The Illinois River CREP: Sediment and Nutrient Delivery Assessment

by
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ILLINOIS DEPARTMENT OF NATURAL RESOURCES

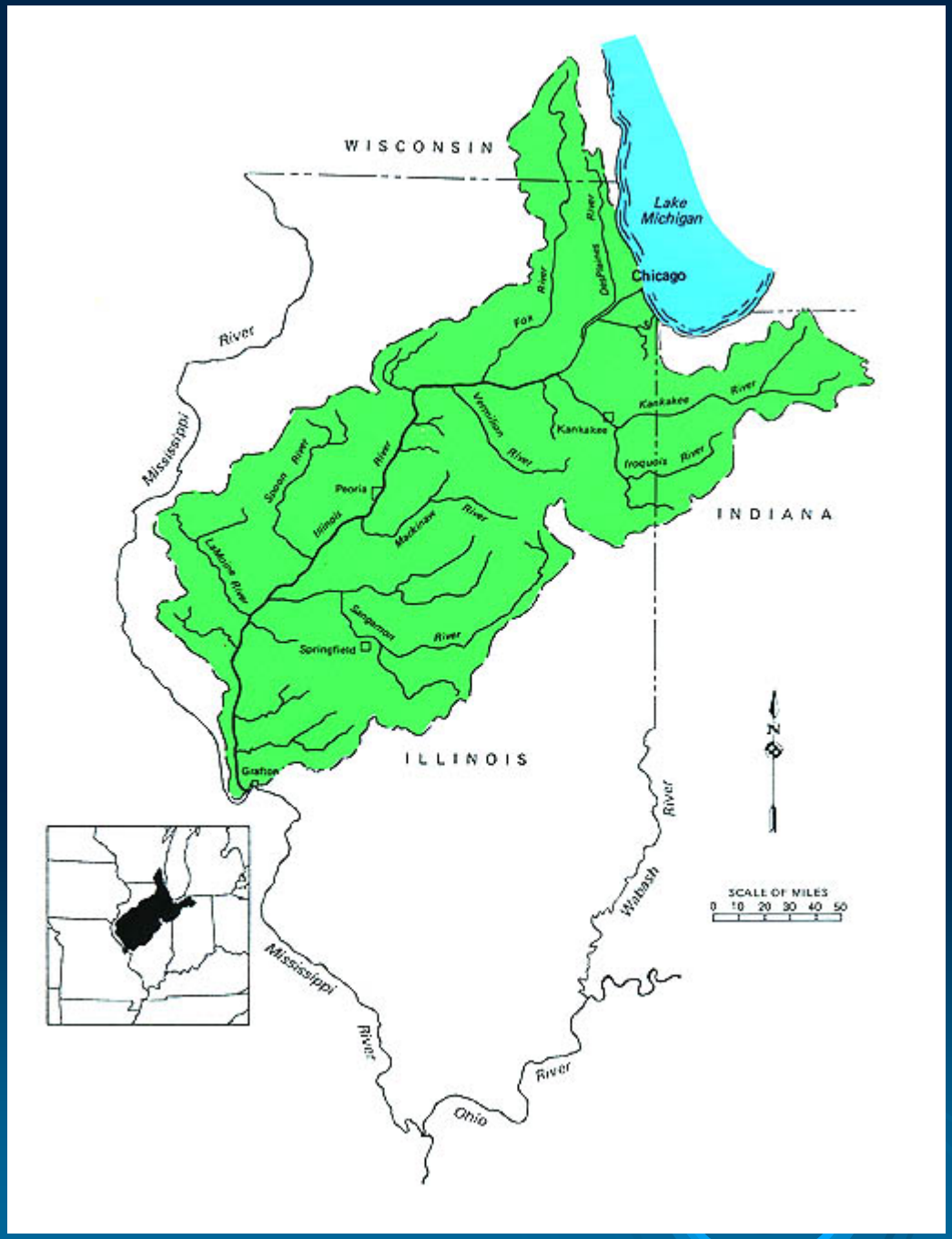
Illinois State WATER SURVEY

Acknowledgments

- *Project Management – IDNR/ORC*
  - Debbie Bruce
  - Richard Mollahan
- *Project Staff – IDNR/SWS*
  - Laura Keefer
  - Amy Russell
  - Jim Slowikowski
  - Kip Stevenson
  - Mike Smith
  - Yanqing Lian
  - Momcilo Markus

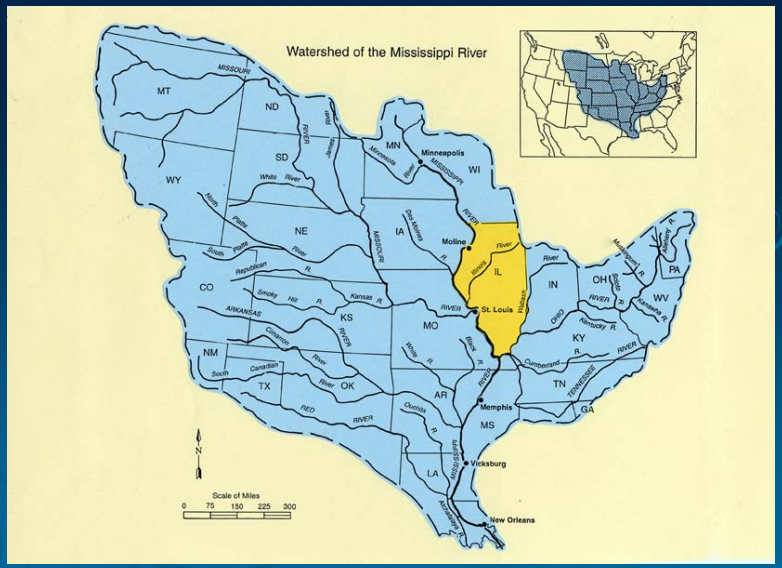
Outline

- Background on the Illinois River
  - Sedimentation issues
- Restoration initiatives
  - CREP
- Evaluation methods
  - Monitoring
  - Modeling
  - Sediment budget
- Summary

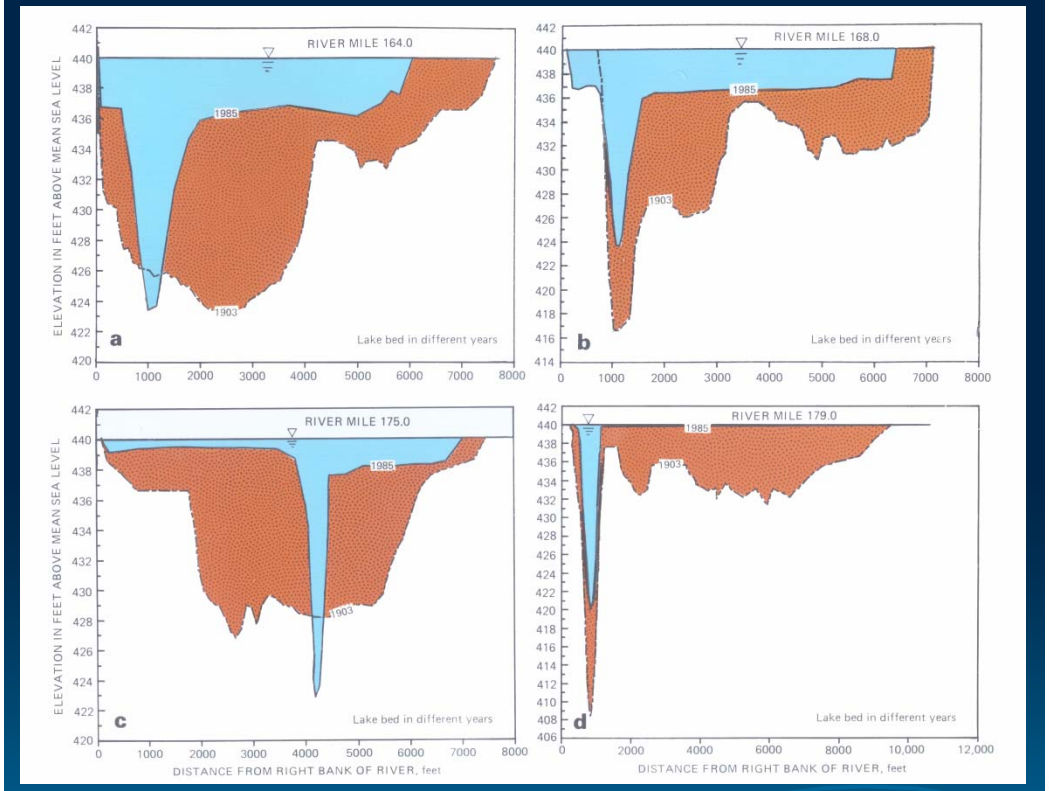


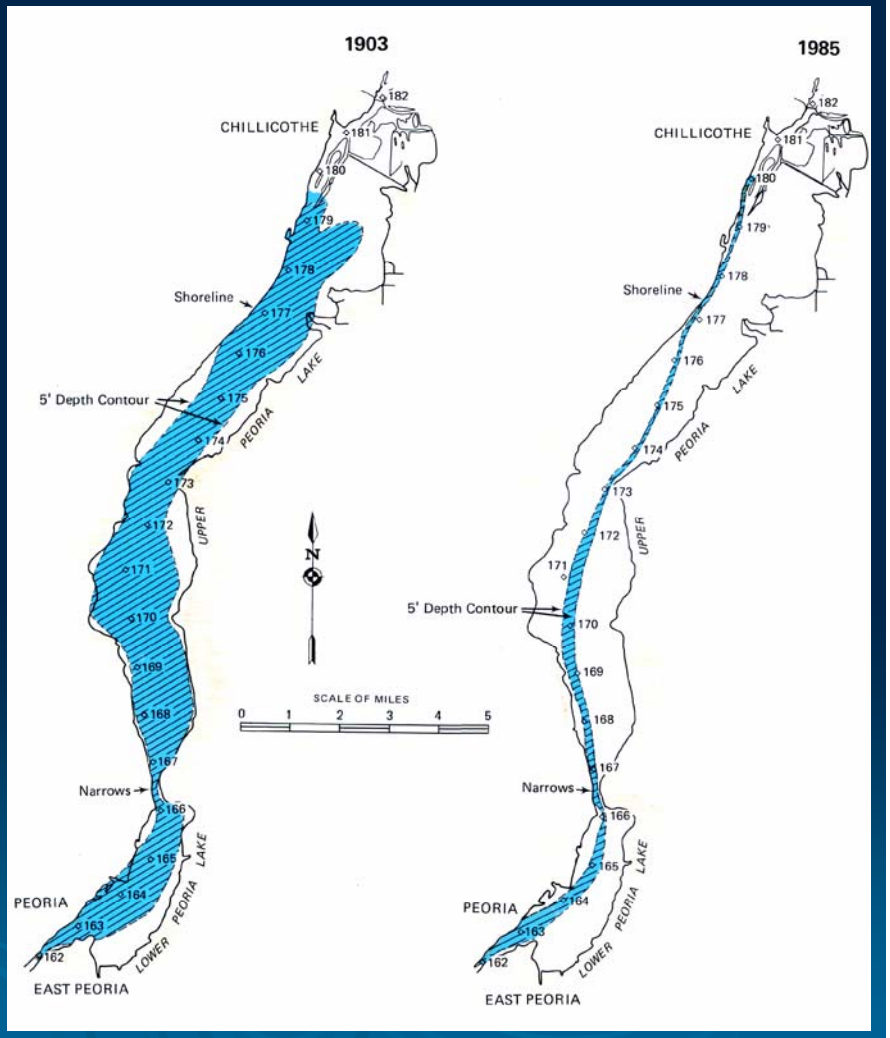
Background

- *Illinois River Issues*
  - Sedimentation
  - Hydrology
  - Water Quality
  - Habitat Degradation



Sedimentation in Peoria Lake





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."

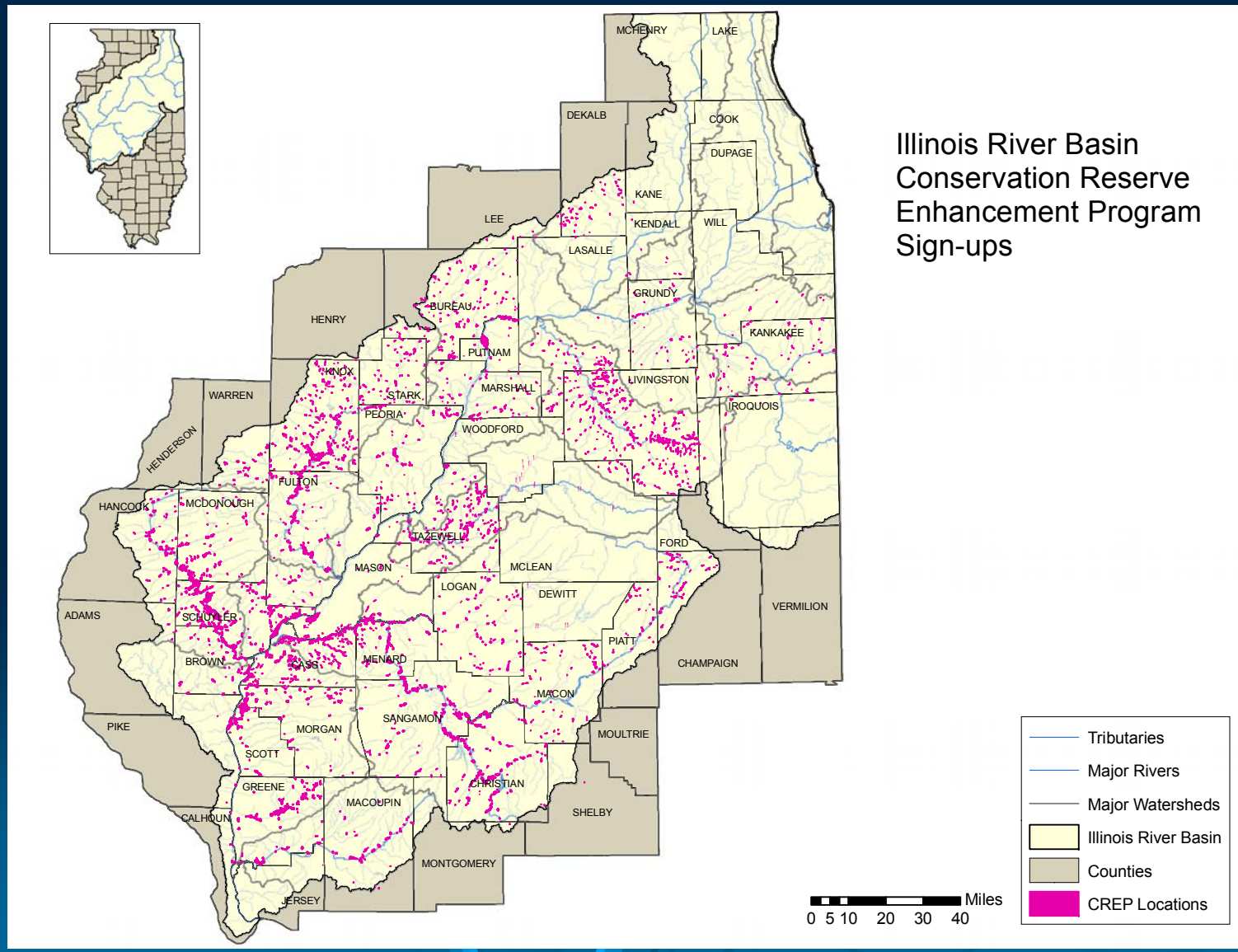
CREP Programs

- 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

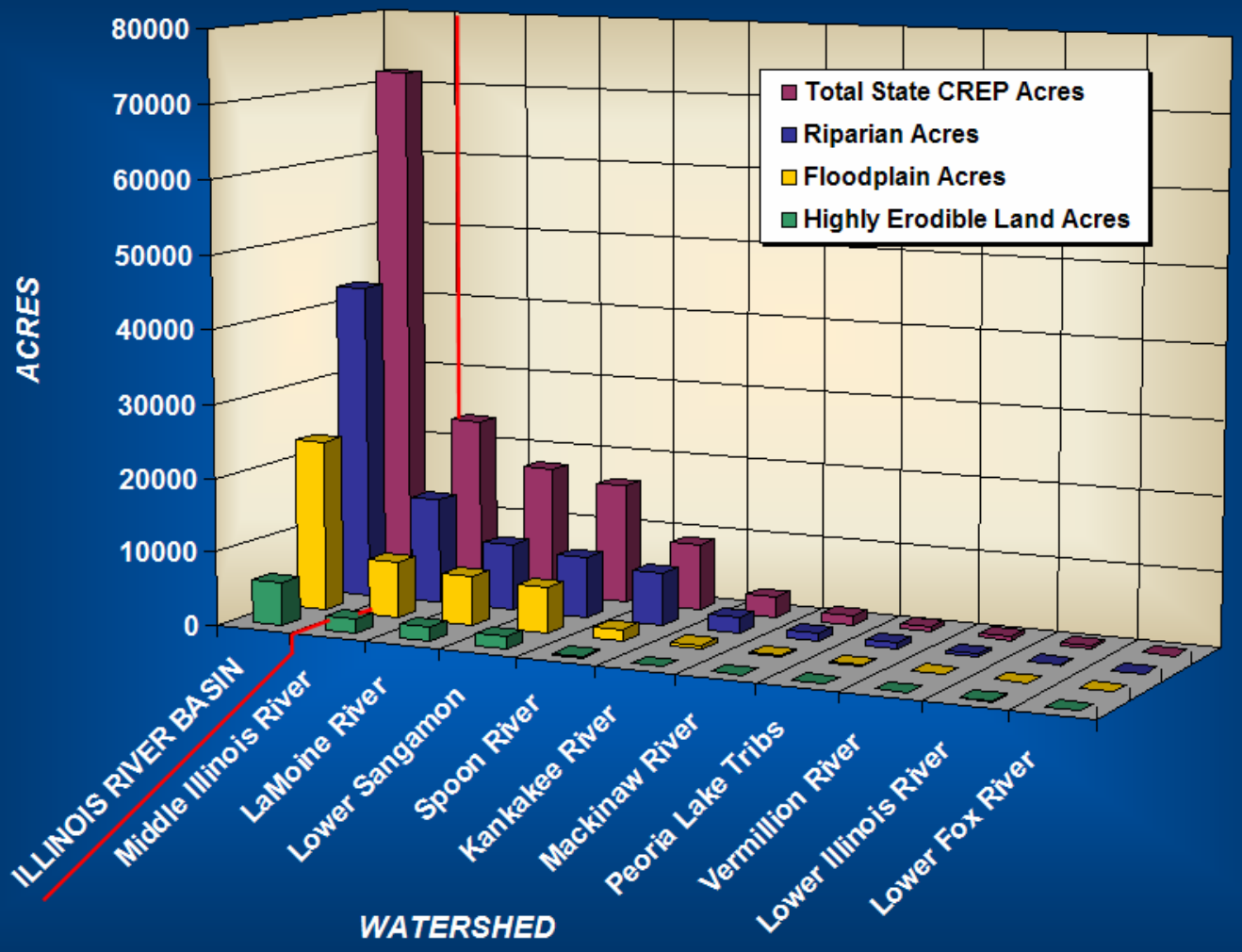
Evaluation Methods

- *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*
  - Sediment and nutrient budgets
  - Development of watershed models
  - Statistical tests and analysis

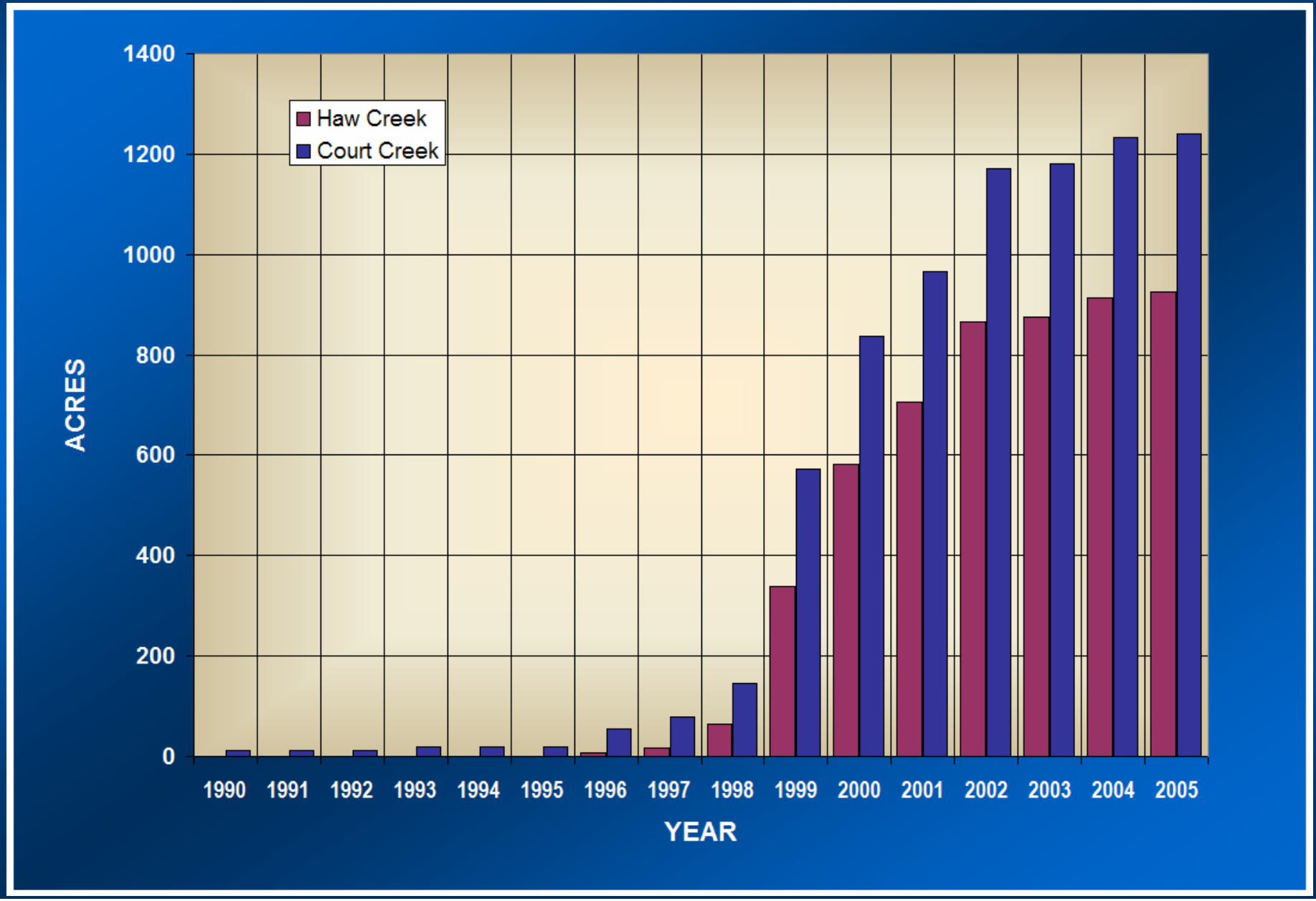
Land Use Changes



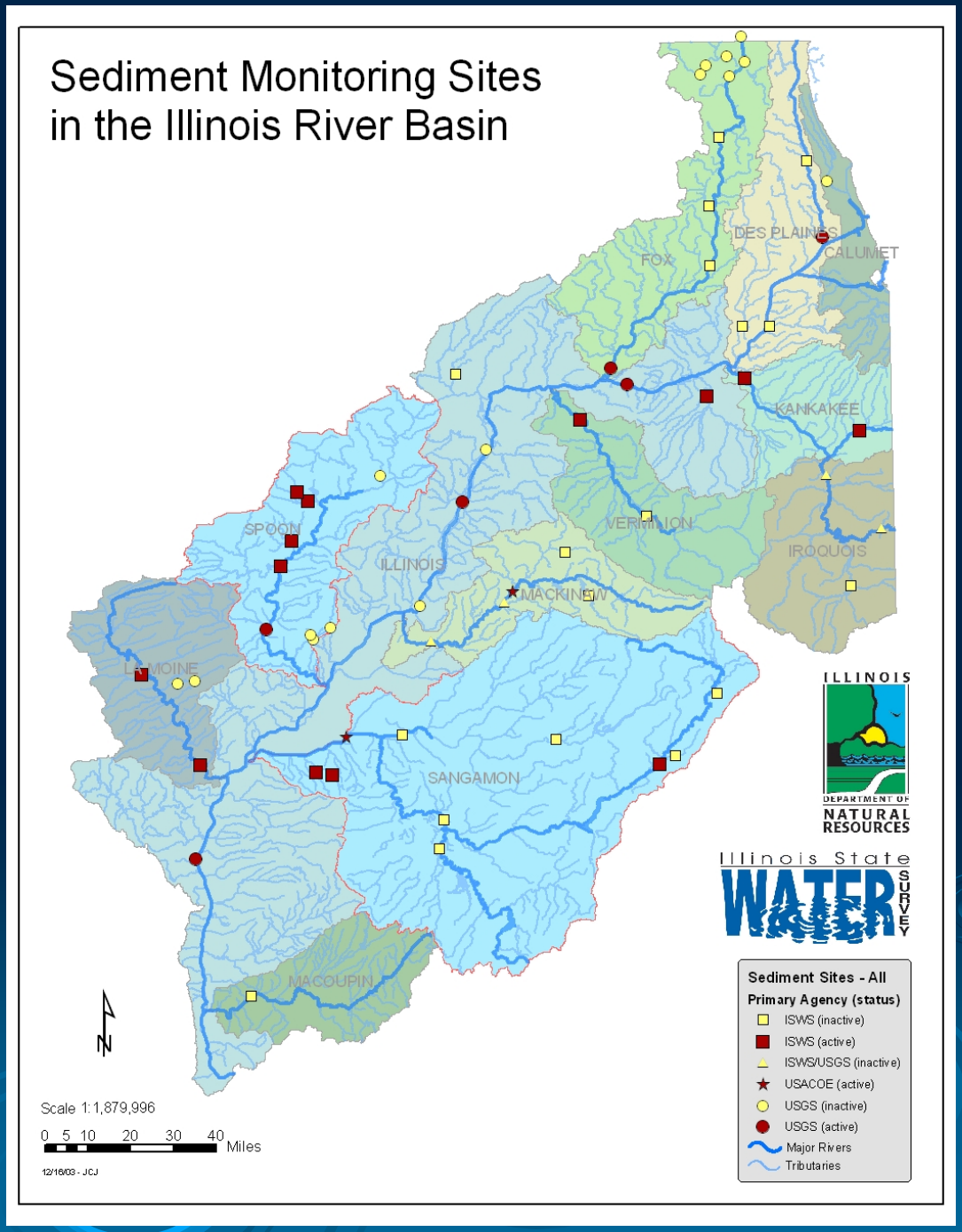
State CREP Contract Distributions



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



Monitoring


Sediment Monitoring Sites
in the Illinois River Basin
DES PLAINES
CALUMET
FOX
KANKAKEE
VERMILION
IROQUOIS
SPOON
ILLINOIS
MACKINAW
LA MOINE
SANGAMON
MACOUPIN
N
Scale 1:1,879,996
0 5 10 20 30 40
Miles
12/16/03 - JCJ
ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES
Illinois State
WATER SURVEY
Sediment Sites - All
Primary Agency (status)
ISWS (inactive)
ISWS (active)
ISWS/USGS (inactive)
USACOE (active)
USGS (inactive)
USGS (active)
Major Rivers
Tributaries

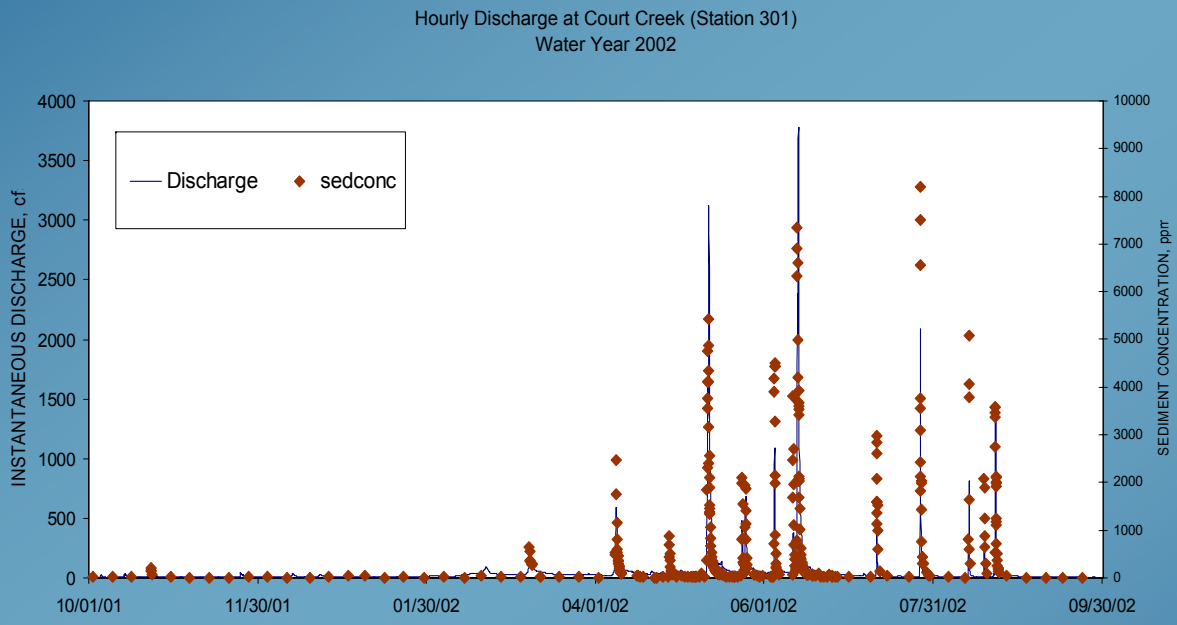
CREP Monitoring Stations

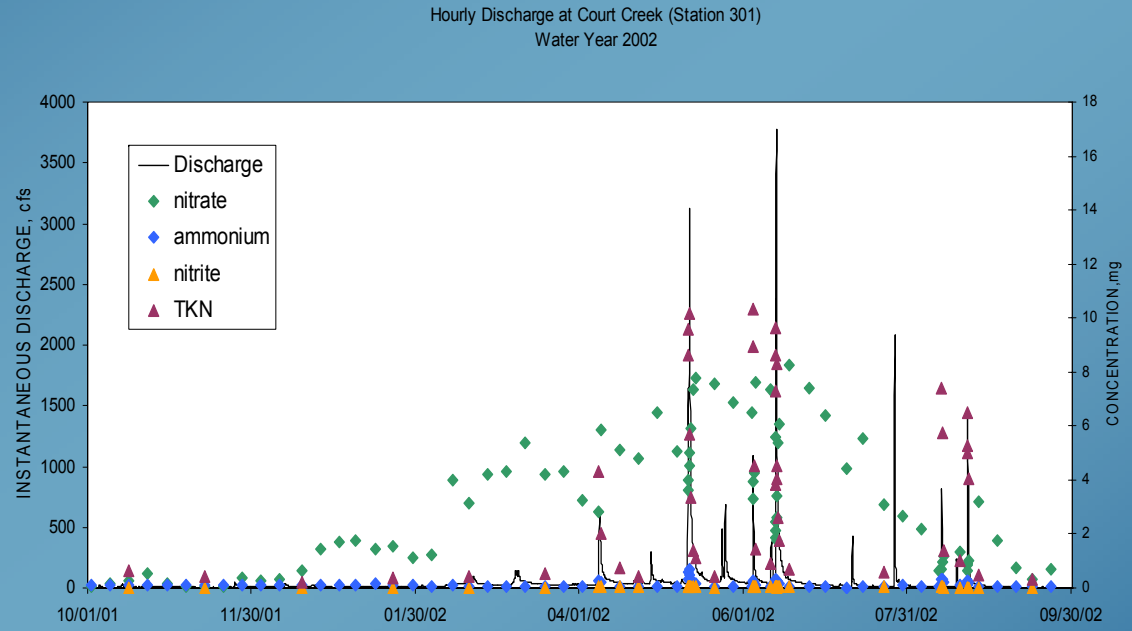
Station ID	*Name*	*Drainage area*	*Watershed*
301	Court Creek	66.4 sq mi (172 sq km)	Spoon River
302	North Creek	26.0 sq mi (67.4 sq km)	Spoon River
303	Haw Creek	55.2 sq mi (143 sq km)	Spoon River
305	Swan Creek	98.1 sq mi (254 sq km)	Spoon River
306	Cedar Creek	146.2 sq mi (379 sq km)	Spoon River
05569500	Spoon River at London Mills	1072 sq mi (2776 sq km)	Spoon River
05570000	Spoon River at Seville	1636 sq mi (4237 sq km)	Spoon River
201	Panther Creek	16.5 sq mi (42.7 sq km)	Sangamon River
202	Cox Creek	12.0 sq mi (31.1 sq km)	Sangamon River

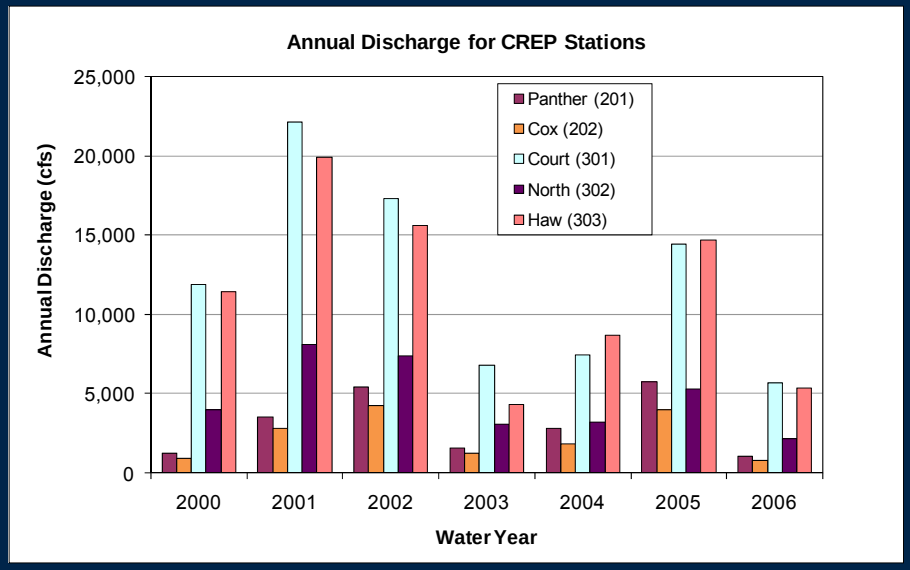
Parameters Analyzed and Frequency of Sampling

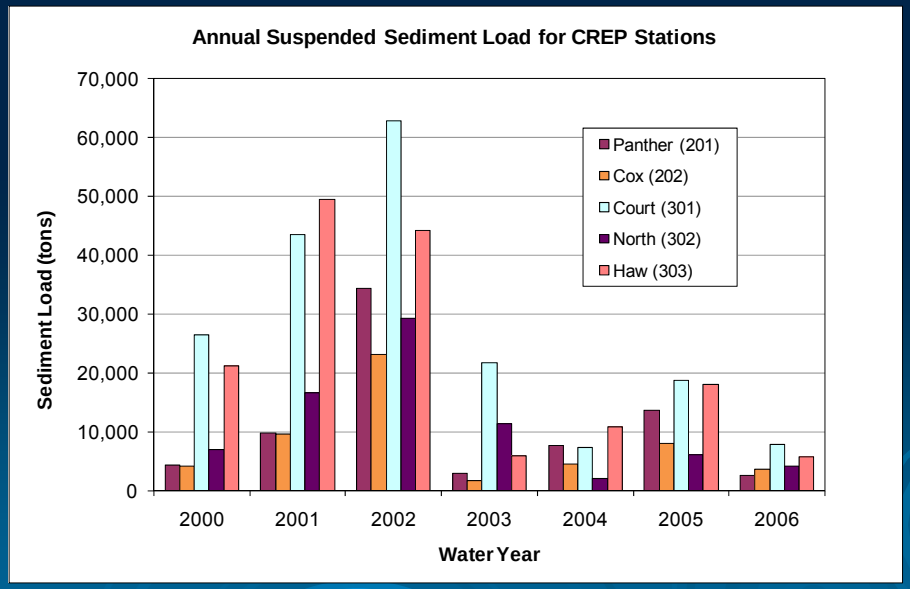
Parameter	*Daily*	*Weekly (Tier I)*	*Monthly (Tier II)*	*During storm events*
Suspended Sediment	*	*	*	*
Nitrate-N		*	*	*
Ammonium-N		*	*	*
Orthophosphate		*	*	*
Nitrite-N			*	*
Total Kjeldahl Nitrogen (TKN)			*	*
Total Phosphorus			*	*
Total dissolved Phosphorus			*	*

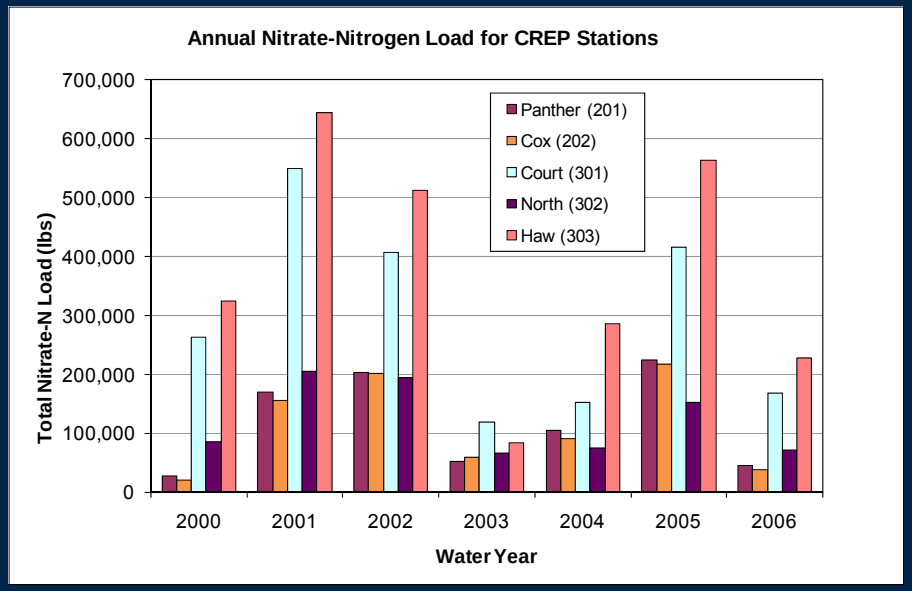
CREP Intensive Monitoring Data

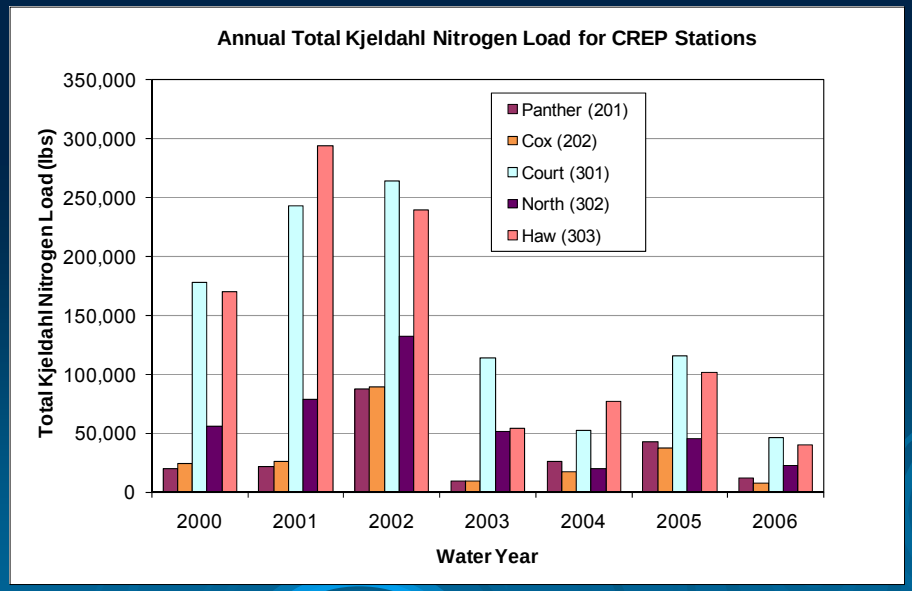


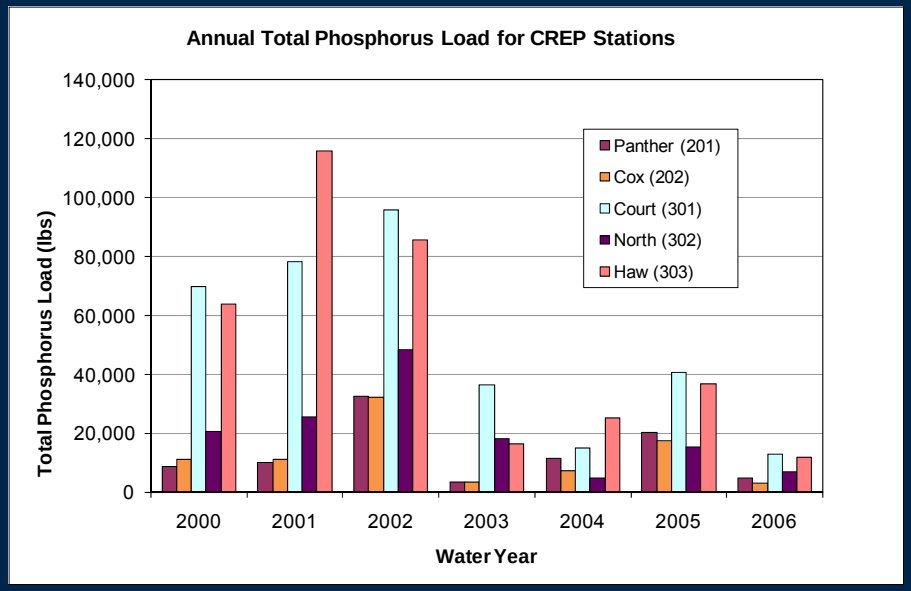


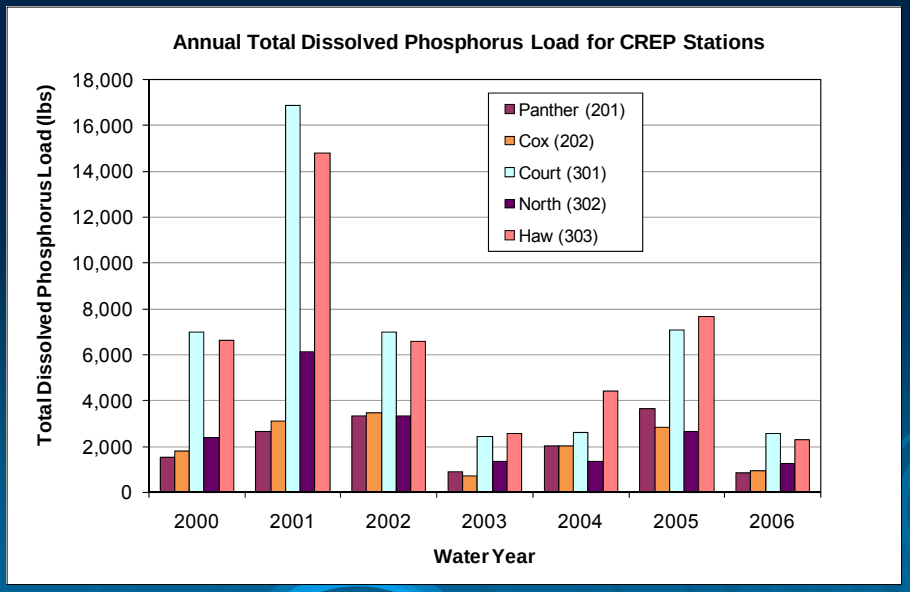

Annual Discharge for CREP Stations
Annual Discharge (cfs)
25,000
20,000
15,000
10,000
5,000
0
2000
2001
2002
2003
2004
2005
2006
Water Year
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

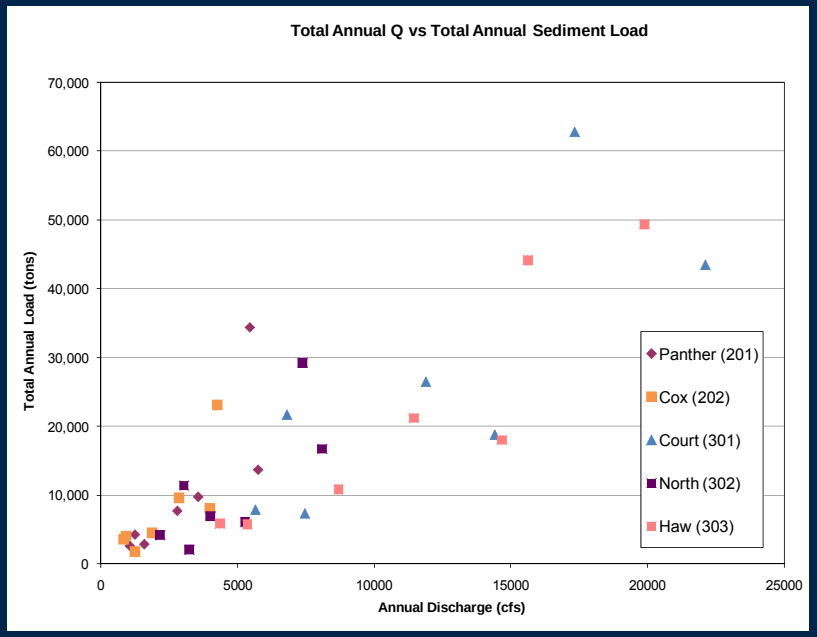

Annual Suspended Sediment Load for CREP Stations
Sediment Load (tons)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2000
2001
2002
2003
2004
2005
2006
Water Year
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

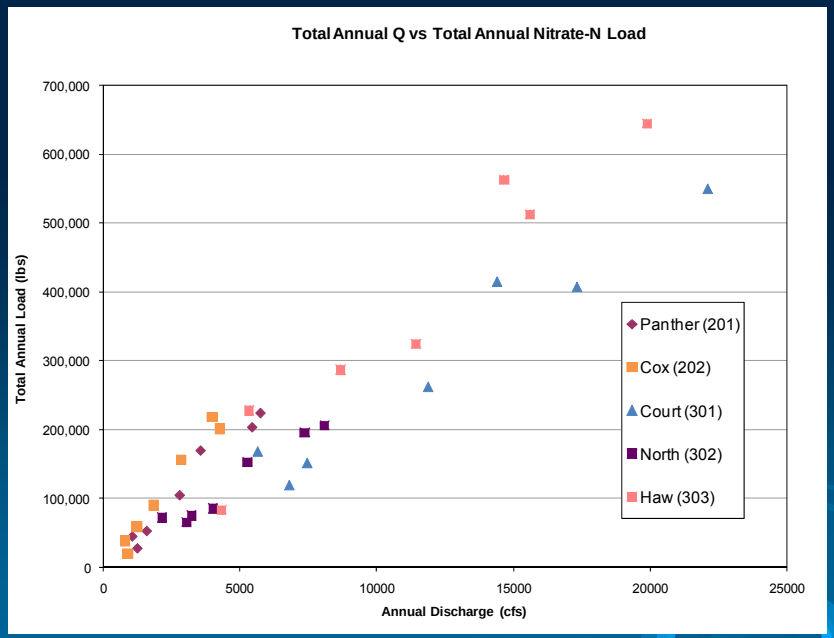

Annual Nitrate-Nitrogen Load for CREP Stations
Total Nitrate-N Load (lbs)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2000
2001
2002
2003
2004
2005
2006
Water Year
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

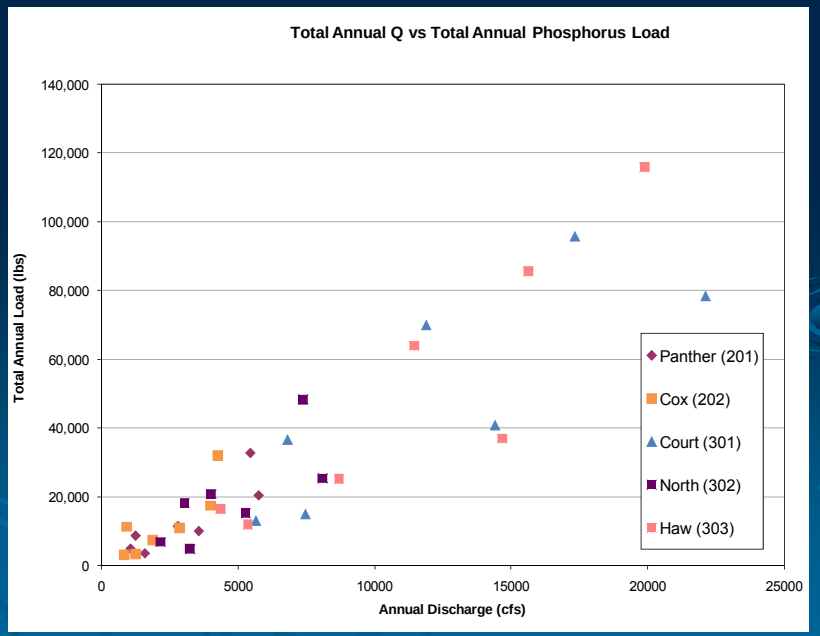

Annual Total Kjeldahl Nitrogen Load for CREP Stations
Total Kjeldahl Nitrogen Load (lbs)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
2000
2001
2002
2003
2004
2005
2006
Water Year
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

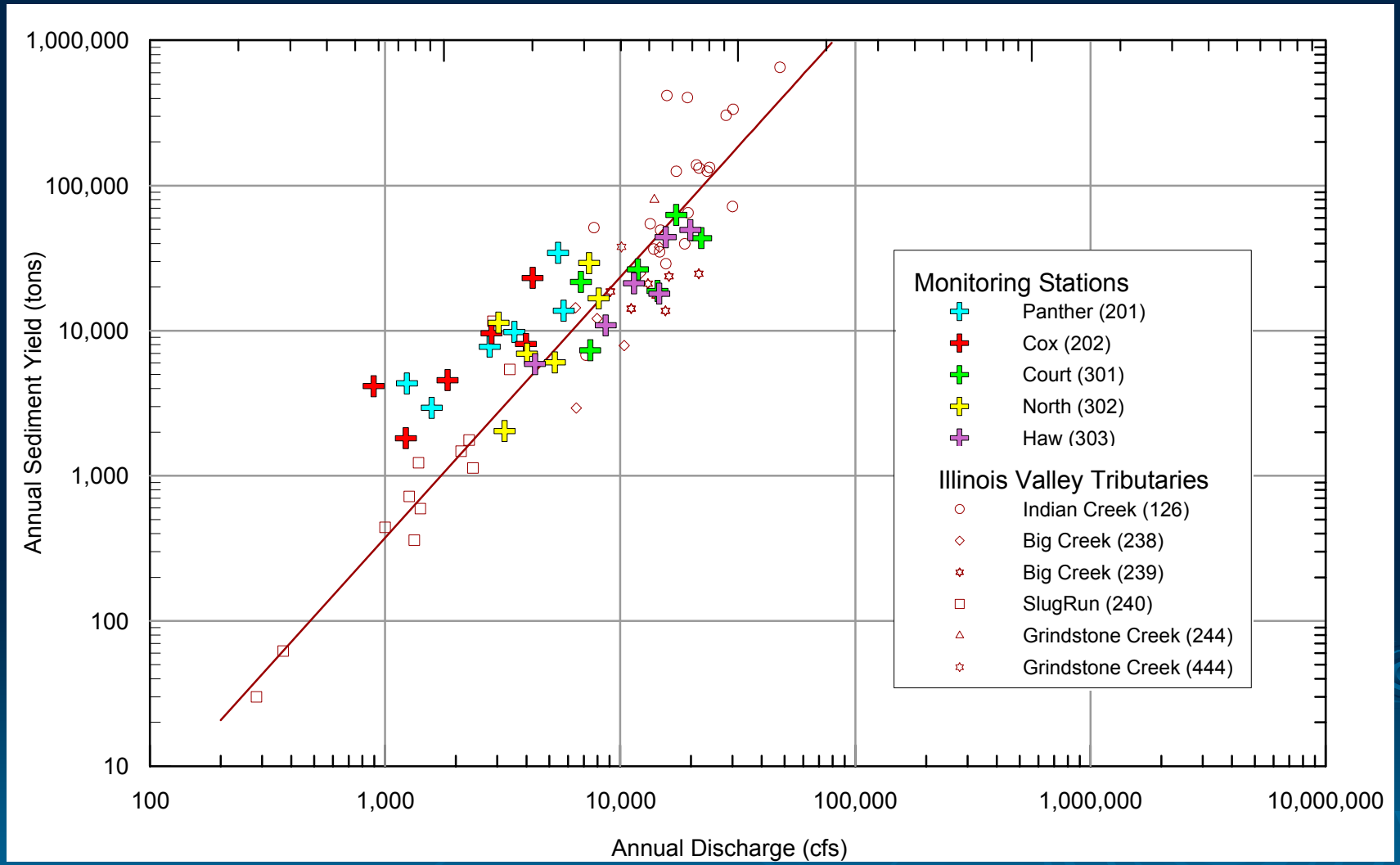

Annual Total Phosphorus Load for CREP Stations
Total Phosphorus Load (lbs)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
2000
2001
2002
2003
2004
2005
2006
Water Year
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)


Annual Total Dissolved Phosphorus Load for CREP Stations
Total Dissolved Phosphorus Load (lbs)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2000
2001
2002
2003
2004
2005
2006
Water Year
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

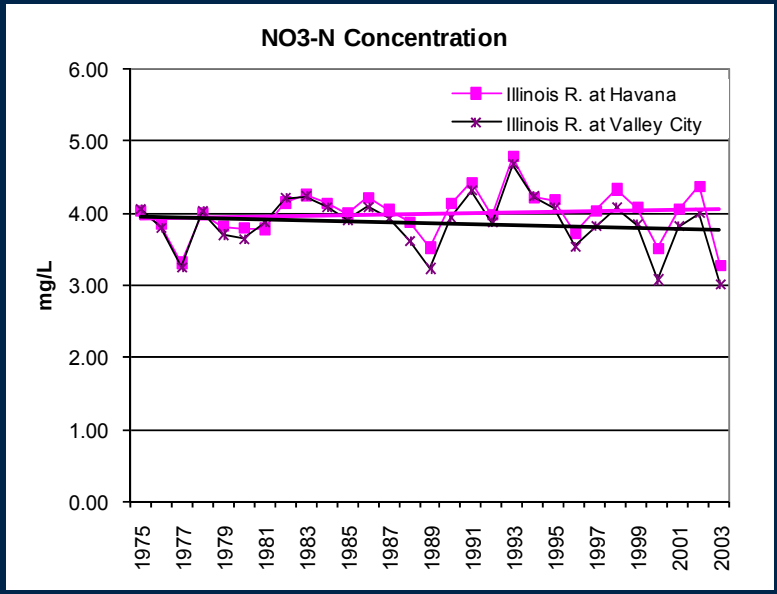

Total Annual Q vs Total Annual Sediment Load
Total Annual Load (tons)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
0
5000
10000
15000
20000
25000
Annual Discharge (cfs)
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

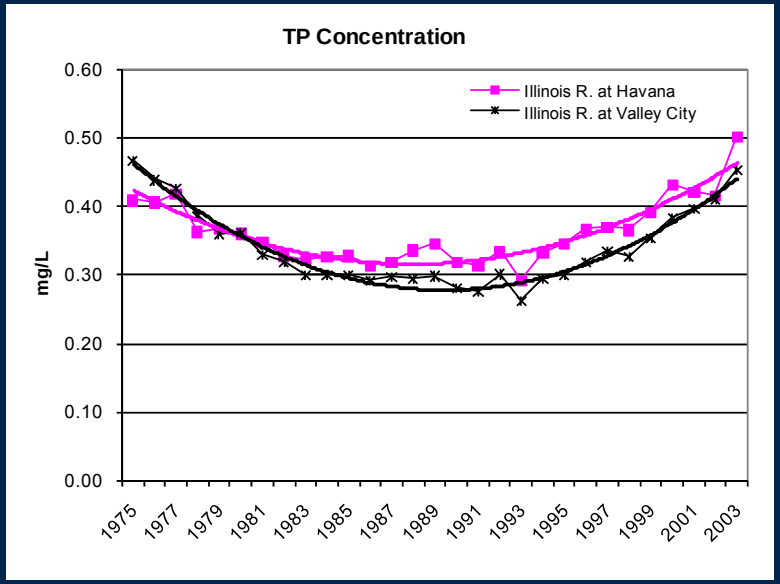

Total Annual Q vs Total Annual Nitrate-N Load
Total Annual Load (lbs)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
0
5000
10000
15000
20000
25000
Annual Discharge (cfs)
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

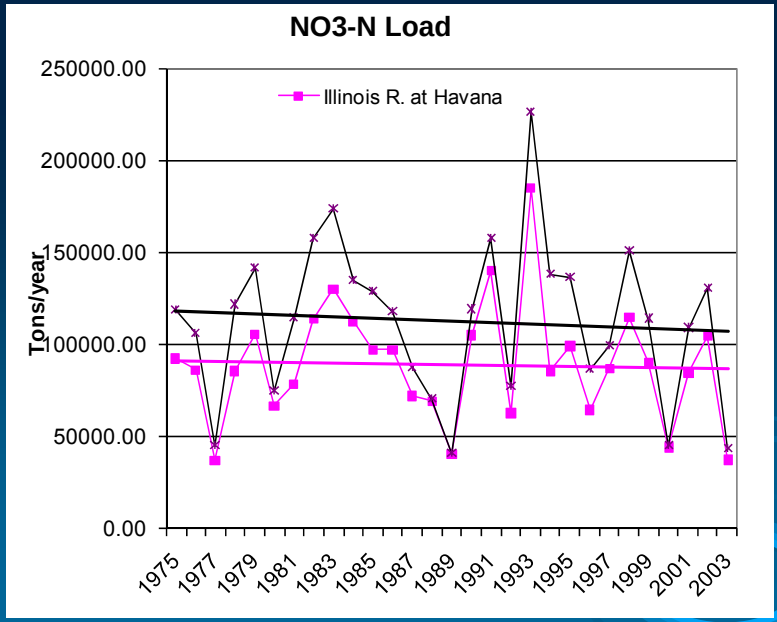

Total Annual Q vs Total Annual Phosphorus Load
Total Annual Load (lbs)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
0
5000
10000
15000
20000
25000
Annual Discharge (cfs)
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)

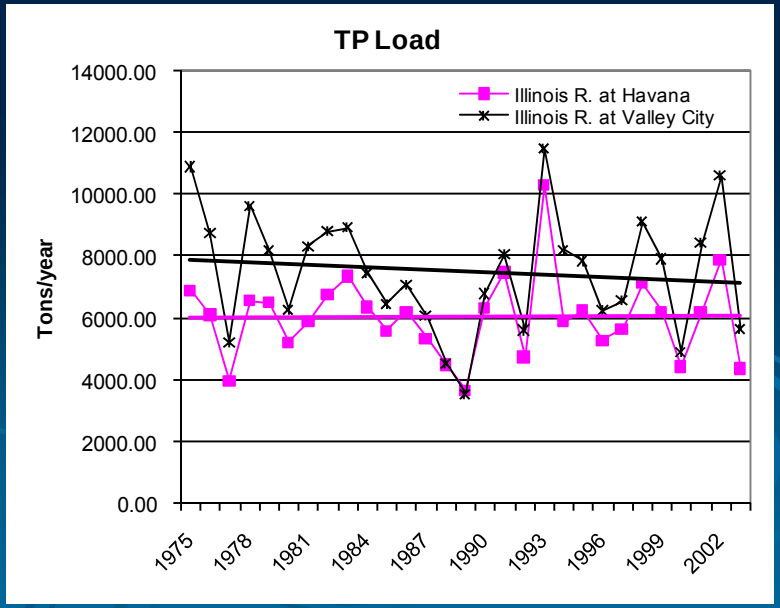

1,000,000
100,000
10,000
1,000
100
10
Annual Sediment Yield (tons)
100
1,000
10,000
100,000
1,000,000
10,000,000
Annual Discharge (cfs)
Monitoring Stations
Panther (201)
Cox (202)
Court (301)
North (302)
Haw (303)
Illinois Valley Tributaries
Indian Creek (126)
Big Creek (238)
Big Creek (239)
SlugRun (240)
Grindstone Creek (244)
Grindstone Creek (444)

Illinois River

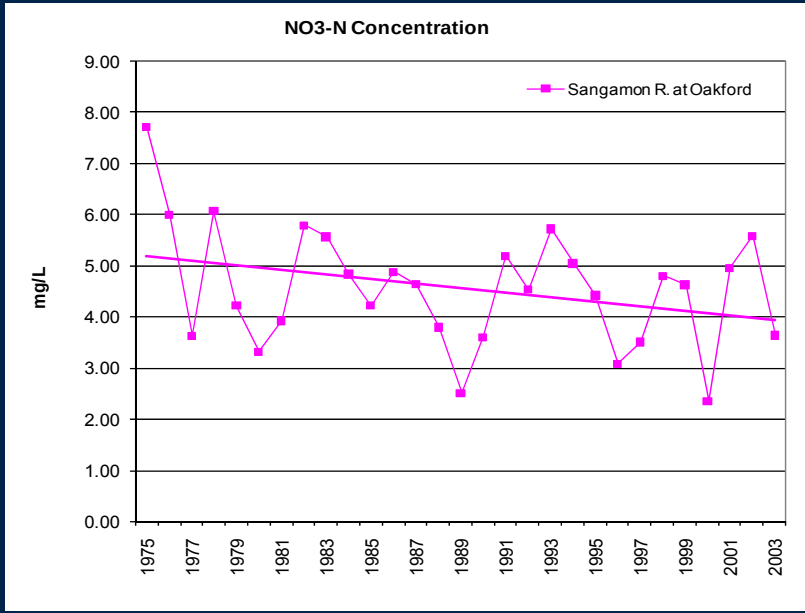


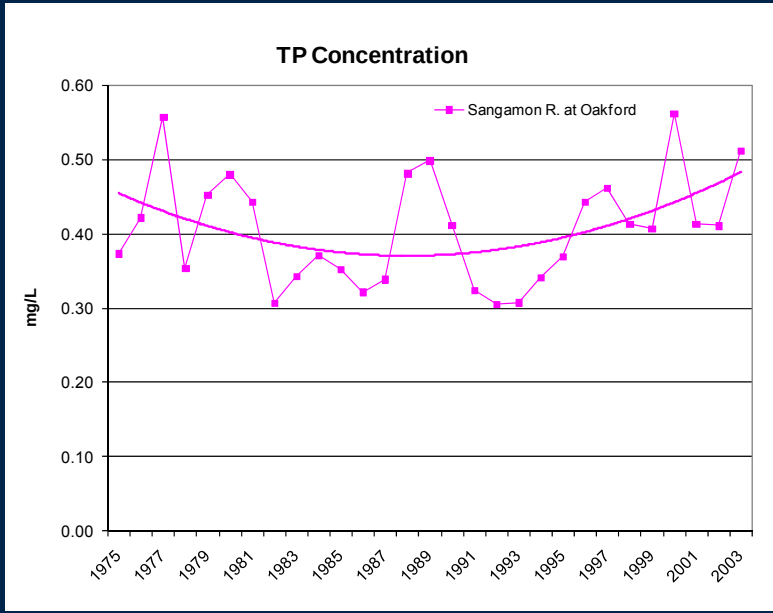


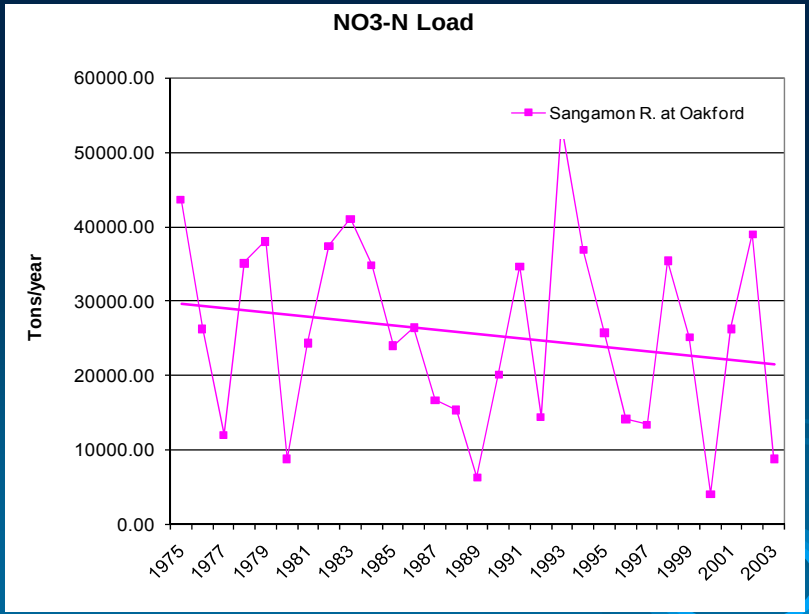


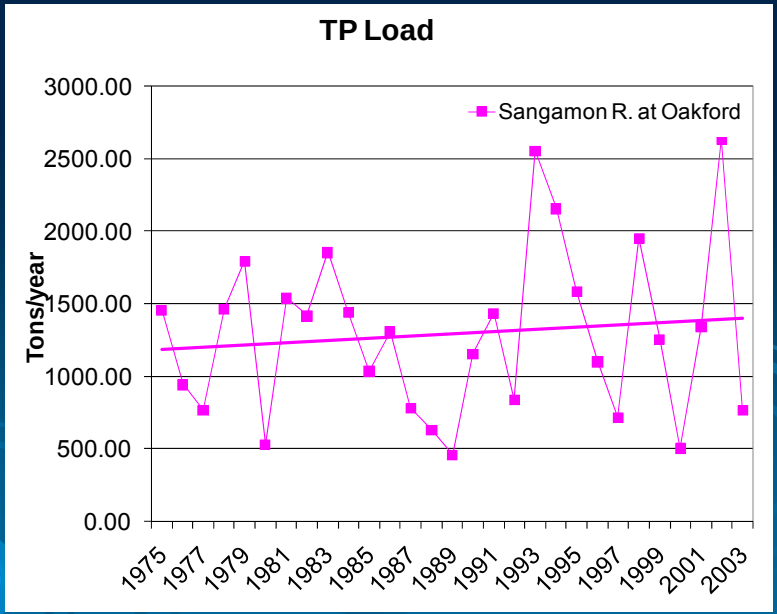


Sangamon River

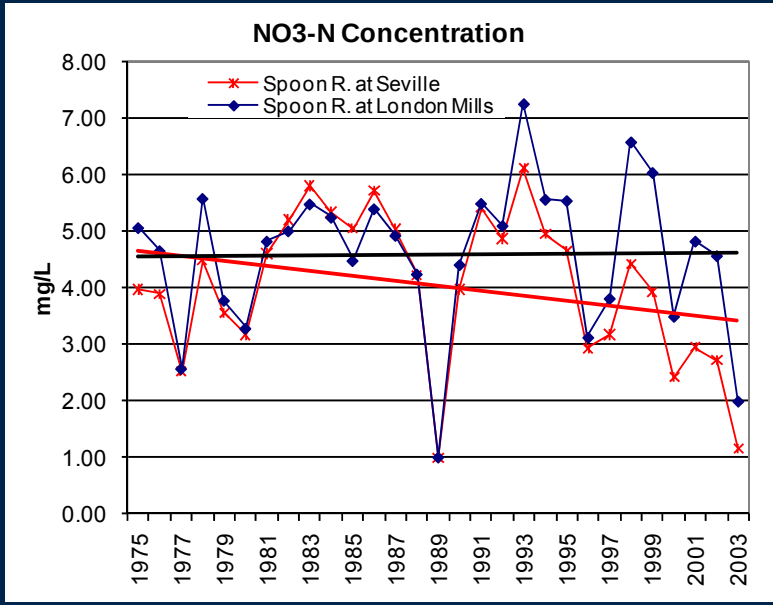


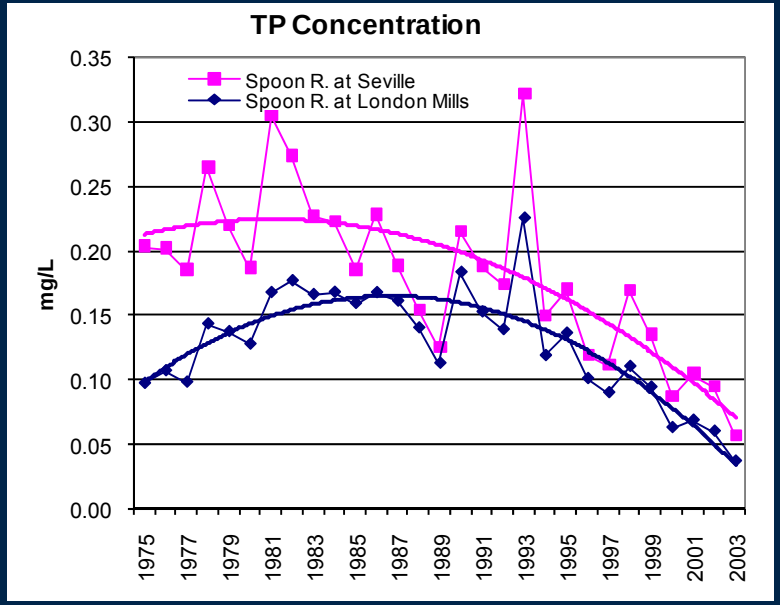


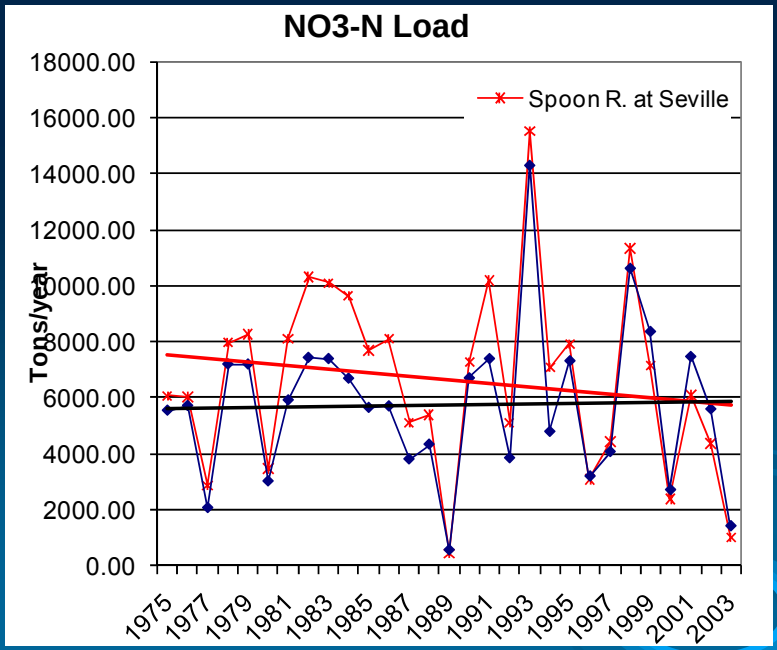


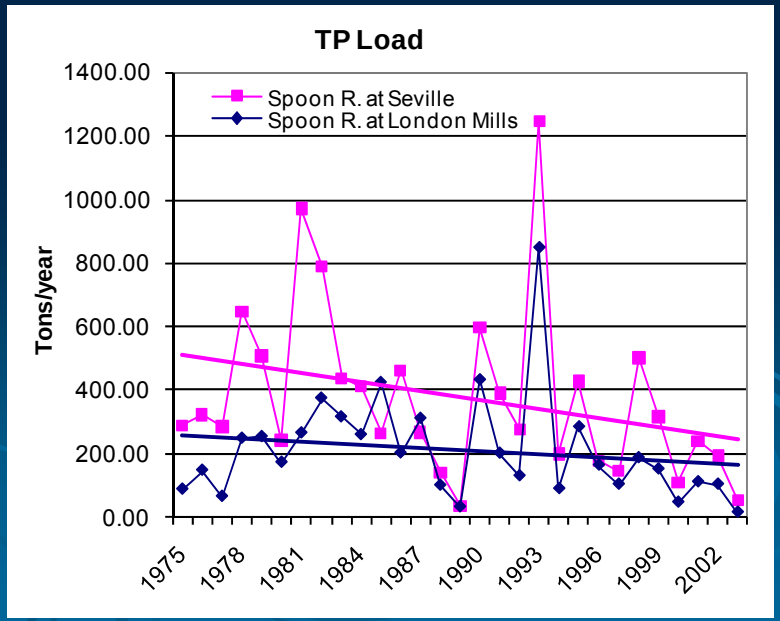


Spoon River


NO3-N Concentration
Spoon R. at Seville
Spoon R. at London Mills
mg/L
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003


TP Concentration
Spoon R. at Seville
Spoon R. at London Mills
mg/L
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003

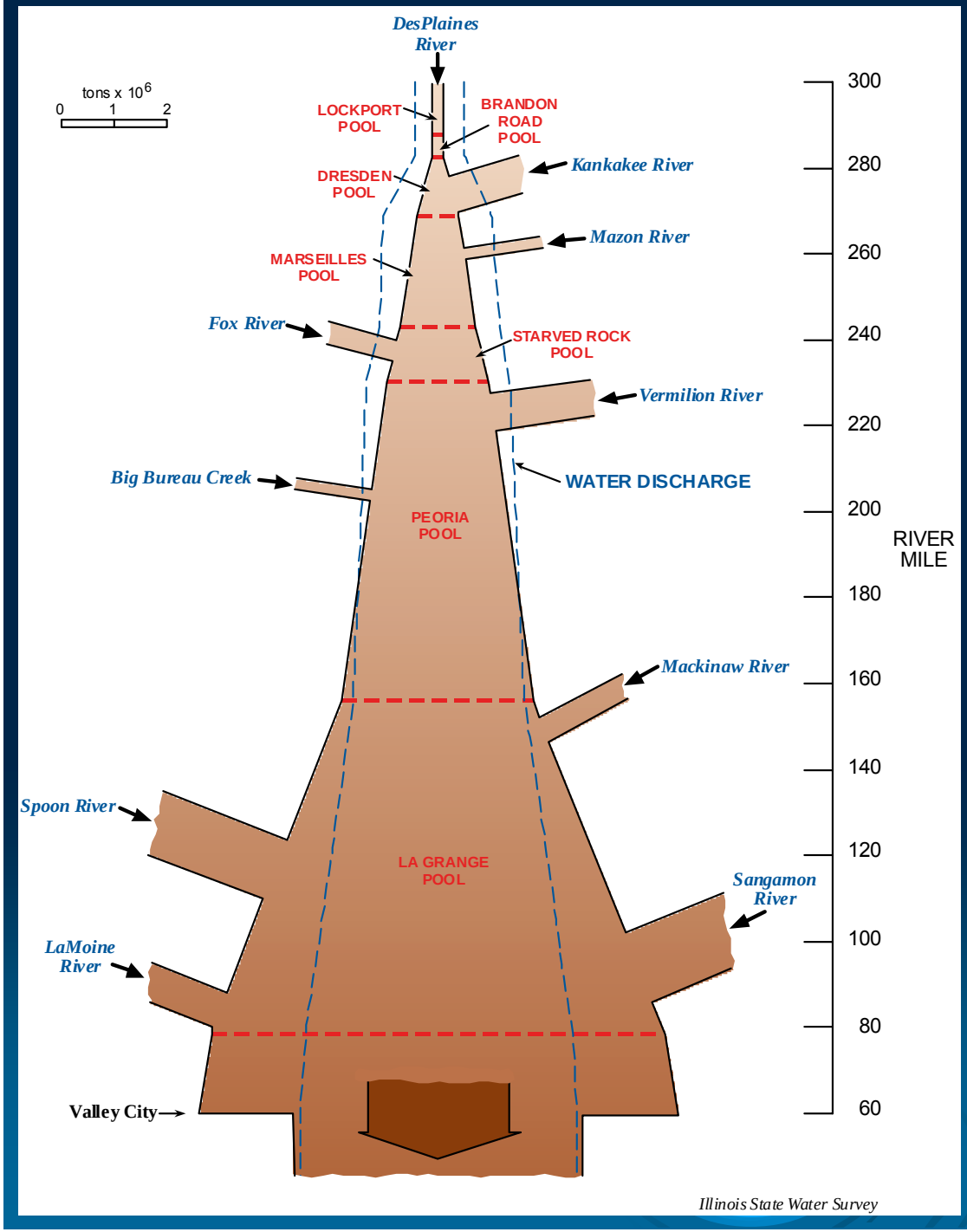

NO3-N Load
Spoon R. at Seville
Tons/year
18000.00
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003


TP Load
Spoon R. at Seville
Spoon R. at London Mills
Tons/year
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002

Summary

- In the long term, CREP is the best restoration program under implementation for the Illinois River basin.
- 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.

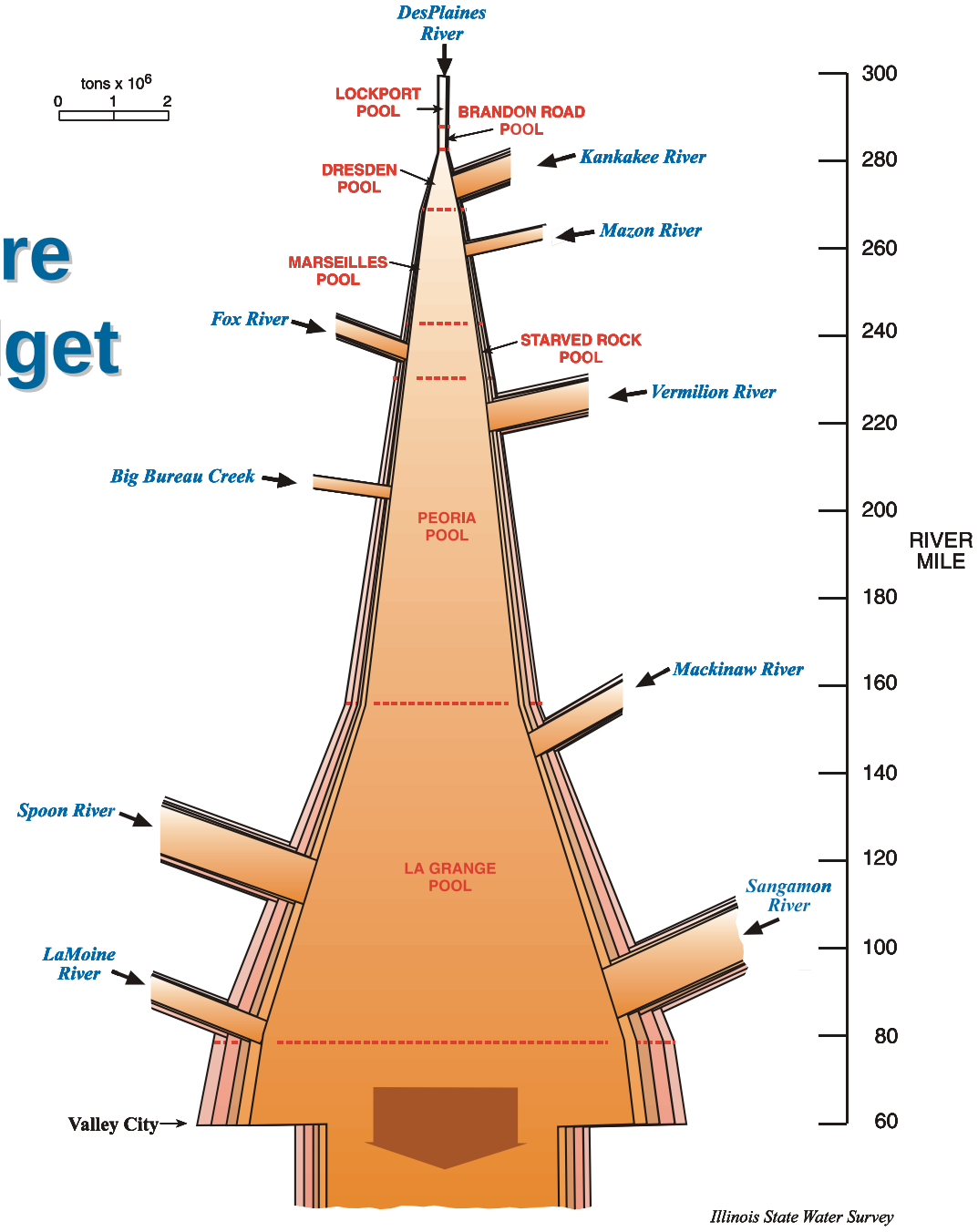

GMC



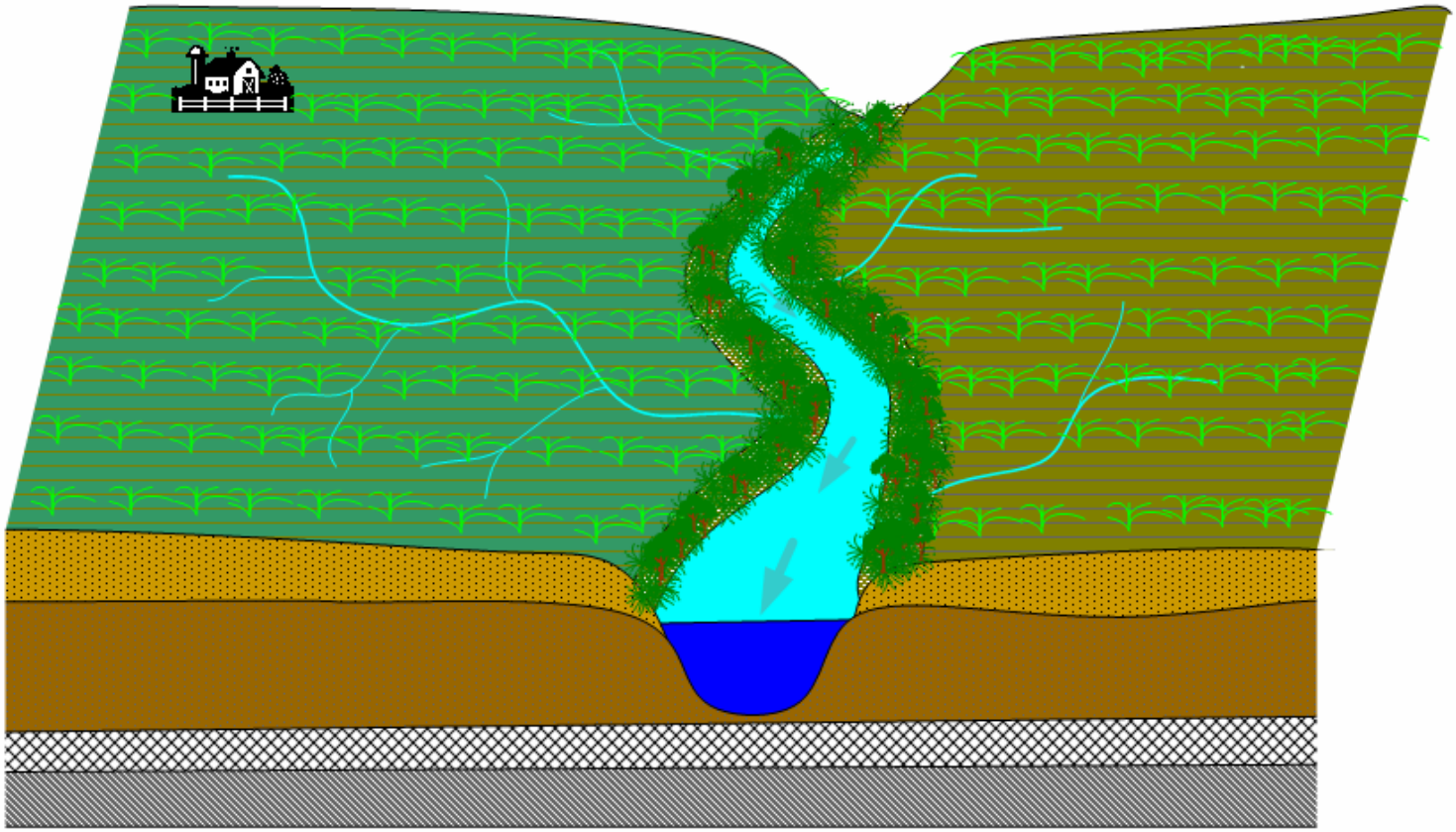
Sediment Budget of the Illinois River (1981-2000)

- Average annual sediment delivery to the Illinois River valley –*11.0 million tons*
- Average annual sediment discharge at Valley City – *4.9 million tons*
- Average annual sedimentation – *6.1 million tons*
- Percent deposited – *55%*
- The Spoon and La Moine Rivers had the highest sediment yield rates for the period of analysis.

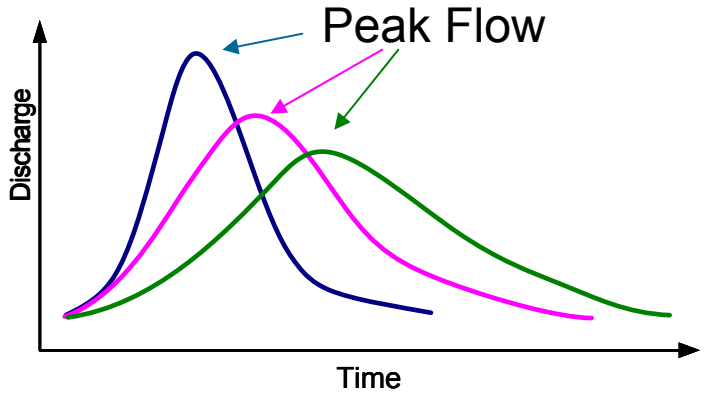
Potential Future Sediment Budget Scenarios



Influence of Floodplain & Riparian Corridor on Stream Hydraulics



Flow Hydrographs



Restoration Initiatives

1997 – Integrated Management Plan for the Illinois River Basin (State of Illinois, Office of the Lieutenant General)

1998 – Illinois River CREP (USDA & State of Illinois)

2000 – Illinois River Basin Ecosystem Restoration Project (USCOE & State of Illinois)

Model Development

- Hydrologic model developed for the entire Illinois River Basin
- Sediment and nutrient transport models under development for the Spoon River watershed
- Once the models are fully developed, apply the models to evaluate impacts of conservation practices on Illinois River basin hydrology, sediment and nutrient transport

Illinois River Restoration

- Integrated Management Plan for the Illinois River Watershed (Stakeholds led)
- Conservation Reserve Enhancement Program (CREP) for the Illinois River Basin
- Ecosystem Restoration of the Illinois River
- Comprehensive Management Plan (agency partnership and stakeholder participation throughout the whole process)