, IL**





ISWS# 229: Spoon River at London Mills, IL

ISWS #229: Spoon River at London Mills, IL



Trend Analysis

ISWS number	Two-sided p values ¹			Number of water years	Trends ²		
	τ_D	τ_{SL}	τ_{SC}		τ_D	τ_{SL}	τ_{SC}
Pecatonica River at Freeport	0.6243	0.2629	0.0802	19	↔	↔	↓
Rock River at Rockton	0.9579	0.1131	0.0645	23	↔	↔	↓
Vermilion River near Leonore	0.5661	0.1742	0.139	21	↔	↔	↔
Mazon River near Coal City	0.2241	0.0079	0.017	16	↔	↓	↓
Kankakee River near Wilmington	0.381	0.0039	0.0048	20	↔	↓	↓
Kankakee River at Momence	0.0641	0.3727	0.2437	12	↓	↔	↔
Spoon River at London Mills	0.0814	0.0019	0.0064	18	↓	↓	↓
La Moine River at Colmar	0.2629	0.0301	0.0424	19	↔	↓	↓
La Moine River at Ripley	0.2079	0.0064	0.0209	19	↔	↓	↓
Sangamon River at Monticello	0.6374	0.0185	0.0092	24	↔	↓	↓
Kaskaskia River at Vandalia	0.8215	0.535	0.3377	22	↔	↔	↔
Silver Creek near Freeburg	0.7917	0.0394	0.0645	23	↔	↓	↓
Little Wabash River at Carmi	0.9212	0.1376	0.0011	15	↔	↔	↓
Cache River at Foreman	0.5912	0.0004	0.0001	25	↔	↓	↓
Cache River at Ullin	0.9170	0.2515	0.0049	11	↔	↔	↓

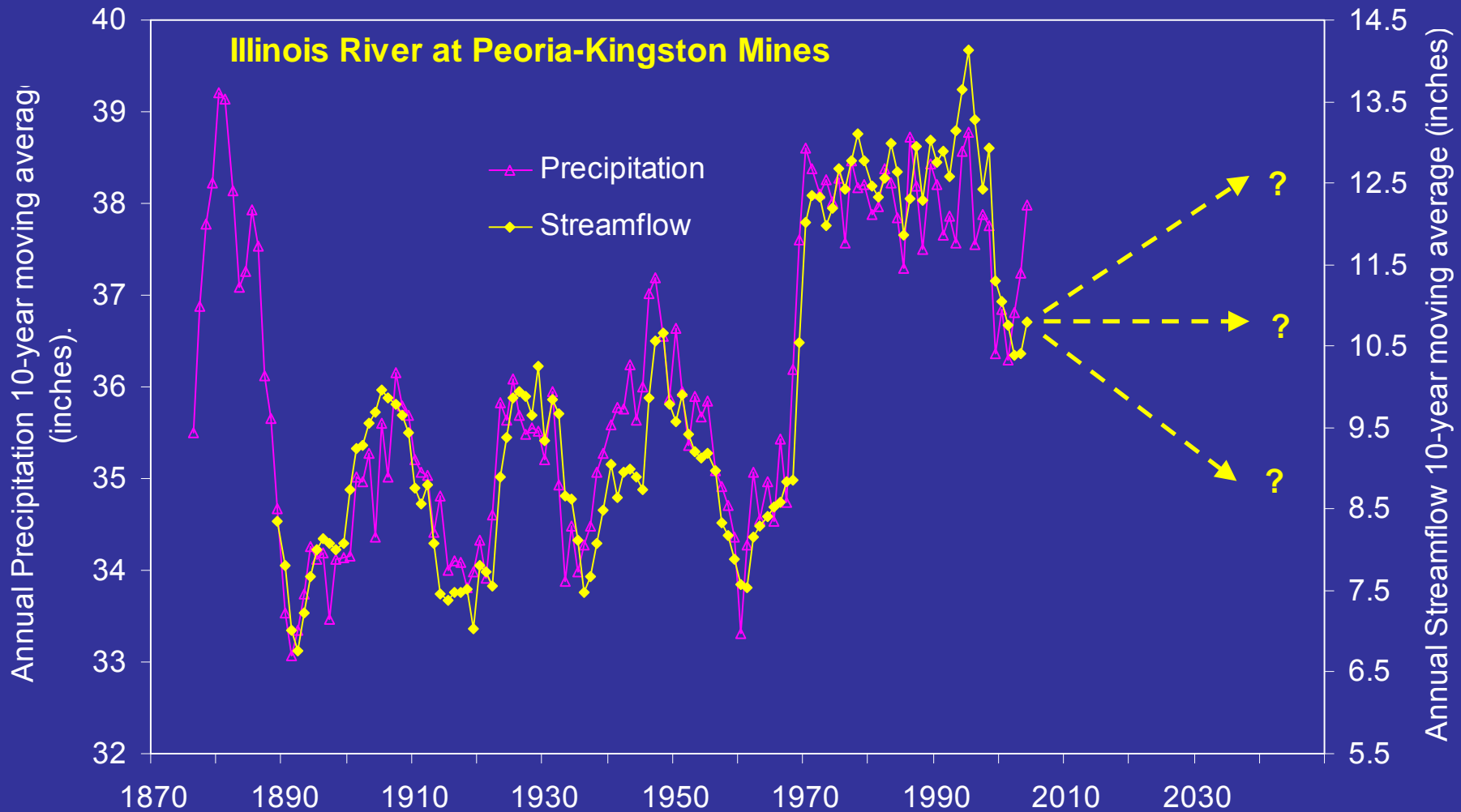


Trend Results

- Trend analyses conducted using Kendall τ coefficients suggest that (at 80% confidence):
 - mean annual discharge decreased at 6 of the 15 stations
 - mean annual load and mean annual concentration decreased at 11 of the 15 stations
 - discharge, sediment load, and sediment concentration decreased at 5 of the 15 stations
- At the 90% confidence limits,
 - No stations showed a decreasing trend in discharge
 - 8 stations showed a statistically significant decreasing trend in both annual mean load and annual mean suspended sediment concentration.



Trends in Streamflow and Precipitation: Illinois River



Illinois River Conservation Reserve Enhancement Program (CREP)

- Joint federal/state program with the goal of improving water quality and wildlife habitat in the Illinois River Basin
- Voluntary program
- Land retirements, easements & conservation practices
- The two main goals are:
 1. “Reduce the amount of silt and sedimentation entering the mainstem of the Illinois River by 20 percent.”
 2. “Reduce the amount of phosphorous and nitrogen in the Illinois River by 10 percent.”

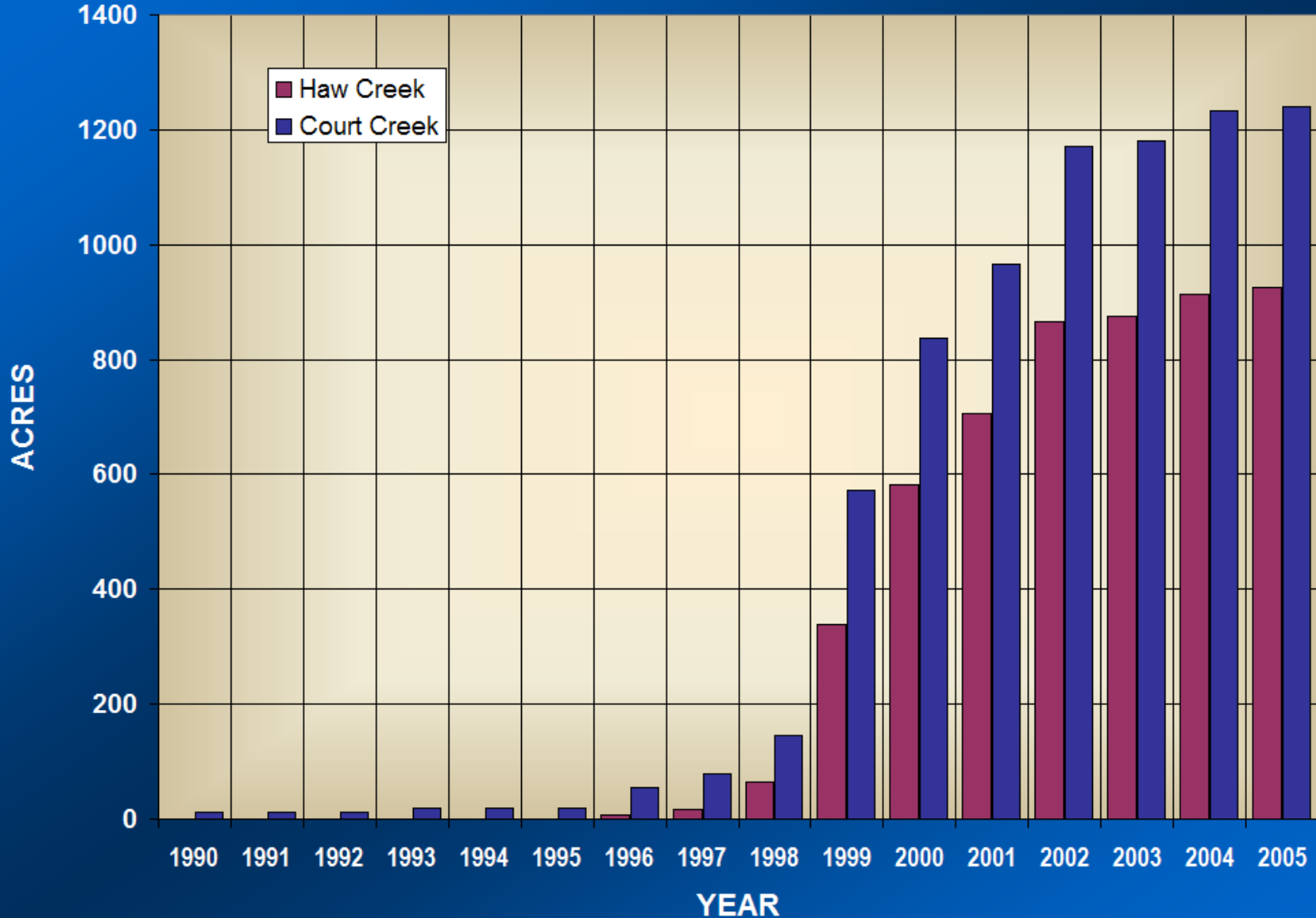


CREP Programs

- USDA-FSA Program (Federal)
 - Eligible acres enroll for 15-year conservation easements
- Illinois state option
 - Extend federal contract to 15-year, 35-year, or permanent conservation easements
- Eligible agricultural land
 - Within 100-year floodplain
 - Highly erodible land (HEL) with erodibility index ≥ 12 adjacent to riparian areas
 - Wetlands farmed under natural conditions or prior converted wetlands



CREP Contracts for Court and Haw Creeks in the Spoon River Watershed



Evaluation Methods

- *Monitor selected watersheds for changes in:*
 - Land use
 - Streamflow
 - Sediment transport
 - Nutrient transport
- *Develop tools to assess and evaluate the effectiveness of CREP in reducing sediment & nutrient delivery to the Illinois River*
 - Development of watershed models
 - Sediment and nutrient budgets
 - Statistical tests-analysis of covariance (ANCOVA)

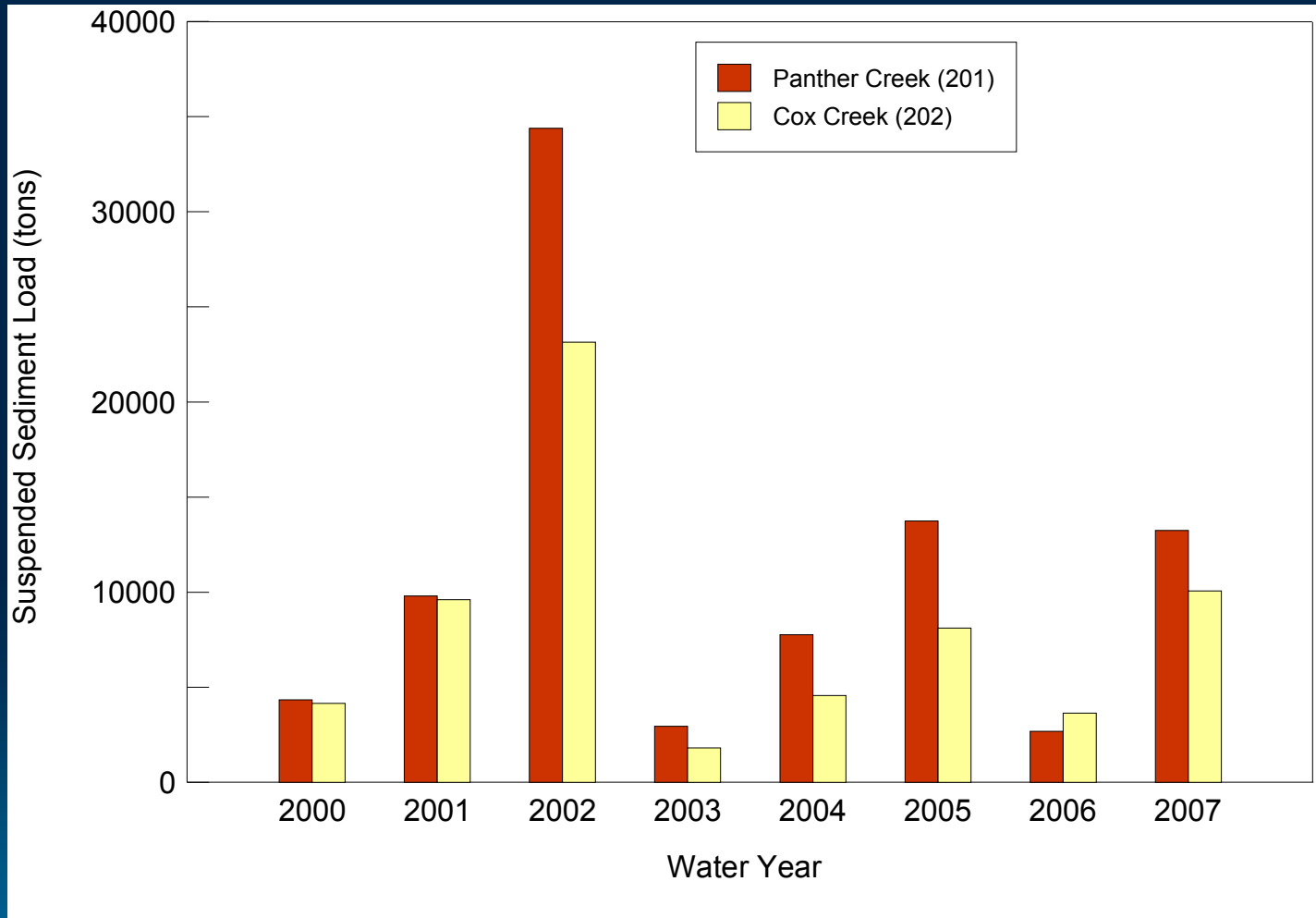


CREP Intensive Monitoring Stations

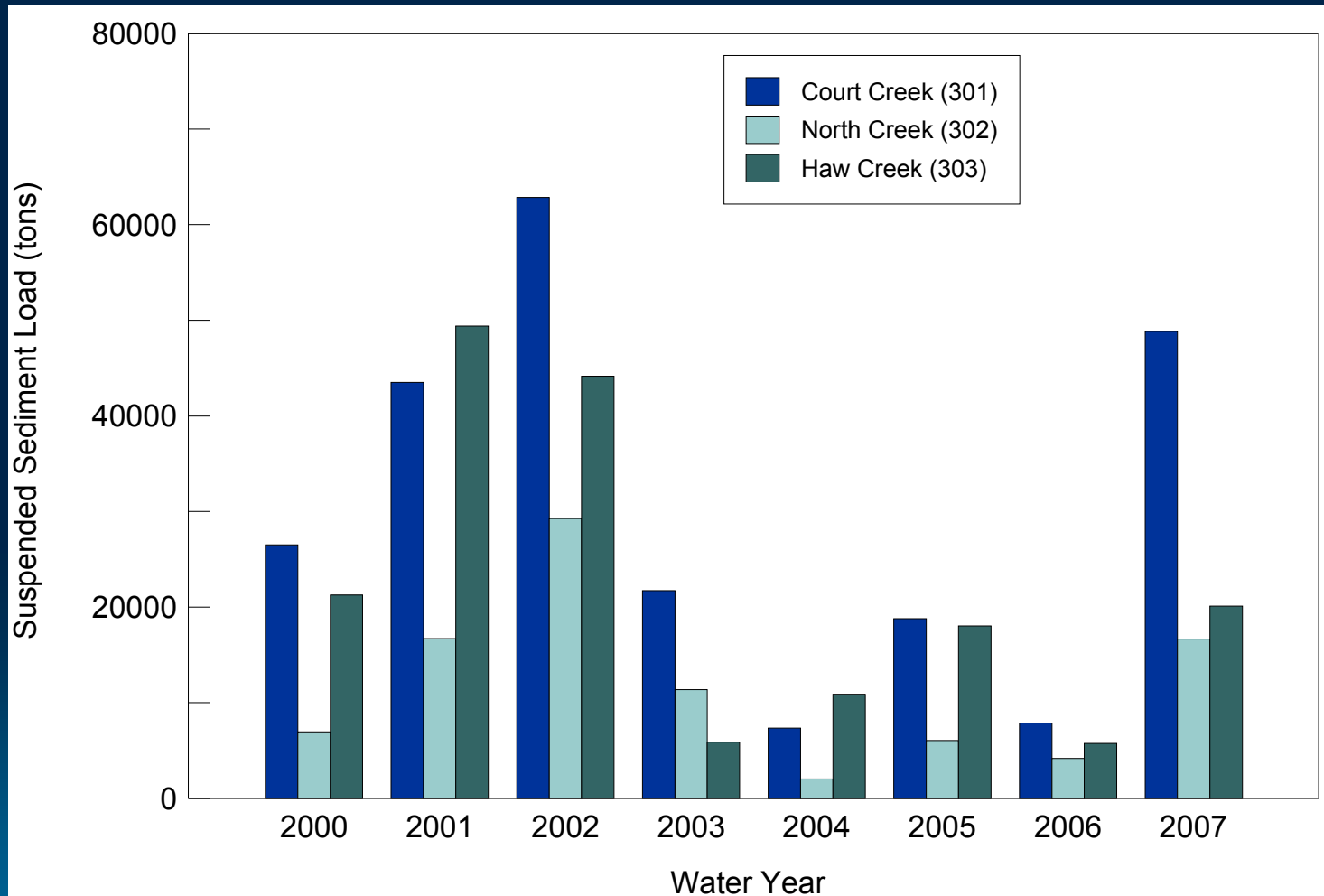
<i>Site ID</i>	<i>Name</i>	<i>Drainage Area</i>
Spoon River		
301	Court Creek	66.4 sq mi / 172 sq km
302	North Creek	26.0 sq mi / 67.4 sq km
303	Haw Creek	55.2 sq mi / 143 sq km
305	Swan Creek	98.1 sq mi / 254 sq km
306	Cedar Creek	146.2 sq mi / 379 sq km
Sangamon River		
201	Panther Creek	16.5 sq mi / 42.7 sq km
202	Cox Creek	12.0 sq mi / 31.1 sq km



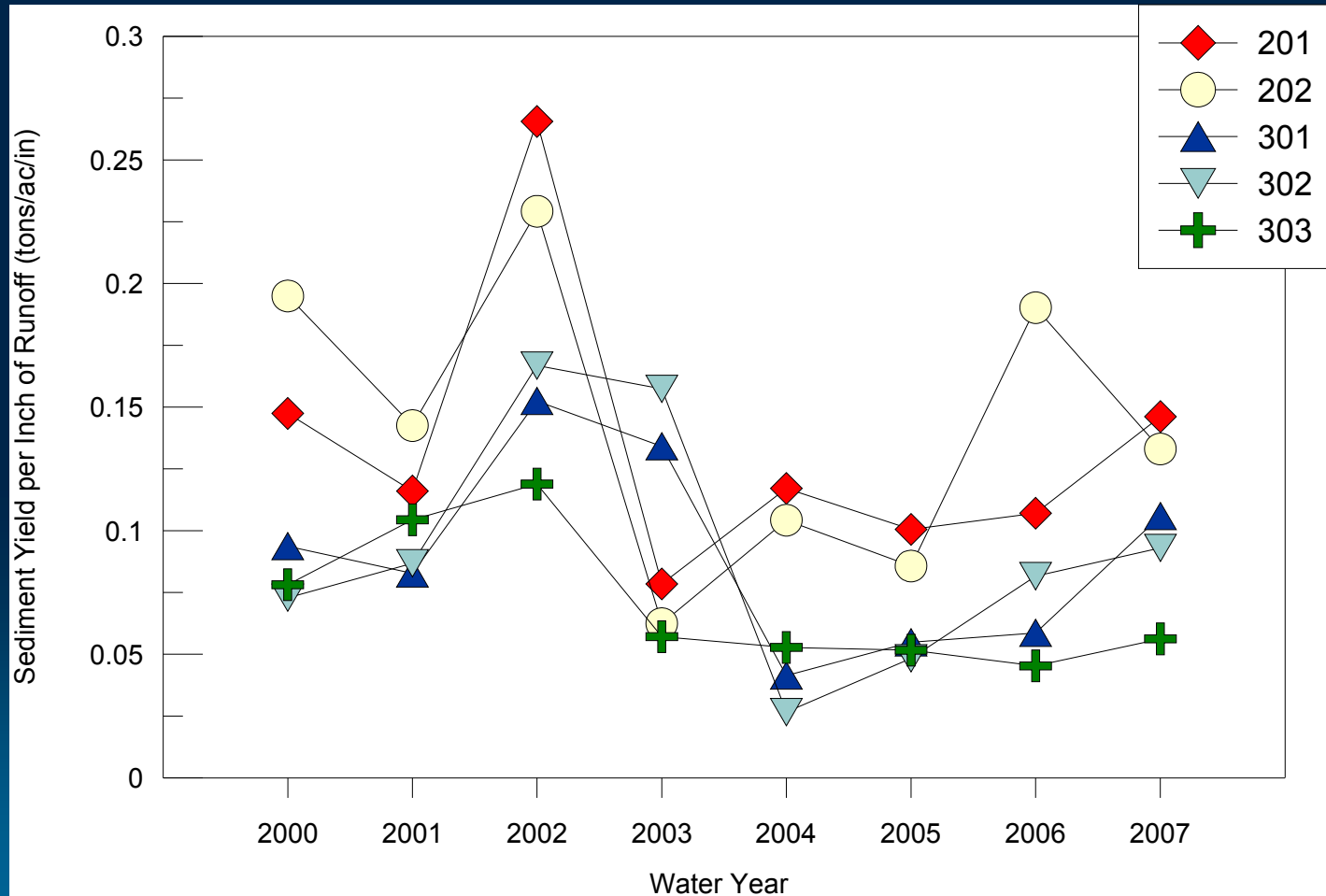
CREP Intensive Monitoring Data



CREP Intensive Monitoring Data



Variability of sediment yield per inch of runoff for CREP monitoring stations



Summary

- Availability of long-term data is extremely useful for assessing changes in watersheds: land use, hydrology, water quality, sediment, and habitat.
- We can document and detect change over time – however, it should be acknowledged that it takes time to see some of these changes and thus quick assessments are not reliable.
- With the collection of the appropriate data and the proper use of watershed models and statistical methods, we can evaluate the effects of watershed projects successfully.





Thank You!

<http://ilrdss.sws.uiuc.edu>

