2013
Annual Report

Illinois

CREP

Conservation Reserve Enhancement Program

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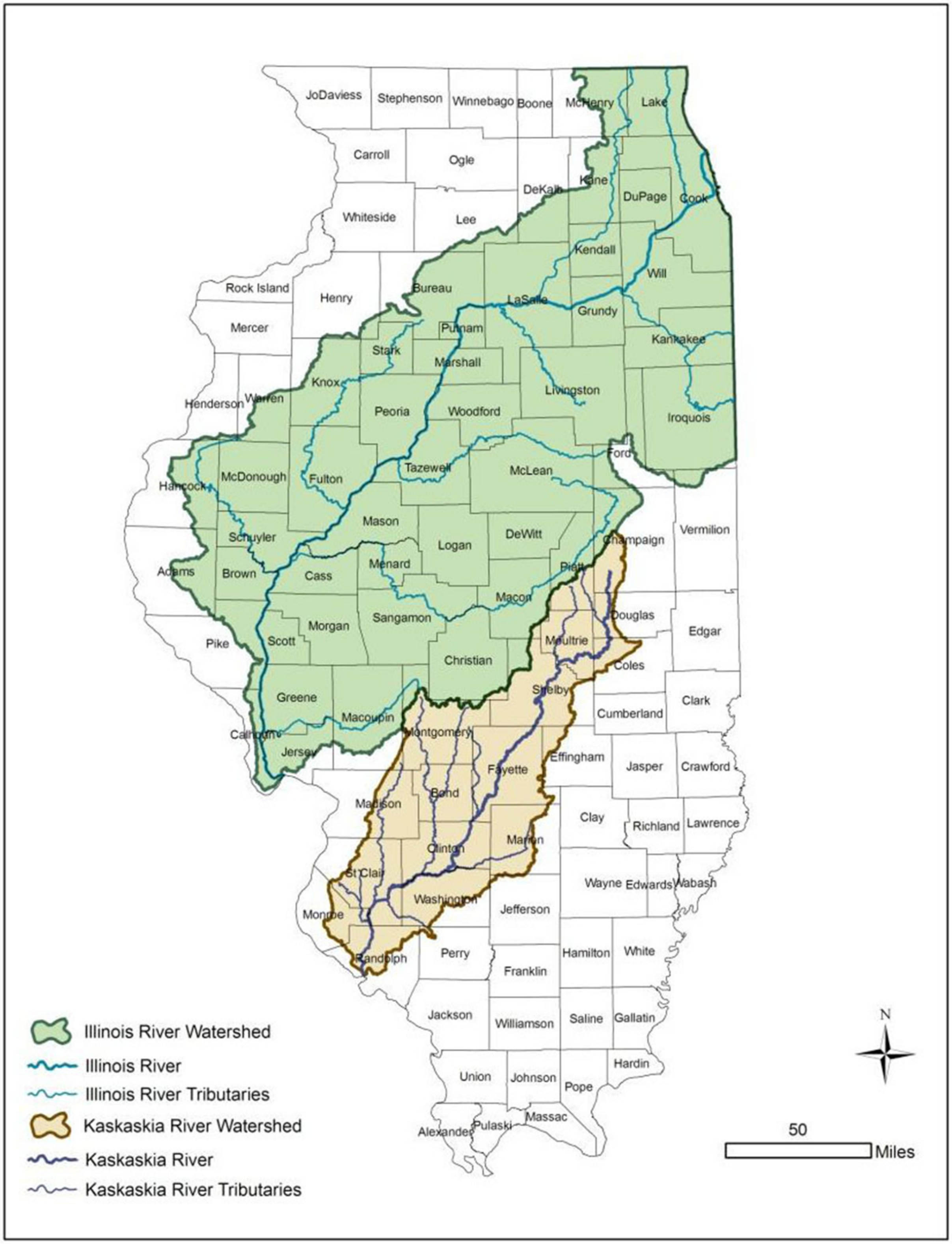
All CREP Annual Reports can be found on the CREP website:
http://www.dnr.illinois.gov/conservation/CREP/Pages/CREPAnnualReports.aspx

Illinois and Kaskaskia River Watersheds CREP Eligible Area



EXECUTIVE SUMMARY

The Illinois Conservation Reserve Enhancement Program (CREP) is a state incentive program tied to the Federal Conservation Reserve Program (CRP). CREP provides long term environmental benefits by allowing 232,000 acres of eligible environmentally sensitive lands within the Illinois and Kaskaskia River Watersheds to be restored, enhanced and protected over periods ranging from 15 years to perpetuity. CREP continues to be driven by locally led conservation efforts, which is evident by increased landowner support. This program is a prime example of how partnerships between landowners, governmental entities, and non-governmental organizations can network to address watershed quality concerns.

Having worked hand in hand with USDA over the years, Illinois CREP has been instrumental in facilitating the ongoing restoration and management efforts within the Illinois and Kaskaskia River Watersheds. To achieve the goal of improving water quality within the targeted watersheds CREP has utilized a variety of Best Management Practices (BMP's) designed to protect and restore miles of riparian corridors. CREP is one of many tools used by IDNR conservation partners to implement the IDNR Illinois Comprehensive Wildlife Action Plan, which provides a framework for the restoration of critical habitats, increasing plant diversity and expanding habitat for species in greatest need of conservation on an agricultural dominated landscape.

Illinois CREP continues to be a successful and very popular program. Since CREP's inception in 1998, 135,517 acres have been enrolled in Federal CREP contracts at an average rental rate of $188.6 per acre. The State has been successful in executing 1,316 CREP easements protecting 83,273 acres.

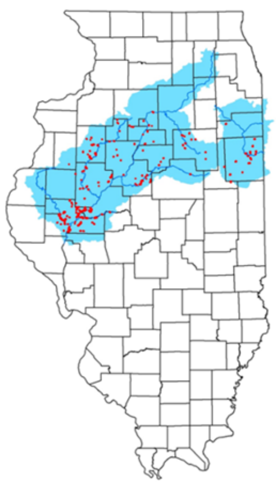
Illinois CREP goals

The goals for the Illinois CREP were revised in 2010 to reflect the expansion into the Kaskaskia River Basin and to highlight the importance of the connection to the Mississippi River and the Gulf of Mexico. The goals of the program are:

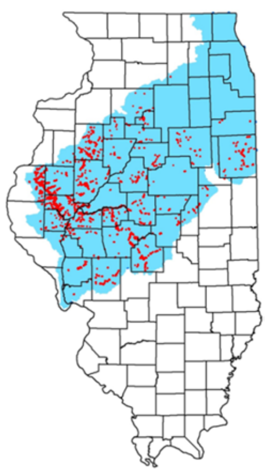
- Reduce the amount of silt and sedimentation entering the main stem of the Illinois and the Kaskaskia Rivers by 20 percent;
- Reduce the amount of phosphorus and nitrogen in the Illinois River and Kaskaskia River by 10 percent;
- Increase by 15 percent, the populations of waterfowl, shorebirds, nongame grassland birds, and State and Federally listed threatened and endangered species such as bald eagles, egrets, and herons;
- Increase the native fish and mussel stocks by 10 percent in the lower reaches of the Illinois River (Peoria, LaGrange, and Alton reaches) and Kaskaskia River; and
- Help meet the Federal goals to reduce nitrogen loading to the Mississippi River and the Gulf of Mexico, thereby helping to reduce hypoxia in the Gulf of Mexico.

Illinois CREP Timeline

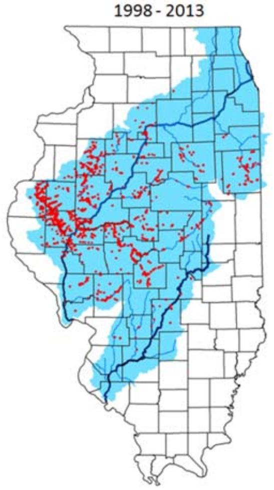
1998-2000



1998-2007



1998 - 2013



Map images depict the eligible watersheds in blue, and CREP easement locations in red

CREP is a federal-state program that was created by a Memorandum of Agreement (MOA) between the U.S. Department of Agriculture, the Commodity Credit Corporation, and the State of Illinois in March 1998. Enrollments into this program began on May 1, 1998. The MOU was amended several times during the early years to clarify terms, increase the number of practices offered, and to expand the eligible area.

In 2005 the IDNR, in cooperation with other conservation partners, initiated the implementation of The Illinois Comprehensive Wildlife Action Plan (ICWAP). The ICWAP's goals are to use consistent science-based natural resource management principles, to increase the amount and quality of habitat available to support Illinois' native plant and animal species and other game species; promote their population viability, and regulate the recreational, commercial, and scientific utilization of those species; to ensure their long-term persistence and abundance and provide for their appreciation and enjoyment by future generations of Illinoisans while also expanding the frontiers of natural resource management. CREP easements which lie within the ICWAP's priority areas will provide long term protection of quality habitats identified by the ICWAP's goals.

Due to insufficient State funds the Illinois CREP was temporarily closed to open enrollment in November 2007. However, monitoring and land stewardship continued.

In October 2010, after overwhelming public support The Illinois General Assembly appropriated $45 million to reopen and expand CREP to include the Kaskaskia River Watershed. The USDA, Commodity Credit Corporation, and the State of Illinois subsequently amended their Memorandum of Agreement (MOA) to include the Kaskaskia River Watershed with the Illinois River Watershed.

Since 2010 a total of 115 state easements have been approved in the Kaskaskia and Illinois River Watersheds totaling 10,056 acres. The Kaskaskia River Watershed totaling 3,564 acres and Illinois Watershed totaling 6,492 acres. The average acreage per enrollment is 87.44 acres.

Since the program started in 1998, landowners have voluntarily enrolled 83,273 acres in CREP through 1,372 easements to help improve and restore natural habitats in the Illinois CREP eligible area. In the last year alone (10/1/2012 – 9/30/2013) 33 state easements were closed protecting 2,733 acres overall, 1,103 acres in the Kaskaskia River Watershed and 1,630 acres in the Illinois River Watershed.

Recent Outreach, Stewardship and Monitoring

The county Soil and Water Conservation Districts (SWCD) within the CREP area are the driving force spearheading CREP on the local level. To simplify the enrollment process the IDNR initiated an on-line enrollment application and database designed to assist our SWCD partners. The database will provide IDNR a mechanism to accurately track enrollments and report the program's accomplishments.

The IDNR has partnered with the Illinois Environmental Protection Agency (IEPA) and the Association of Illinois Soil and Water Conservation Districts (AISWCD) to hire six (6) CREP Resource Specialists. These specialists are dedicated to the Illinois River Watershed to assist the SWCD's with landowner outreach and enrollment. In the Kaskaskia River Watershed, IDNR and the National Great Rivers Research and Education Center (NGRREC) were awarded a National Fish and Wildlife Fund Grant to hire four (4) Land Conservation Specialists to market CREP and assist the districts as needed in the Kaskaskia River Watershed. Additionally, two (2) foresters are funded through a State Wildlife Grant and a partnership with the National Wild Turkey Federation, USDA Natural Resources Conservation Service, and two sponsoring SWCD offices to address CREP related forestry issues in their regions.

The State continues to monitor and evaluate sediment and nutrient delivery to the Illinois River. Nutrient and sediment data have been collected since the program's inception in 1999. According to the Illinois State Water Survey's (ISWS) recent data indicates that both sediment and nutrient delivery to the Illinois River has gradually either stabilized or decreased as a result of the implementation of BMP's in the Illinois River watershed. The most significant outcome has been the slow decreasing trend of nitrate-N yield from major tributary watersheds.

The Illinois Department of Natural Resources (IDNR) is working with the University of Illinois' Critical Trends Assessment Program (CTAP) staff to establish a biological monitoring program for CREP to assess the conservation practices and wildlife habitat on property enrolled in CREP.
CTAP samples the bird communities of forests, grasslands, and wetlands using point-count based methods. During data collection, the presence and abundance of each species seen or heard during the count period is recorded.

The Illinois Department of Natural Resources (IDNR) is also working with Illinois Natural History Survey working to initiate a basin-wide monitoring and assessment program for wadeable streams in the Kaskaskia River. Baseline information on aquatic macroinvertebrates (EPT), freshwater mussels, and fish will be collected at selected reaches using a stratified random sampling design to characterize conditions throughout the watershed and provide for long-term trends assessments. Populations of selected species will be monitored in focal reaches associated with high biological diversity (BSS reaches) or sensitive taxa (enhanced DO reaches, SGNC).

Program Expenditures

The Memorandum of Agreement (MOA) for the Illinois CREP details the formula to determine the overall costs of the program: total land retirement costs (which will include the CRP payments made by the Commodity Credit Corporation (CCC) and the easement payments or the bonus payments made by Illinois), the total reimbursement for conservation practices paid by the CCC and Illinois, the total costs of the monitoring program, and the aggregate costs of technical assistance incurred by Illinois for implementing contracts and easements and a reasonable estimate of the cost incurred by the State to develop conservation plans.

Since the CRP contract payments are annual payments spread out over 15 years, a 2.35 percent net present value (NPV) discount rate (per MOA) was used to compare the CRP payments to the State Easement payments.

Per the current agreement, the State of Illinois must contribute 20% of the total program costs. Based on USDA reports at https://arcticocean.sc.egov.usda.gov/ IDNR contributed 20.33% of the total program costs based on the following calculations;

> $398,572,453.20 (15 years x 140,872.2 acres x 188.6 avg. rental rate = $398,527,453.80) given to IDNR by USDA FSA was amended by IDNR to reflect the 2013 re-enrollment of expired CRP acres with perpetual CREP easements ($1,528,283.64) and expiring 1998 CRP contracts (26,445.2 acres x $156.00 **1998** avg. rental rate = $4,125,451.20).

2014 USDA Report	$398,572,453.20
2013 USDA CREP re-enrollments	($1,528,283.64)
1998 expired contracts	($4,125,451.20)
Amended total	$392,918,718.36

CREP Enrollment and Financial Figures

Illinois CREP 1998 - Sept 30, 2013	
Number of Federal Contracts - 8,127	Total Federal Acres - 135,517
Number of State Easements - 1,372	Total State Protected Acres - 83,273

CREP Payments 1998 - Sept 30, 2013	IDNR	USDA *	USDA (NPV 2.35%) **
Acres Enrolled Through Sept 30, 2013		135,517	
Total Life of Contract Rent (15 Years)		$392,918,718.36	$277,322,440.73
Cost Share		$16,727,552.00	$16,727,552.00
Monitoring	$4,117,906.42		
IEPA CREP Assistants IEPA 319	$1,878,941.96		
Illinois State Enrollments	$64,390,406.55		
IDNR In-Kind Services	$4,664,905.01		

CREP Match 1998 – Sept 30, 2013	IDNR	IDNR/USDA *	IDNR/USDA **
USDA Total		$409,646,270.36	$294,049,992.73
IDNR Total	$75,052,159.94	$75,052,159.94	$75,052,159.94
Program Total		$484,698,430.30	$369,102,152.67
% of IDNR Match		15%	20.33%

*** January 2014 Payment and Practice Summary of active CREP Contracts by Program Year, CRP – Monthly Contracts Report**
https://arcticocean.sc.egov.usda.gov/CRPReport/monthly_report.do?method=displayReport&report=January-2014-ActiveCrepContractsSummaryByProgramYearWithProject-17

**** Net Present Value (NPV)** http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html

PARTNER UPDATES

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

One of the key missions of Illinois EPA is to monitor and protect the water resources of Illinois; these resources are relied upon for drinking water, fishing, transportation and recreational use and other environmental and economic benefits. One of the most dramatic improvements in water quality that Illinois EPA has documented has taken place on the Illinois River.

Illinois EPA has eight Ambient Water Quality Monitoring Sites on the main channel of the Illinois River. Water chemistry is collected at these sites nine times per year. There are approximately 475 Intensive Basin Survey Sites in the Illinois and Kaskaskia River watersheds. These sites are monitored "intensively" once every five years. The monitoring includes water chemistry, macro-invertebrates, fish, habitat, sediment and at some sites fish tissue contaminants are collected. This information is cooperatively collected with the Illinois Dept. of Natural Resources, a partnership that began many years ago and continues annually.

The monitoring shows that the Illinois River mainstream water quality has improved significantly since the passage of the Federal Clean Water Act in 1972. Early improvements were due primarily to point source controls, such as additional treatment requirements and limits on discharges from wastewater treatment plants. The majority of water quality improvements over the last fifteen years have been from the implementation of nonpoint source management programs that reduce urban and agricultural runoff, and programs such as CREP.

As reported by the Illinois EPA in their 2012 Integrated Report, of the *stream miles assessed* in the Illinois River Basin for Aquatic Life Use Support attainment, 80.4% were reported as —Good, 17.3% as —Fair, and 2.3% as —Poor. This compares to statewide figures of 62.1% —Good, 32.2% —Fair, and 5.7% —Poor.

Illinois EPA continues to participate on the State CREP Advisory Committee and continues to provide financial assistance to local soil and water conservation districts so they can assist landowner enrollment into CREP. Since 1999, more than $1,838,000 of Section 319 grant funds have been spent to hire and train personnel responsible for outreach and the enrollment process.

The benefits derived through this financial support is not only efficiency in the sign-up process to increase CREP enrollment, but it also allows the existing SWCD and NRCS staff to continue to implement the other conservation programs so desperately needed to improve water quality in the Illinois and Kaskaskia River watersheds.

Other Illinois EPA programs that complement CREP include:

Section 319**:** Since 1990, the IEPA has implemented 285 Clean Water Act Section 319 projects within the Illinois and Kaskaskia River Watersheds. The Agency receives these federal funds from USEPA to identify and administer projects to prevent nonpoint source pollution. These projects include watershed management planning; best management practices implementation and outreach efforts. Illinois EPA has dedicated over $62 million with another $53 million of local and state funds for total project costs of nearly $115 million towards these projects to help improve the health of the Illinois and Kaskaskia Rivers, their tributaries and ultimately the Mississippi River and Gulf of Mexico. Hundreds of conservation practices have been installed in the Illinois and Kaskaskia River watersheds by dozens of our partners through the Section 319 program. Traditional practices such as terraces and waterways are dotting the landscape along with porous pavement parking lots, green roofs and miles of rural and urban stabilized streambank.

Since 1990, the 319 NPS program, through on the ground implementation can show load reductions in the Illinois and Kaskaskia River watersheds of: 685,808 lbs. of nitrogen, 321,652 pounds of phosphorus, and 282,336 tons of sediment per year, each and every year since the Best Management Practices were implemented as a result of 319 grant projects between IEPA and our local partners, in both the private and government sectors. The IEPA invites you to visit http://water.epa.gov/polwaste/nps/success319/ for a sample of Illinois'319 success stories.

IGIG: Since 2011, the Illinois EPA has implemented 28 Illinois Green Infrastructure Grant Program for Stormwater Management (IGIG) projects within the Illinois and Kaskaskia River watersheds. IGIG is administered by the Illinois EPA. Grants are available to local units of government and other organizations to implement green infrastructure best management practices (BMPs) to control stormwater runoff for water quality protection in Illinois. Projects must be located within a Municipal Separate Storm Sewer System (MS4) or Combined Sewer Overflow (CSO) area. Funds are limited to the implementation of projects to install BMPs. Illinois EPA has dedicated over $10 million with another $4 million of local funds for total project costs of over $14 million towards these projects to help improve water quality in the Illinois and Kaskaskia River watersheds.

Construction Site Inspection Program**:** Illinois EPA continues to implement a program in partnership with nineteen soil and water conservation districts covering twenty-one counties. Those partners located with the Illinois and Kaskaskia River watersheds include the Champaign, DeKalb, DeWitt, Jersey, Kane/DuPage, Kankakee, Kendall, Knox, Macon, Madison, McHenry/Lake, Monroe, North Cook, Peoria, St. Clair, and Will/South Cook County Soil and Water Conservation Districts. District staff complete on-site NPDES Construction Stormwater Permit inspections and provide technical assistance in implementing best management practices to minimize runoff to nearby water bodies. This program is a natural fit for properly developing acreage that does not qualify for CREP.

Total Maximum Daily Load (TMDL): TMDLs are a tool that we use to restore impaired watersheds so that their waters will meet Water Quality Standards and Full Use Support for those uses that the water bodies are designated. A TMDL looks at the identified pollutants and develops, through water quality sampling and modeling, the amount or load reductions needed for the water body to meet its designated uses. USEPA has approved 253 completed TMDL evaluations and Illinois EPA is currently developing another 230 TMDLs in the Illinois and Kaskaskia River watersheds.

Partners for Conservation: A total of 67 lake monitoring (study) or protection/restoration projects have been conducted in the Illinois and Kaskaskia River watersheds via the Illinois EPA's Illinois Clean Lakes Program and Priority Lake and Watershed Implementation Program. Over $11.6 million of local and state funds have been allocated for these efforts.

Excess Nutrients: A High Profile Water Quality Issue

The impact of excess nitrogen and phosphorus in rivers, lakes, streams and the Gulf of Mexico has become a very high profile water quality issue. Under the right conditions, nutrients can cause excessive algal blooms, low oxygen and nuisance conditions that adversely impact aquatic life, drinking water and recreational uses of the water. The Illinois Environmental Protection Agency has identified many waterbodies in the state with these problems.
Nitrogen and phosphorus come from municipal wastewater treatment, urban stormwater, row crop agriculture, livestock production, industrial wastewater and combustion of fossil fuels. In other words, most aspects of modern society contribute to this pollution problem. The proportion of loading to a particular waterbody from these sources varies from watershed to watershed, with point sources and urban storm water being most important in urbanized watersheds and row crop and/or livestock production being predominant contributors in agricultural watersheds.

Illinois EPA has three additional efforts concerning nutrients that began in 2011. The first is identification of six sub-watersheds that are considered our ―Nutrient Priority Watersheds . Five of the six designated watersheds are in the Illinois River Basin, they are: Lake Bloomington, Lake Vermilion, Lake Decatur, Vermilion River (Illinois Basin) and Lake Mauvaise Terre, each of these watersheds has a Total Maximum Daily load developed for one or two nutrient pollutants (nitrogen and phosphorus). The second nutrient effort that the agency is partnering with is a program called ―KIC 2025 (www.kic2025.org). ―KIC by 2025 will seek to educate the agricultural sector, dedicate significant resources toward research to reduce nutrient losses and enhance nutrient efficiency, educate suppliers and farmers, and measure the adoption of in-field practices to enhance nutrient stewardship beginning in priority watersheds and expanding over years to a state-wide nutrient stewardship program. Lastly the agency has been involved in the two (Illinois Basin) designated Mississippi River Basin Initiatives, Bureau Creek and Indian Creek. The Agency is providing technical assistance and monitoring in the Bureau Creek project and is proving funds for significant outreach in the Indian Creek Watershed along with growing season weekly samples and monthly sampling the rest of the year.

In conclusion, the Illinois and Kaskaskia River basins are a valuable resource that we are working hard to protect and restore. Illinois EPA will continue long-term monitoring of the rivers and their watersheds and will continue to pursue funds to help implement CREP and other water quality restoration and protection projects and to work with citizen groups and local government and industry to continue the progress we all have made.

Current Management Approaches and Issues

The Clean Water Act framework requires: the establishment of water quality standards that protect aquatic life and/or other beneficial uses of the water; monitoring and assessment to determine attainment of standards; listing of waters not attaining and development of Total Maximum Daily Loads (TMDL) to limit pollution to those water bodies.

TMDL load limits are required to be implemented through National Pollutant Discharge Elimination System permits, which address point sources—municipal or industrial wastewater dischargers. Management of non-point source pollution is through voluntary implementation of best management practices (BMP), so there is no guarantee that TMDL load limits allocated to non-point sources will be achieved.

Cost-share incentives to implement/install BMPs include federal Conservation Reserve Program and state Conservation Reserve Enhancement Program, state Partners for Conservation Program, various Farm Bill conservation programs and Section 319 non-point source management grants. The federal Farm Bill programs, though relatively well-funded, are not consistently targeted at water quality improvement, nutrient reduction or locations most in need of BMPs.

There are various other efforts through state farm groups, industry and non-profit organizations to promote the use of agricultural BMPs, but these efforts are not consistently coordinated nor targeted to particular watersheds. In addition, the degree of implementation of key nutrient-related BMPs is not comprehensively quantified or mapped, so the collective status of BMP implementation in the state is unknown.

Available data do indicate that Illinois producers are not over-applying fertilizers or manure and that the traditional suite of conservation practices will not be adequate to achieve such large reductions. Absent the development of an economically viable third crop such as a perennial for biofuels, the costs to significantly reduce nutrient losses from agriculture could be billions of dollars.

New and expanding major (one million gallons per day or greater design flow) municipal sewage treatment plants and some sewage treatment plants discharging to certain lake watersheds are required by Illinois Pollution Control Board regulations to limit total phosphorus to 1.0 mg/L on a monthly average basis. Plants currently achieving this level of phosphorus reduction represent 9% of the approximately 900 municipal discharges in the state. However, of the 214 major municipals discharges, whose effluent constitutes a large majority of the phosphorus loading from point sources, 25% are required to remove phosphorus. Requiring phosphorus removal from the minor facilities would be very costly for customers on a per capita basis and would represent a relatively small portion of the total point source phosphorus discharged.

What U.S. EPA Expects

U.S. EPA expects states to establish numeric water quality standards for phosphorus and nitrogen and to carry out the other pieces of the Clean Water Act framework, as appropriate. U.S. EPA‗s Inspector General issued a finding in 2009 that U.S. EPA had not done enough to get state numeric nutrient water quality standards established. In response, U.S. EPA has developed a ―corrective action plan which includes a commitment to identify states where federal promulgation of nutrient water quality standards is required. U.S. EPA has been petitioned and sued by various environmental groups for failure of states to establish numeric nutrient standards, so there is mounting pressure on U.S. EPA and states to address nutrients by developing numeric nutrient water quality standards.

States have concerns on the issue of numeric nutrient water quality standards. They raise two main points:

1. There is not a straightforward relationship between nutrient concentration in the water and adverse effects, so a statewide ―one size fits all standard that meets the test of scientific defensibility is almost unachievable; and
2. The Clean Water Act programs are effective for point sources but do not assure reductions from non-point sources that are often the predominant contributors of nutrients in a particular watershed.

ILLINOIS DEPARTMENT OF AGRICULTURE

The Illinois Department of Agriculture administers numerous soil and water conservation programs that produce environmental benefits in the Illinois River Watershed. In FY12, the Partners for Conservation Program, administered by IDOA, has allocated over $363,000 to the 45 counties that have significant acreage in the Illinois River Watershed for cost-sharing the installation of upland soil and water conservation practices. Administered by the Department, with assistance from County Soil and Water Conservation Districts (SWCDs), this program provides up to 70% of the cost of constructing conservation practices that reduce soil erosion and protect water quality.

Eligible conservation practices include terraces, grassed waterways, water and sediment control basins, grade stabilization structures and nutrient management plans. A total of 129 projects have been completed by the SWCD's with significant benefits in the Illinois River Basin during the last 2 fiscal years. Individual conservation projects were completed with funding of nearly $321,000. These projects are responsible for bringing soil loss to tolerable levels on hundreds of acres of land. This translates into over 4,632 fewer tons of soil loss each year, or the equivalent of more than 230 semi truckloads of soil saved.

The Department of Agriculture provided funding to the county SWCD offices in the Illinois River Watershed for operational expenses. Specifically, these funds were used to provide financial support for SWCD offices, programs, and employee' salaries. Employees, in turn, provided technical and educational assistance to both urban and rural residents of the Illinois River Watershed. Their efforts are instrumental in delivering programs that reduce soil erosion and sedimentation and protect water quality.

In an effort to stabilize and restore severely eroding streambanks that would otherwise contribute sediment to the Illinois River and its tributaries, the Department of Agriculture, with assistance from SWCDs, is administering the Streambank Stabilization and Restoration Program (SSRP). The SSRP, funded under the Partners for Conservation Program, provides funds to construct low-cost techniques to stabilize eroding streambanks. In all, over 1.25 miles of streambanks have been stabilized to protect adjacent water bodies during the past 2 fiscal years.

Another environmentally oriented program administered by the Department of Agriculture is the Sustainable Agriculture Grant Program. A total of 4 grants were made available with funding of $24,495, to individuals, organizations and universities for conducting research, demonstration, or education programs or projects related to profitable and environmentally safe agriculture in such areas as local food systems, community gardening and composting.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Illinois Recreational Access Program

One of the more challenging problems facing Illinois and the Department of Natural Resources (IDNR) is to provide more public outdoor recreational access and opportunities in Illinois. In order to carry on our outdoor traditions, it is important to connect youth and families to land and opportunities. 95 % of Illinois is privately owned and ranks 46th for public lands for recreation but hosts more than 323,000 hunters and 780,000 fishermen and millions of other recreational users.

Through the Illinois Recreational Access Program (IRAP), the IDNR is increasing public recreational opportunities for the following activities:

- Youth Turkey Hunting
- Fishing (Ponds and Streambanks)
- Non-Motorized Boat Access on Public Waterways
- Outdoor Naturalist (Birding, Nature Watching and Outdoor Photography)

Utilizing resources obtained through a grant from the US Department of Agriculture's Voluntary Public Access and Habitat Incentive Program, the IDNR began leasing private land in November of 2011 from private landowners so that outdoor recreationalists will have more places to go. IRAP is targeting CREP enrollments but it is also available to all eligible farm, ranch, and forested land in the 68 county CREP areas.

In addition to the annual stipend lessees receive, emphasis is placed on developing a conservation management plan for the landowner and assisting with the implementation of the management plan. Resources for habitat protection and enhancement come from IRAP, CREP, EQIP, WHIP, NWTF and other cost-share programs.

- IRAP has leased totaled 11,334 acres have been leased in 26 counties within the Illinois and Kaskaskia River Watersheds.
- Made available 320 spring turkey hunting opportunities to youth hunters
- Received 100 youth applications to participate in 2012 spring turkey hunting on IRAP leased sites
- Completed a new stewardship plan and began implementing BMPs in the Honey Creek watershed in Macoupin County involving private landowners, the city of Carlinville, USFWS, NWTF and others partnering together to implement an Illinois Forest Management Plan.

Landowners can enroll their land in any combination of the three turkey seasons: Youth Season, Regular Season 3 and Regular Season 4. If the land isn't enrolled for a particular season, the land will remain open for the landowner to use at their discretion.

Partners for Conservation

Partners for Conservation (formerly Conservation 2000 – or C2000) is a multi-agency, multi-million dollar comprehensive program designed to take a holistic, long-term approach to protecting and managing Illinois' natural resources. The Illinois Department of Natural Resources administers the Ecosystems Program and the Critical Trends Assessment Program (CTAP), a statewide ecosystem assessment and monitoring program.

The Ecosystems Program**,** a landmark program, is based upon an extensive network of local volunteers working to leverage technical and financial resources to promote ecosystem based management primarily on private lands. With 95% of the state in private ownership (non-state owned), the main objective of the program is to assist in the formation of public/private partnerships, *Ecosystem Partnerships*, to develop plans and projects on a watershed scale with an ecosystem-based approach. There are two key criteria established for the Ecosystems Program. One, that they must be voluntary, and based on incentives rather than government regulation; and, two, they must be broad-based, locally organized efforts, incorporating the interests and participation of local communities, and of private, public and corporate landowners.

Currently, there are 41 Ecosystem Partnerships covering 86% of Illinois. Half of those partnerships are located in counties that comprise the Illinois River watershed; 21 to be exact. They are Big Rivers, Chicago Wilderness, DuPage River Coalition, Fox River, Headwaters, Heart of the Sangamon, Illinois River Bluffs, Kankakee River, Lake Calumet, LaMoine River, Lake Michigan Watershed, Lower Des Plaines, Lower Sangamon Valley, Mackinaw River, North Branch of the Chicago River, Prairie Parklands, Spoon River, Thorn Creek, Upper Des Plaines, Upper Salt Creek, and Vermillion Watershed Task Force.

Since its inception in 1996, the C2000 Program has awarded more than $16.4 million in C2000 grants to Ecosystem Partnerships in the **Illinois River watershed** basin for projects providing a variety of conservation practices and outreach. Another $17.75 million has been leveraged as match for these projects for a total of more than $34 million for 489 projects. Accomplishments from these projects include: 15,899 acres of habitat restoration, 169,756 feet of stream bank restoration, 1,814 sites have been or are being monitored, and more than 685,745 people have been educated on watershed protection and restoration.

NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

EQIP

One of NRCS‘ primary conservation programs is the Environmental Quality Incentives Program (EQIP), which is designed to provide cost-share funds to farmers who qualify for practices designed to improve or create conservation-minded operations or solutions. EQIP addresses practices for livestock operations, grazing operations or non-livestock operations, which covers most of Illinois‘private landowners in need of conservation solutions.

EQIP's Forestry Efforts

The primary focus of the Forest Management Plans special project incentive is to help applicants develop management plans and protect their forested acres. Eligible applicants receive funds to help hire a professional forester who will visit the property, inventory the site, and write out a complete woodland management plan. This Special Projects opportunity through Illinois‘EQIP can help landowners manage their woodland resources better and obtain a quality management plan that is also approved by the State of Illinois. With more acres of Illinois forest resources well planned for and managed, the health and value of our forest resources will be greatly improved.

Wetland Reserve Program

NRCS'Wetland Reserve Program (WRP) continues to create and restore quality wetland habitats in the Illinois River Watershed and across the state.
For additional information on NRCS conservation programs, please visit www.nrcs.usda.gov.

US FISH AND WILDLIFE SERVICE (USFWS)

Partners for Fish and Wildlife

The US Fish and Wildlife Service Partners for Fish and Wildlife Program (Partners) has supported the Illinois River Conservation Reserve Enhancement Program (CREP) since its inception. The addition of the Kaskaskia River watershed to the CREP program has expanded the opportunities for a collaborative effort to support landscape scale restoration. The Midwest Region's Partners program assists with projects that conserve or restore native vegetation, hydrology and soils associated with imperiled ecosystems such as bottomland hardwoods, native prairies, marshes, rivers and streams. Collaborating with the Illinois and Kaskaskia River CREP has provided opportunities on a landscape scale for restoration, enhancement, and preservation of these natural habitats on private land. Benefits from this collaboration are the enhancements of privately–owned land for Federal Trust Species, such as migratory birds, inter-jurisdictional fish, threatened and endangered species of plants and animals, and other species of conservation concern. Federally listed threatened and endangered species, particularly the threatened decurrent false aster (*Boltonia decurrens*) have benefited from the Illinois CREP. Equally significant are both direct and indirect benefits to National Wildlife Refuge lands located on or near the Illinois and Kaskaskia Rivers' that accrue as a result of expanded habitat adjacent and near the Refuges, as well as improved water quality that results from implementing approved conservation practices.

Partners' primary contribution to the Illinois and Kaskaskia River CREP has been technical assistance through participation on the CREP Advisory Committee, providing technical and policy assistance input to the program. At the local level, Partners personnel coordinate with local NRCS, SWCD, and Illinois DNR staff as necessary on individual or groups of projects. CREP has opened a host of opportunities for habitat restoration, enhancement, and preservation on private land that fulfills the objectives of a broad coalition of Federal, State, local, and non-government conservation organizations.

Within the Illinois and Kaskaskia River Watersheds, individual Partners projects compliment CREP and other habitat programs. The Partners program provides a tool for restoration and enhancement of habitats on private lands that may not be eligible for other landowner assistance programs. Partners' local coordinators also review the full range of landowner assistance programs with each potential cooperator and refer landowners to CREP and other USDA and Illinois DNR programs that best meet their habitat development and economic goals.
For more information about the Partners for Fish and Wildlife Program please contact:
gwen_kolb@fws.gov.

ILLINOIS FARM BUREAU

Illinois Farm Bureau (IFB) continues to publicize and promote the Conservation Reserve Enhancement Program (CREP). IFB also used their statewide radio network to highlight details of the program. Information on CREP was sent directly to county Farm Bureaus® (CFB) via e-mail and through county Farm Bureau mail system. Illinois Farm Bureau continues to provide input about CREP through various groups and committees and also continues to voice support for the program. CREP is another tool producers can use that provides cost share incentives and technical assistance for establishing long-term, resource-conserving practices and is a positive program in Illinois.

ASSOCIATION OF ILLINOIS SOIL AND WATER CONSERVATION DISTRICTS

The AISWCD, in partnership with the Illinois Environmental Protection Agency and the Illinois Department of Natural Resources, helped with administration of the CREP program, by providing funding to SWCDs through a two-year grant funded in part by IEPA 319 and IDNR CREP funds. The grant, which began in June 2012, is a cooperative effort between IEPA, IDNR and the AISWCD. Through the grant, six positions have been established in strategic workload areas of the Illinois River basin. The six CREP Resource Specialists (CRSs) work with groups of SWCDs within Land Use Councils to monitor existing contracts and work with landowners to enroll additional acres into the Illinois River CREP Area. In addition, the CRSs work with interested landowners to help them enroll acres in the Federal CRP in an effort to increase the acres that will also be eligible for enrollment in CREP. CRSs are also working with landowners to help develop post enrollment management plans for their CREP acres. The ability to utilize six full-time staff to work exclusively with the CREP program is helping to expedite the enrollment process, increasing the level of monitoring of existing contracts and providing landowners with additional services to benefit their CREP acres and ultimately increase water quality benefits attributable to the Conservation Reserve Enhancement Program.

ENVIRONMENTAL DEFENSE FUND PARTNERSHIP PROJECT WITH THE NATURE CONSERVANCY

A partnership is working with local farmers on an innovative approach to protect drinking water supplies to the City of Bloomington and improve water quality in the Mackinaw River. Environmental Defense Fund and The Nature Conservancy joined with the City of Bloomington, USDA's Farm Service Agency and Natural Resources Conservation Service, the McLean County Soil and Water Conservation District, and the University of Illinois to launch a voluntary, incentive-based program focused on constructing wetlands in strategic locations within drinking supply watersheds that will intercept tile-drained runoff from agricultural farmlands. The focus on Six Mile Creek and Money Creek by this partnership builds on The Nature Conservancy's 20 years of science work in the Mackinaw River watershed, more than 30 years of work by the City of Bloomington to comply with drinking water and surface water quality regulations, and the policy and science expertise of the Environmental Defense Fund. Additional partners engaged in this effort include the McLean County GIS Consortium and scientists from Illinois State University.

Highly qualified technical service providers are working with interested farmers and other landowners who have potential sites for treatment wetland installations. These advisors help landowners enroll in the Farmable Wetlands Program of the Conservation Reserve Program, a USDA voluntary conservation program that provides good financial incentives to landowners for installing practices such as drainage water treatment wetlands. USDA and SWCD staff helps with outreach to producers. Partners have secured grant funding to offset costs to the producers so no installation costs are incurred by landowners.

These wetlands are designed to retain agricultural runoff and reduce nitrogen concentrations upstream from drinking water reservoirs and the Mackinaw River; thus, providing benefits to the local community's drinking water, the Mackinaw River, and ultimately the Gulf of Mexico. The wetlands are a natural fit in the landscape – they provide beauty and recreation for landowners and important habitat for wildlife while serving as a long-lasting, highly cost-effective way to address local drinking water concerns and downstream water quality. Challenges related to excessive loading of nitrogen goes beyond local drinking water concerns. Nitrogen originating from states within the Mississippi River Basin contributes substantially to the Dead Zone in the Gulf of Mexico [1]. In fact, the Upper Mississippi River Basin (UMRB) contributes more than 50% of the nitrate reaching the Gulf of Mexico. The UMRB, particularly the —Corn Belt, is one of the most productive agricultural regions in the world and is dominated by intensive, high production, row-crop agriculture. The extensive subsurface drainage systems that have enabled many producers to realize significant increases in productivity have also created the unintended effect of creating a highly efficient conduit of nitrogen to the Mississippi River and the Gulf of Mexico. Subsurface agricultural drainage short circuits the natural drainage pattern, flushing nitrogen from farm fields and funneling it directly into local rivers and streams, and from there into the Mississippi and the Gulf of Mexico. Illinois has the highest total area of subsurface drainage of any state in the UMRB [2] and contributes 17% of the nitrogen and 13% of the phosphorus delivered to the Gulf of Mexico [3].

By working together, the conservation partners are achieving both the goals of CREP and the objectives of private landowners. They help implement the Illinois Wildlife Action Plan by creating and enhancing habitat corridors along Illinois' rivers and tributaries for species protection and migration. The partners are developing strategies to facilitate landowner enrollment in many different conservation programs and ensure the programs are implemented effectively. Continued monitoring efforts will provide the long-term data required to properly assess changes in Illinois' watersheds, and assessment of these changes will ensure efficient implementation of CREP and other conservation programs.

[1] Goolsby et al. 1999
[2] 4.7 million ha, Sugg 2007
[3] Alexander et al. 2008

NATIONAL GREAT RIVERS RESEARCH AND EDUCATION CENTER

With an expanded partnership in 2012, the National Great Rivers Research and Education Center (NGRREC) continued to provide grant-funded staff support to the Illinois CREP Program in 2013. With a focus on the expansion of the CREP watershed to include the Kaskaskia River basin, land conservation staff placed with the Fayette County SWCD, DeWitt County SWCD, Lewis and Clark Community College, and the IDNR in Springfield provided CREP support to all counties of the Kaskaskia River basin and a few Illinois River basin counties.

NGRREC's *Illinois CREP Initiative* is made possible by funding provided by the National Fish and Wildlife Foundation and the Illinois Department of Natural Resources. This effort and other agricultural conservation efforts at NGRREC leverage NGRREC's research and education missions to provide high-quality, science-based technical assistance and develop innovative outreach strategies for farm tract conservation opportunities.

The National Great Rivers Research and Education Center is a partnership of Lewis and Clark Community College, the University of Illinois, and the Prairie Research Institute's Illinois Natural History Survey. The Costello Confluence Field Station is located at the confluence of the Mississippi and Missouri Rivers in East Alton, Illinois.

ONGOING INITIATIVES

Monitoring and Assessment of Aquatic Life in the Kaskaskia River for evaluating IDNR Private Lands Programs – Illinois Natural History Survey

Work during the beginning of the reporting period focused on aggregation and summarization of existing biological and landscape data. We have reviewed and integrated into our database system spatial locations of collections and monitoring data from IDNR/IEPA Intensive Basin Survey Program, IDNR biennial fisheries surveys.

Additionally we have secured the IEPA ambient water quality monitoring for the past 10 years within the Kaskaskia River and its tributaries. Biological survey data, watershed characteristics, and additional information concerning anthropogenic stressors have been assembled and georeferenced for the basin. This includes information on landuse/landcover, surficial geology, modeled flow and water temperature, and point locations from ongoing and historic sampling and monitoring efforts. Locations of CRP/CREP parcels, NPDES permits, stream segments with enhanced dissolved oxygen designation, and stream segments with biologically significant stream designation have also been incorporated into the project GIS data layers. The second half of the reporting period focused on preparation for the field season and beginning the spring and summer sampling programs. Project staff also attended the March meeting of the Kaskaskia Watershed Association in Carlyle to meet with regional constituents and researchers. After coordinating with CREP Mapping Coordinator Lisa Beja on availability of spatial data for CRP and CREP parcels in the study area we attributed local watersheds (1:100,000) throughout the Kaskaskia Basin with summaries of total and local catchment CRP/CREP enrollments to assist with sampling site selection. Private lands practices were classified by their expected efficiency at mitigating sediment and nutrient runoff and local watersheds were classified (high quality, moderate quality, low quality). We developed strata (HUC8, stream size, proportion of CRP/CREP enrolled land) and randomly selected stream reaches for basinwide monitoring that span the range of conditions within the Kaskaskia Basin.

Spring sampling was conducted at 33 sites and included basic habitat, water quality, and biological collections following the protocol established by the Critical Trends Assessment Program (CTAP). The summer sampling program revisited these sites and conducted basic water quality, habitat quality, and biological (electrofishing, rapid macroinvertebrate) sampling. We also sampled 15 sites within stream reaches designated with enhanced dissolved oxygen status and as Biologically Significant Stream segments. Basic water quality data, habitat surveys, and macroinvertebrate collections were made at these focal sites.

A minor budget revision was made to allow for the purchase of a backpack stream shocking unit to be used in fish collections. Having a dedicated stream shocking unit available for the project allowed us to adjust our sampling schedule to coincide with appropriate weather and flow conditions. Total budget and project scope were not changed as a result of this budget adjustment. These efforts were conducted by one full time and one part-time research scientist and several hourly workers. We hired Eric James South to assist Dr. DeWalt with macroinvertebrate sample processing of existing samples and biodiversity assessment of EPT taxa during the Spring sampling period. Eric will begin a graduate program in Entomology in Fall 2013 at University of Illinois Urbana-Champaign and continue to work as part of the project group. We also successfully recruited an additional graduate student to work with Dr. Cao. Levi Drake will join our team in the Fall 2013 Semester pursuing an MS degree at the University of Illinois Urbana-Champaign in the Department of Natural Resources and Environmental Sciences. A total of six summer workers (some part-time) assisted permanent staff with collecting basin-wide and focal reach monitoring data during the summer sampling period.
Please reference Appendix A for the full report.

Establishing a biological monitoring program for CREP to assess the conservation practices and wildlife habitat on property enrolled – Illinois Natural History Survey

The Illinois Department of Natural Resources (IDNR) is working with the University of Illinois'Critical Trends Assessment Program (CTAP) staff to establish a biological monitoring program for CREP to assess the benefit of conservation practices and wildlife habitat to avian species on property enrolled in CREP. The monitoring program samples the bird communities of shrublands, grasslands, and wetlands at randomly selected CREP easements using point- count based methods. During data collection, the presence and abundance of each species seen or heard during the count period is recorded. Avian point counts are conducted in 4 specific state CREP conservation practices in the Illinois River watershed. Species data will be used to determine CREP easement contribution to regional and state population goals for species of conservation concern. After two years, sampling efforts have detected 103 bird species using CREP easements. Species of conservation concern with frequent detections include Field Sparrow, Dickcissel, Northern Bobwhite, Yellow-billed Cuckoo, Willow Flycatcher and Bell's Vireo. CREP easements appear to be providing habitat for many early successional species.

During the 2013 field season this project initiated a monitoring effort to assess the reproductive success of shrubland bird species at CREP easements. Nest data are collected at a subset of randomly selected CREP easements. Nest data collected will be used to determine the relative habitat quality and the reproductive contribution of CREP easements to regional and state population goals for species of conservation concern. Focal species include American Robin, Bell's Vireo, Brown Thrasher, Field Sparrow, Grey Catbird, Northern Cardinal, and Willow Flycatcher.

Please reference Appendix B for the full species list.

Monitoring and Evaluation of Sediment and Nutrient Delivery to the Illinois River – Illinois State Water Survey

To assess CREP's progress towards meeting 2 of its program goals, the Illinois Department of Natural Resources (IDNR) and the Illinois State Water Survey (ISWS) are developing a scientific process for evaluating the effectiveness of the program. The process includes data collection, modeling, and evaluation.

The monitoring and data collection component consist of a watershed monitoring program to monitor sediment and nutrient loading for selected watersheds within the Illinois River basin and also to collect and analyze land use data throughout the river basin. Historically, there have been a limited number of sediment and nutrient monitoring stations within the Illinois River Basin, and most of the available records are of short duration. Therefore, the available data and monitoring network was insufficient to monitor long-term trends especially in small watersheds where changes can be observed and quantified more easily than in larger watersheds.

To fill the data gap and to generate reliable data for small watersheds, the Illinois Department of Natural Resources funded the Illinois State Water Survey to initiate a monitoring program that will collect precipitation, hydrologic, sediment, and nutrient data for selected small watersheds in the Illinois River basin that will assist in making a more accurate assessment of sediment and nutrient delivery to the Illinois River.

Five small watersheds located within the Spoon and Sangamon River watersheds were selected for intensively monitoring sediment and nutrient within the Illinois River basin. The full report presents the data that have been collected and analyzed at each of the monitoring stations.

As outlined in the Illinois River Basin Restoration Plan, the alternative of no-action in the Illinois River watershed will result in increased sediment delivery to the Illinois River and habitats and ecosystem would continue to degrade. However, recent data indicate that both sediment and nutrient delivery to the Illinois River have either stabilized or decreased as a result of implementation of conservation practices in the watershed. If the present trends continue for the next 10 to 15 years, sediment and nutrient delivery to the Illinois River will be significantly reduced, and lead to improved ecosystem in the river and tributary watersheds in the long-term.
Please reference Appendix C for the full report.

NWTF Habitat Grant Project

- An NWTF Habitat Fund grant targeted to the Forest and Woodlands Campaign is providing nearly $50,000 with a match of $50,000 to do private forest management in both the Shawnee Hills and Western Forest-Prairie Natural Divisions. Eligible practices will include TSI, NNIS control and prescribed burning. Rates are based on FDA rates, and we will be working with District Foresters to find interested landowners with Forest Management Plans in place. The selected regions have seen a high demand for forest management, and EQIP dollars for this important work is often not available.
- In addition, NWTF State Wildlife Grant forester working in the northern Kaskaskia watershed is providing support for CREP and EQIP in this region. Accomplishments from October 2012 – October 2013 are summarized below.
    - Visited 79 CREP/CRP site visits
    - Wrote 37 tree planting plans
    - Over 521 acres of tree plantings planned
    - Reviewed over 1100 acres of tree plantings
    - Consulted with 77 private landowners
    - Wrote 10 Forest Management Plans
    - 789 acres in Forest Management Plans
    - Reviewed 698 acres of EQIP forest management practices on 32 properties
    - Reviewed 1031 acres of CREP easements
    - Participated in 3 outreach field days attended by 370 people
    - Conducted 3 prescribed burns
    - Marked 37 acres of timber for harvest or TSI

Appendix A

ILLINOIS NATURAL HISTORY SURVEY
PRAIRIE RESEARCH INSTITUTE

Monitoring and Assessment of Aquatic Life in the Kaskaskia River for evaluating IDNR Private Lands Programs: Annual Report 2013

Leon C. Hinz Jr.
and
Brian A. Metzke

Illinois Natural History Survey
Prairie Research Institute
University of Illinois

28 August 2013

INHS Technical Report 2013 (30)

Prepared for: Illinois Department of Natural Resources
Office of Resource Conservation

Unrestricted: for immediate online release.

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Annual Summary Report

Project Title:
Monitoring and Assessment of Aquatic Life in the Kaskaskia River for evaluating IDNR Private Lands Programs.

Project Number: RC13CREP01

Contractor information:

University of Illinois at Urbana/Champaign
Institute of Natural Resource Sustainability
Illinois Natural History Survey
1816 South Oak Street
Champaign, IL 61820

Annual Reporting Period: 1 July 2012—30 June 2013

Annual Project Report Due Date: 28 August 2013

Principle Investigator:

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Goals/ Objectives: (1) Develop and initiate monitoring program that provides a basin-wide assessment of status and trends for aquatic life in wadeable streams of the Kaskaskia River; (2) track the status of selected populations of sensitive species in focal reaches of the Kaskaskia River associated with enhanced DO regulations, BSS designation, and presence of SGNC; (3) evaluate the influence of conservation easements and associated practices on biological communities within the Kaskaskia River Basin.

Title: Monitoring and Assessment of Aquatic Life in the Kaskaskia River for evaluating IDNR Private Lands Programs

Narrative:

Work during the beginning of the reporting period focused on aggregation and summarization of existing biological and landscape data. We have reviewed and integrated into our database system spatial locations of collections and monitoring data from IDNR/IEPA Intensive Basin Survey Program, IDNR biennial fisheries surveys. Additionally we have secured the IEPA ambient water quality monitoring for the past 10 years within the Kaskaskia River and its tributaries. Biological survey data, watershed characteristics, and additional information concerning anthropogenic stressors have been assembled and georeferenced for the basin. This includes information on landuse/ landcover, surficial geology, modeled flow and water temperature, and point locations from ongoing and historic sampling and monitoring efforts. Locations of CRP/CREP parcels, NPDES permits, stream segments with enhanced dissolved oxygen designation, and stream segments with biologically significant stream designation have also been incorporated into the project GIS data layers.

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Objective 1: Basin-wide status and trends (basin-wide monitoring).

Existing Data: We focused on incorporating existing biological and limnological data within our GIS framework and using these data to select sampling locations for basin-wide monitoring and assessment.

We coordinated with IDNR Stream Specialists (Randy Sauer and Trent Thomas) on obtaining site location and access to fisheries data for recent samples as well as earlier collections (Figure 1). The initial IDNR/IEPA Intensive Basin Survey (IBS) sampling (1982-1983) included 128 stations throughout the Kaskaskia basin. The 2012 IBS sampling program included stations on the Kaskaskia River with a total of 56 sites visited. Fish assemblages have also been sampled biennially at eight stations and these data are currently available from IDNR's sportfish analysis system (SAS) database through 2011 (QA/QC is ongoing). Additional records of fisheries (Figure 2a) and mussel (Figure 2b) samples have also been incorporated into the Kaskaskia assessment database. Project staff also uncovered historic (1952-1969) INHS fisheries data from 65 stations in the Kaskaskia Basin that were sampled prior to the construction of the USACE dams that created Lake Shelbyville and Carlyle Lake. These data have also been incorporate into our database to assist with establishing baseline conditions for fish assemblages.

Total upstream (Figure 3a) and local watersheds (Figure 3b) varied greatly in the proportion of CRP/CREP enrollments in the Kaskaskia Basin with higher enrollment levels in the central part of the watershed. CRP/CREP practices were rated and assigned into three categories (High, Moderate, Low) based on their expected efficiency at reducing sediment and nutrient loading to streams (Figures 4a-c).

Stratified random sampling was used to select stream reaches within each combination of Hydrologic Unit (4 HUC8s), stream size (2 classes of wadeable stream), and proportion of CRP/CREP (5 classes) in the local watershed (Figure 5). A total of 104 sampling locations were selected for basin-wide monitoring over the course of the project.

Spring Sampling: We collected macroinvertebrate, habitat quality, and basic water quality information at 33 sampling locations during May and early June of 2013 (Table 1). For each acceptable site, a dipnet was used to collect macroinvertebrates from two high energy microhabitats and two low energy microhabitats. Specimens were individually picked from debris examined in collecting trays and subsequently stored in 95% ETOH. Water temperature, dissolved oxygen, percent saturation of dissolved oxygen, conductivity and pH were recorded using a Quanta hydrolab. Observations were recorded for general land use, erosion, stream morphology, sediment characteristics, water surface oils, weather conditions and collected invertebrate taxa. Habitat assessment was recorded for 12 parameters suggested by the Critical Trends and Assessment Program. This work will continue in subsequent years of the project at additional sites.

Summer Sampling: A training session was conducted for summer staff and 32 of the randomly selected locations were sampled during the 2013 summer sampling season including revisits to sites that had been sampled during the Spring survey (Figure 6; one revisited site was too large for wadeable stream electrofishing and was not sampled during the summer sampling period). During these site visits we sampled two different biological communities: fish (using an electric seine or backpack electrofishing unit at small sites) and macroinvertebrates (using a 20 jab method proportional to available habitat). Fish were identified and processed at the site and returned to the stream while macroinvertebrate samples were preserved in ethanol and stored for later processing. Basic water quality information (water temperature, pH, specific conductance, dissolved oxygen) was collected using a portable field meter (HACH model HQ40) and nutrient chemistry (N and P using a HACH DR 900 Multiparameter Handheld Colorimeter) data were also collected during these site visits. Information for two qualitative habitat indices (QHEI [Ohio EPA 2006] and IHI [Sass et al. 2010]) was recorded at each site. This work will continue in subsequent years of the project at additional sites.

Objective 2: Status of sensitive species (focal reach monitoring).

Spatial data for Biologically Significant Stream Segments (BSS; Bol et al. 2007, State of Illinois 2008), enhanced Dissolved Oxygen segments (IDNR/IEPA 2006) (Figure 7), CAFOs, and CRP/CREP parcels was obtained and integrated into our GIS (Figures 3a, b). These data form the basis for selection of focal reaches for monitoring. Point source locations (Figure 8) and Water quality data from the past 10 years were secured from IEPA Ambient Water Quality Network staff for nutrients (NH_4, NO_3-NO_2, TP, PO_4) throughout the basin (Figure 1).

Locations for all fish and mussel samples that we have been able to acquire have been georeferenced. Distribution maps of sensitive fish species have been reviewed. Maps of mussel species distribution are being developed. We reviewed known distributions of fish and mussels in the basin using IDNR and INHS databases to identify additional monitoring needs and potential focal species. We have also discussed using these data to model “natural distributions” for fish and mussel species.

Habitat Data: We characterized the physical and chemical habitat of 15 sites within focal reaches by collecting basic water quality data, conducting a habitat survey, and placing a series of water temperature monitors in enhanced DO reaches that overlap with BSS segments (Figure 7). Macroinvertebrate samples were also collected at these sites using the 20 jab method proportional to available habitat. These efforts will continue in subsequent years of the project at these sites.

Fish Community Data: We collected a total of twelve fish samples in consecutive reaches along five stream segments within the Kaskaskia basin (Figure 6, intense sites). These samples will be used to evaluate the efficiency of our collection methods, track species fidelity to local habitat conditions, and improve our ability to assess the distribution and abundance of rare species in the basin. These efforts will continue in subsequent years of the project at additional sites.

Mussel Community Data: We coordinated with INHS staff responsible for statewide mussel collections (Illinois State Wildlife Grant T-53) to obtain mussel collections data from the Kaskaskia River and its tributaries. Sample station locations and species collection records through the 2012 field season have been secured (Figure 2b). During these surveys (2009 – 2012) ninety-five sites within the Kaskaskia River Watershed were sampled for mussels with live individuals of 29 species (32 species total including relic shells) collected (Shasteen et al. 2013). No young individuals (i.e., fewer than 4 growth rings) were found in twelve of these species suggesting a lack of recent successful reproduction.

Objective 3: Influence of private land conservation efforts (fixed site monitoring).

Project staff have meet with personnel from the Illinois State Water Survey (ISWS; Laura Keefer and John Beardsley) to discuss collaborative sampling efforts and coordinate staff recruitment. We are working with ISWS staff on identifying fixed-site monitoring locations that can take advantage of their data intensive discharge, sediment, and nutrient monitoring.

ISWS is looking for sites in relatively small drainages with little influence from large-scale water withdrawals or additions from industrial or municipal facilities (i.e., without major water control structures or point discharges). The current focus is on investigating site locations along Lost Creek, Shoal Creek, Silver Creek, and Hurricane Creek.

We expect to collect baseline data from locations associated with ISWS monitoring locations as they are established. This work is ongoing.

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Table 1. Spring Sampling Locations for macroinvertebrates, habitat, and water quality (CTAP methods).

Reach Code	County	Body of Water	Latitude	Longitude	Date Sampled
K15	Champaign	Kaskaskia Ditch	40.08007	-88.34995	05/14/13
K46	Champaign	Kaskaskia Ditch	40.01112	-88.34871	05/14/13
K273	Moultrie	West Okaw River	39.65996	-88.68392	05/15/13
K299	Moultrie	West Okaw River	39.64975	-88.69464	05/15/13
K754	Shelby	Angel Branch	39.44958	-88.95811	05/16/13
K795	Shelby	Mud Creek	39.40991	-88.89952	05/16/13
K992	Shelby	Mitchell Creek	39.31132	-88.88154	05/22/13
K1160	Shelby	Mitchell Creek	39.25612	-88.89892	05/22/13
K1250	Shelby	Polecat Creek	39.23119	-88.91961	05/22/13
K1900	Fayette	Trib. Of Linn Creek	39.03952	-89.01681	05/23/13
K2182	Fayette	Vandalia Ditch	38.97686	-89.06161	05/23/13
K2261	Fayette	Raccoon Creek	38.92369	-89.20036	05/23/13
K3126	Madison	Sugar Creek	38.69154	-89.64869	05/24/13
K3536	Clinton	Sugar Creek	38.57401	-89.63127	05/24/13
K3621	Clinton	Sugar Creek	38.55367	-89.64402	05/24/13
K3386	Clinton	Lake Branch	38.62847	-89.57501	05/28/13
K3496	Clinton	Trib. Of Beaver Creek	38.57861	-89.45931	05/29/13
K3570	Marion	Trib. Of Crooked Creek	38.56233	-89.01046	05/29/13
K3963	Washington	Webster Creek	38.48457	-89.15375	05/29/13
K2858	Marion	East Fork Kaskaskia River	38.76218	-88.94841	05/30/13
K3107	Marion	Crooked Creek	38.67911	-88.90274	05/30/13
K3380	Marion	Trib of Brubaker Creek	38.60731	-88.89476	05/30/13
K2756	Marion	North Fork Kaskaskia River	38.78694	-88.97711	05/31/13
K2232	Bond	Headwater Governor Bond Lake	38.93551	-89.34005	05/31/13
K1474	Montgomery	East Fork Shoal Creek	39.17352	-89.36142	06/03/13
K1542	Montgomery	East Fork Shoal Creek	39.14887	-89.35163	06/03/13
K1581	Montgomery	East Fork Shoal Creek	39.14298	-89.35374	06/03/13
K1635	Montgomery	Miller Creek	39.11608	-89.47446	06/04/13
K1648	Montgomery	East Branch Lake Fork	39.11686	-89.63176	06/04/13
K1879	Montgomery	Grove Branch	39.04552	-89.62346	06/04/13
K2668	Bond	Shoal Creek	38.80671	-89.5074	06/05/13
K2349	Bond	Dorris Creek	38.90523	-89.53351	06/05/13
K1104	Montgomery	Blue Grass Creek	39.26891	-89.53411	06/05/13

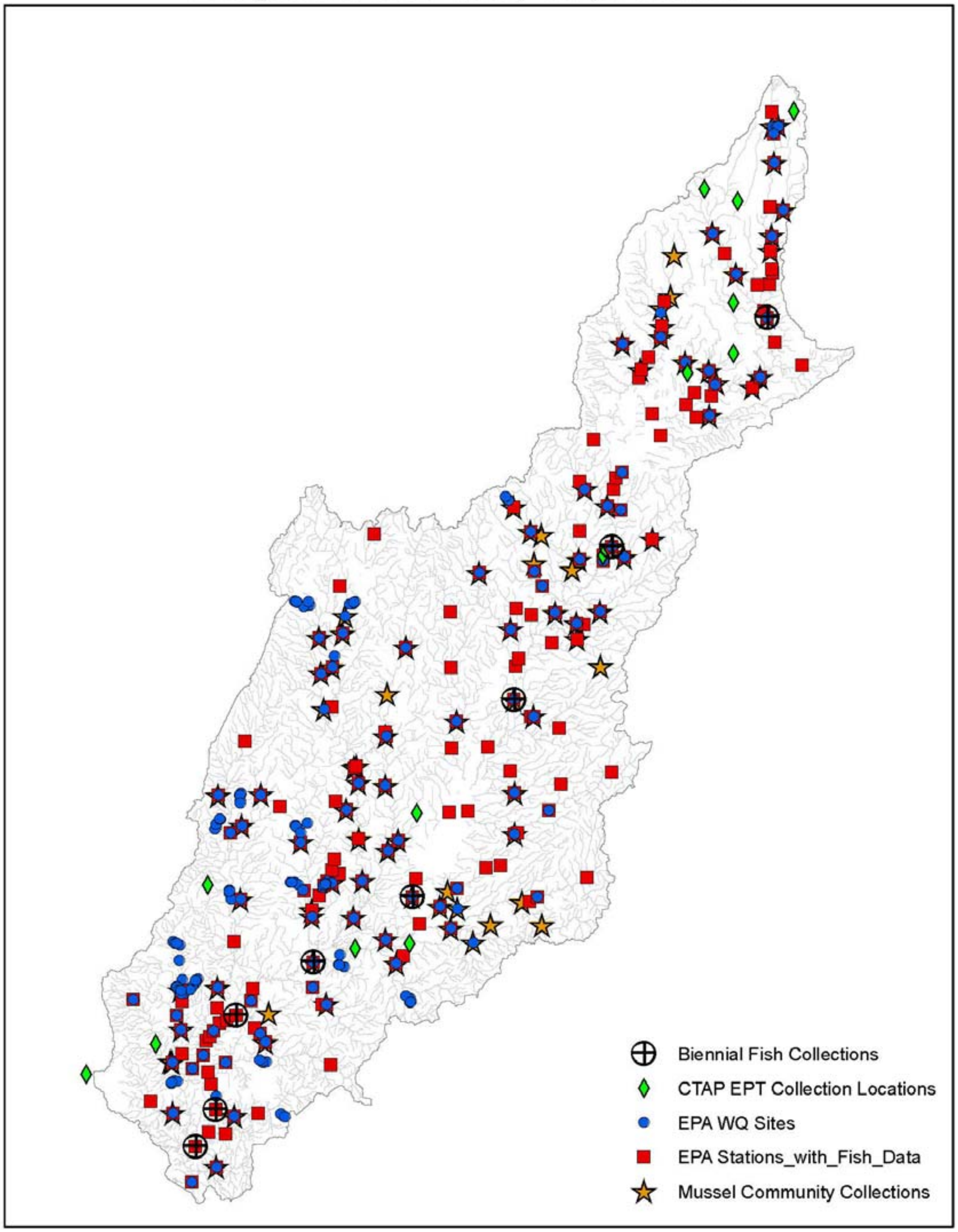

Figure 1. Locations of historical biological and water quality monitoring stations in the Kaskaskia River basin. Type of data collected and temporal coverage varies between locations.

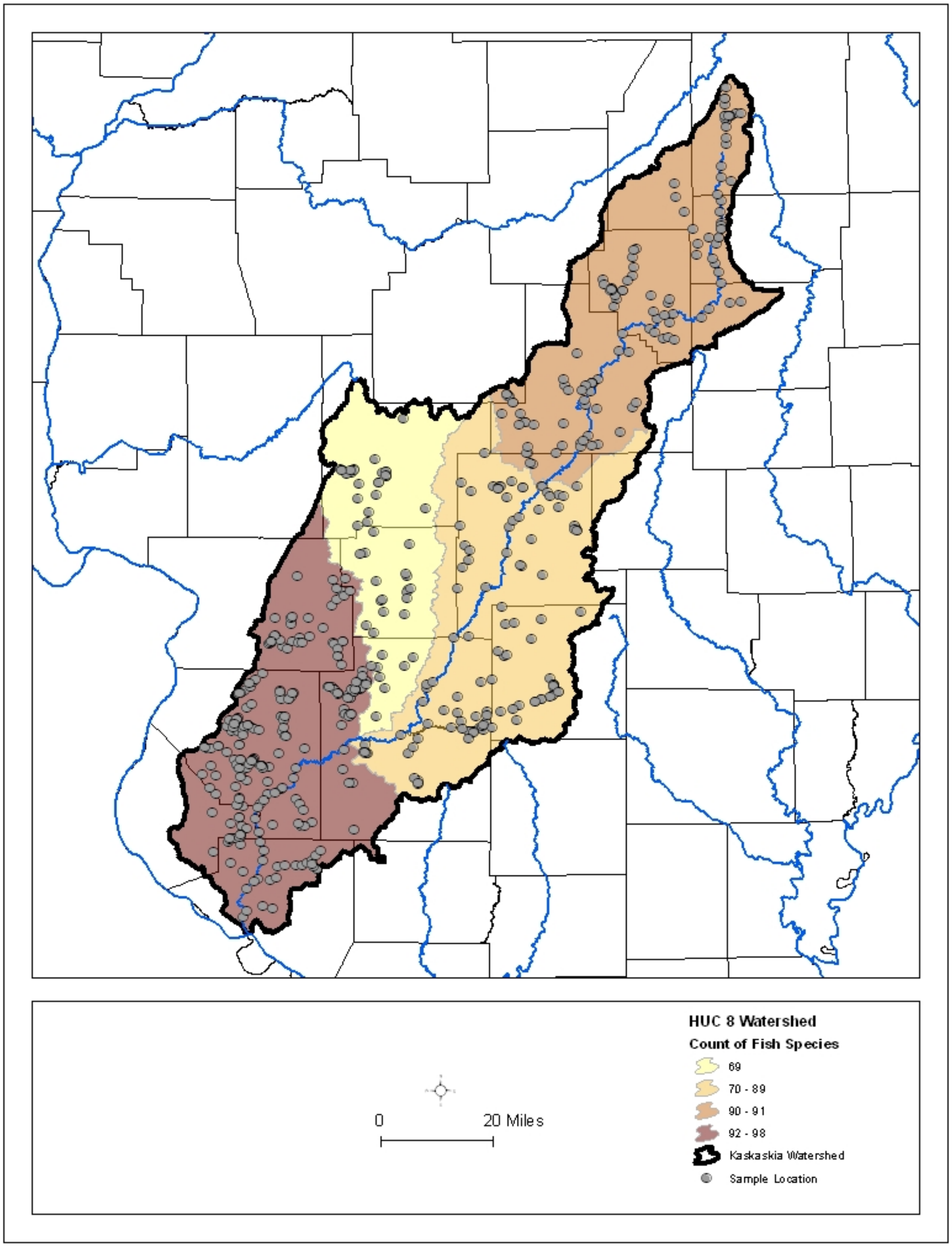

Figure 2a. Fish species richness within the Kaskaskia River basin. Total number of fish species recorded by HUC 8 watershed (Note: Not all existing sample locations are depicted).

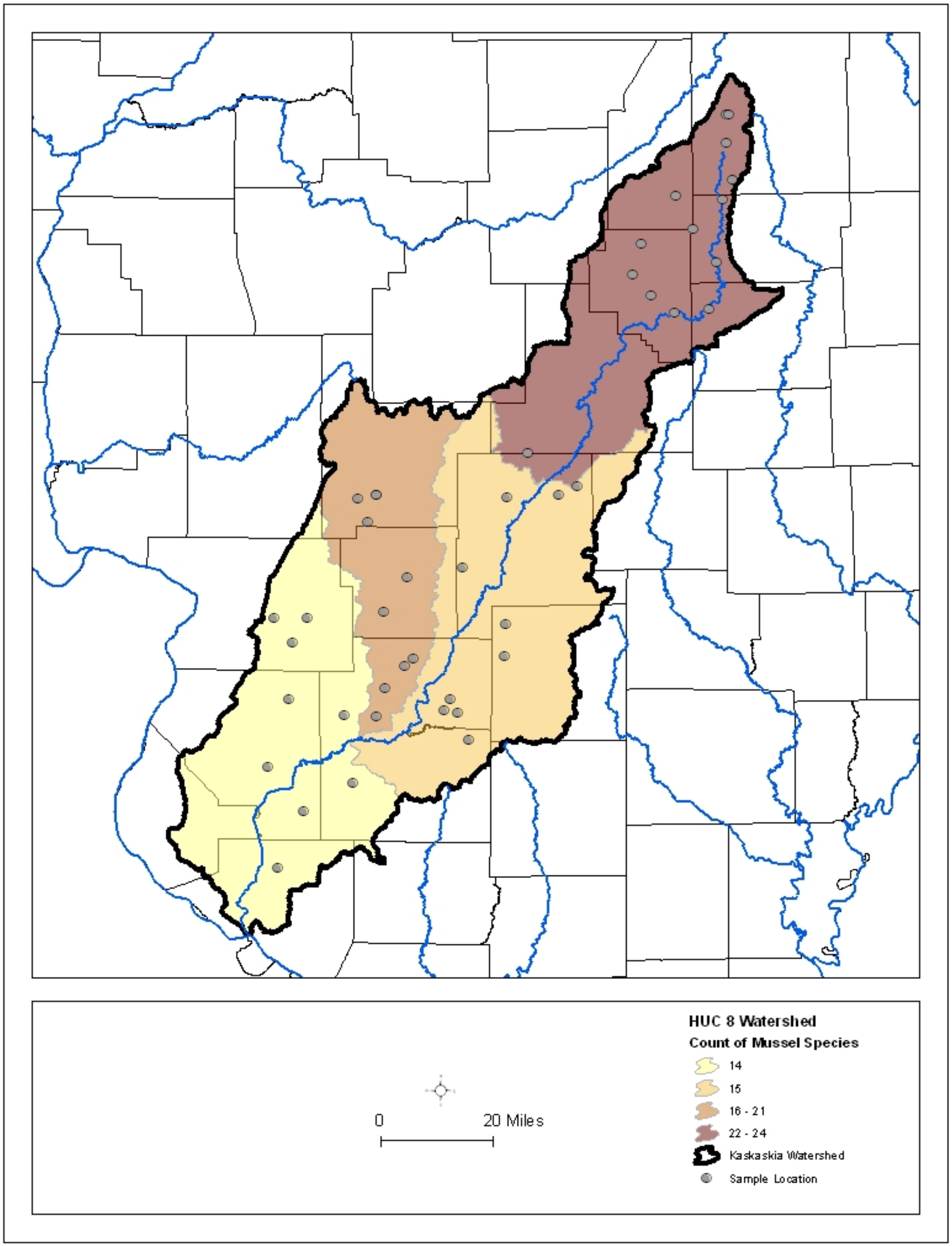

Figure 2b. Mussel species richness within the Kaskaskia River basin. Total number of mussel species within each HUC 8 watershed (Note: Not all existing sample locations are depicted).

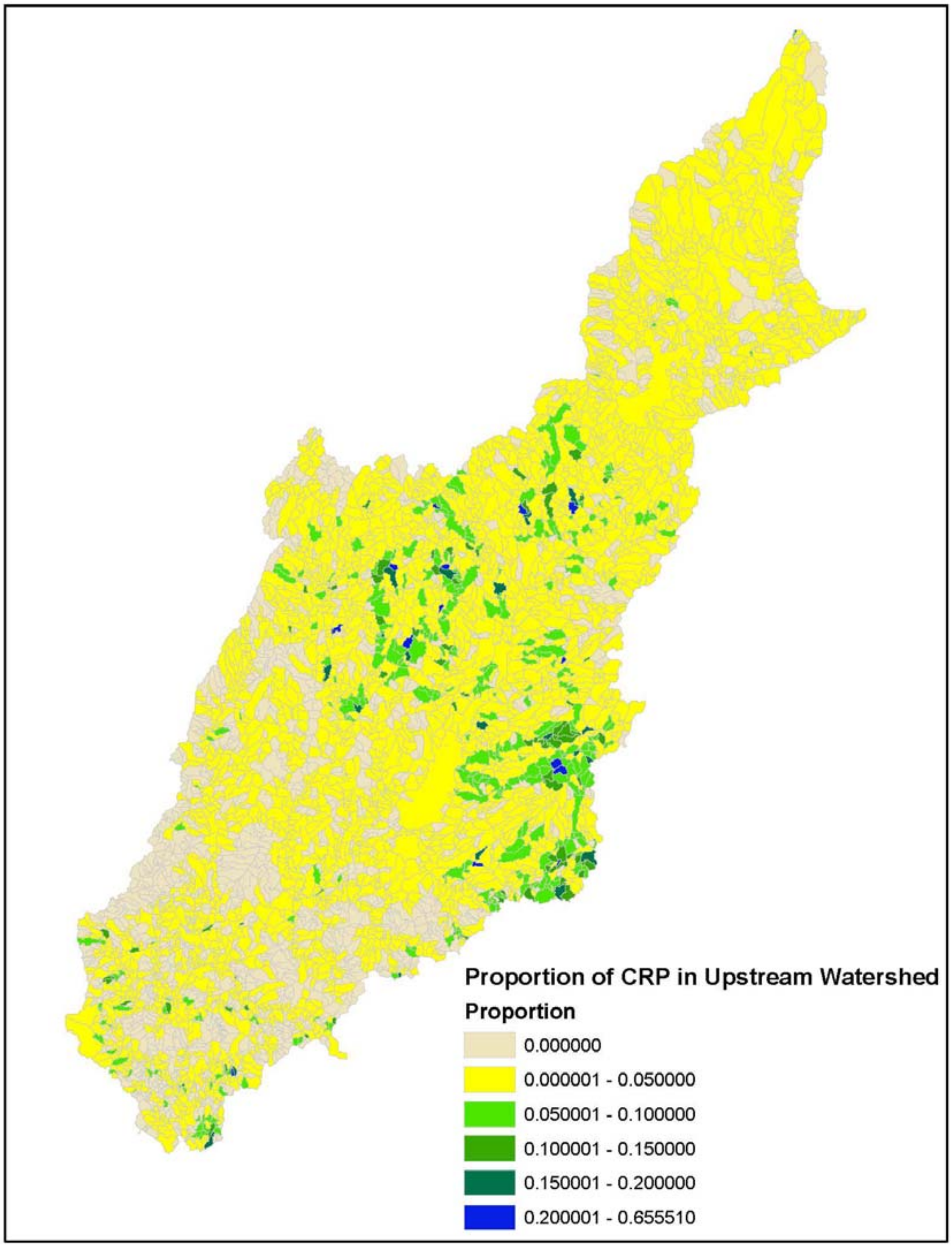

Figure 3a. Proportion of total upstream watershed containing land enrolled in the Conservation Reserve Program (CRP or CREP) in the Kaskaskia River basin.

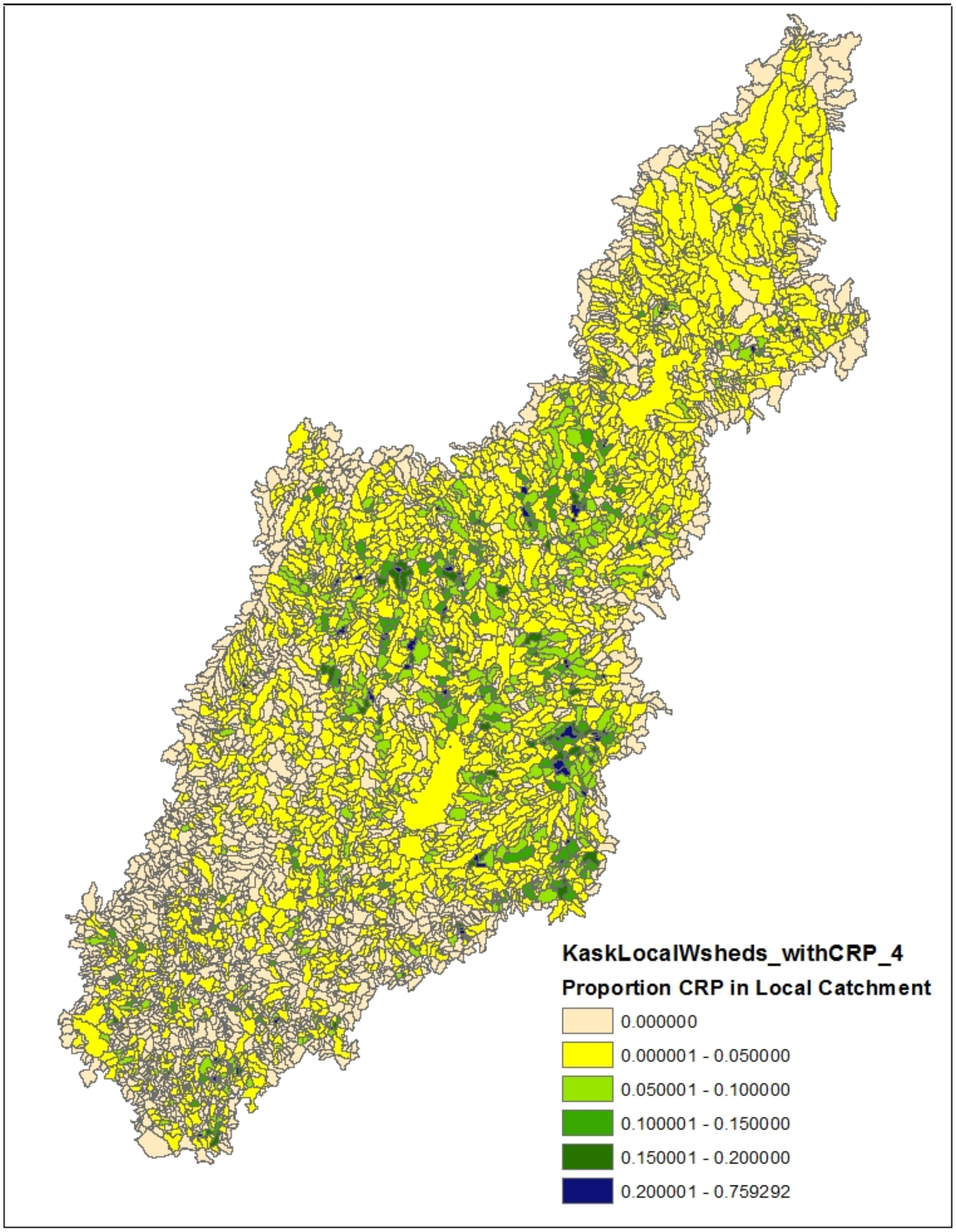

Figure 3b. Proportion of local watershed containing land enrolled in the Conservation Reserve Program in the Kaskaskia River basin.

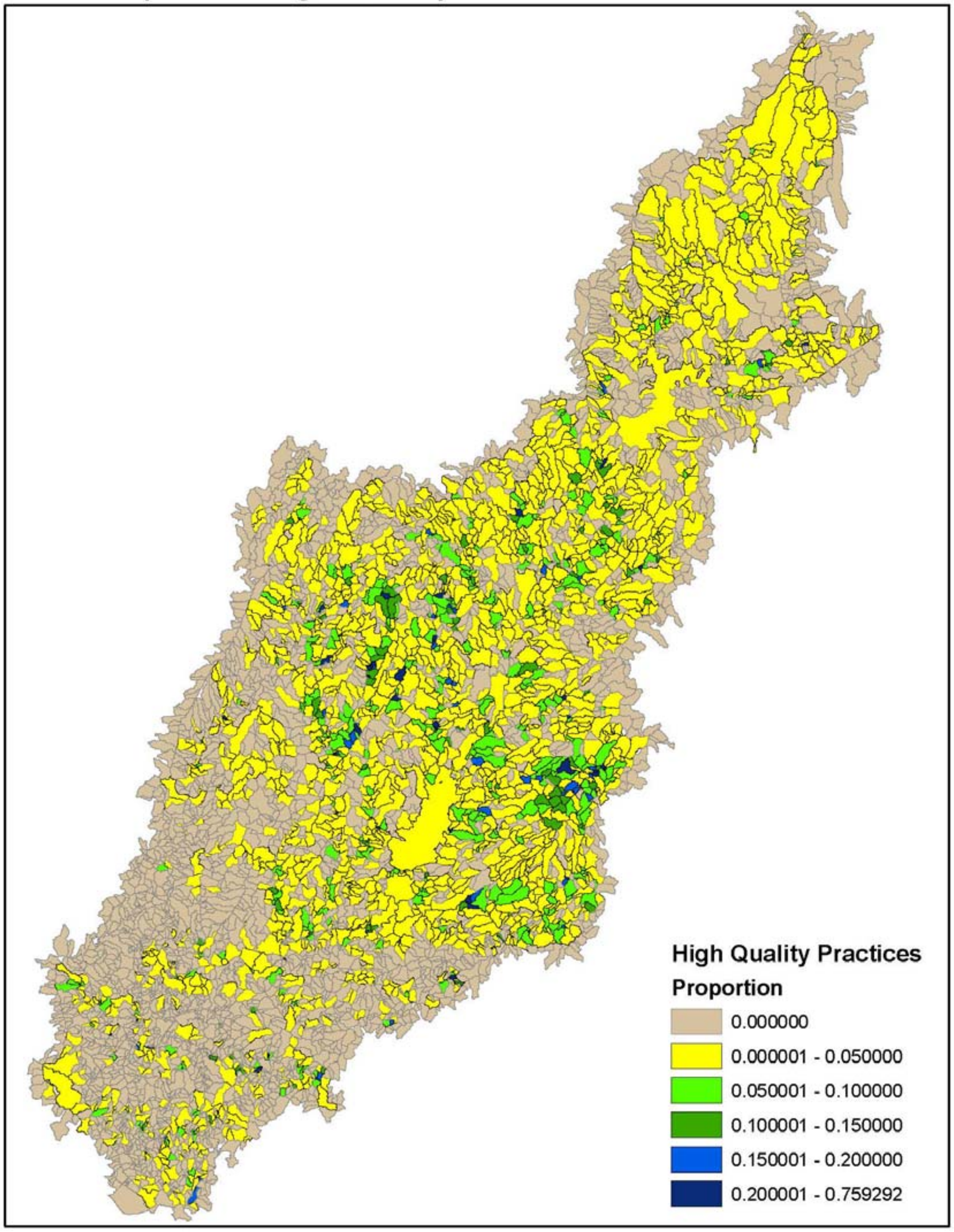

Figure 4a. Proportion of local watershed containing land enrolled in the Conservation Reserve Program in the Kaskaskia River basin having practices with high expected reductions in runoff and/or loading of sediments and nutrients.

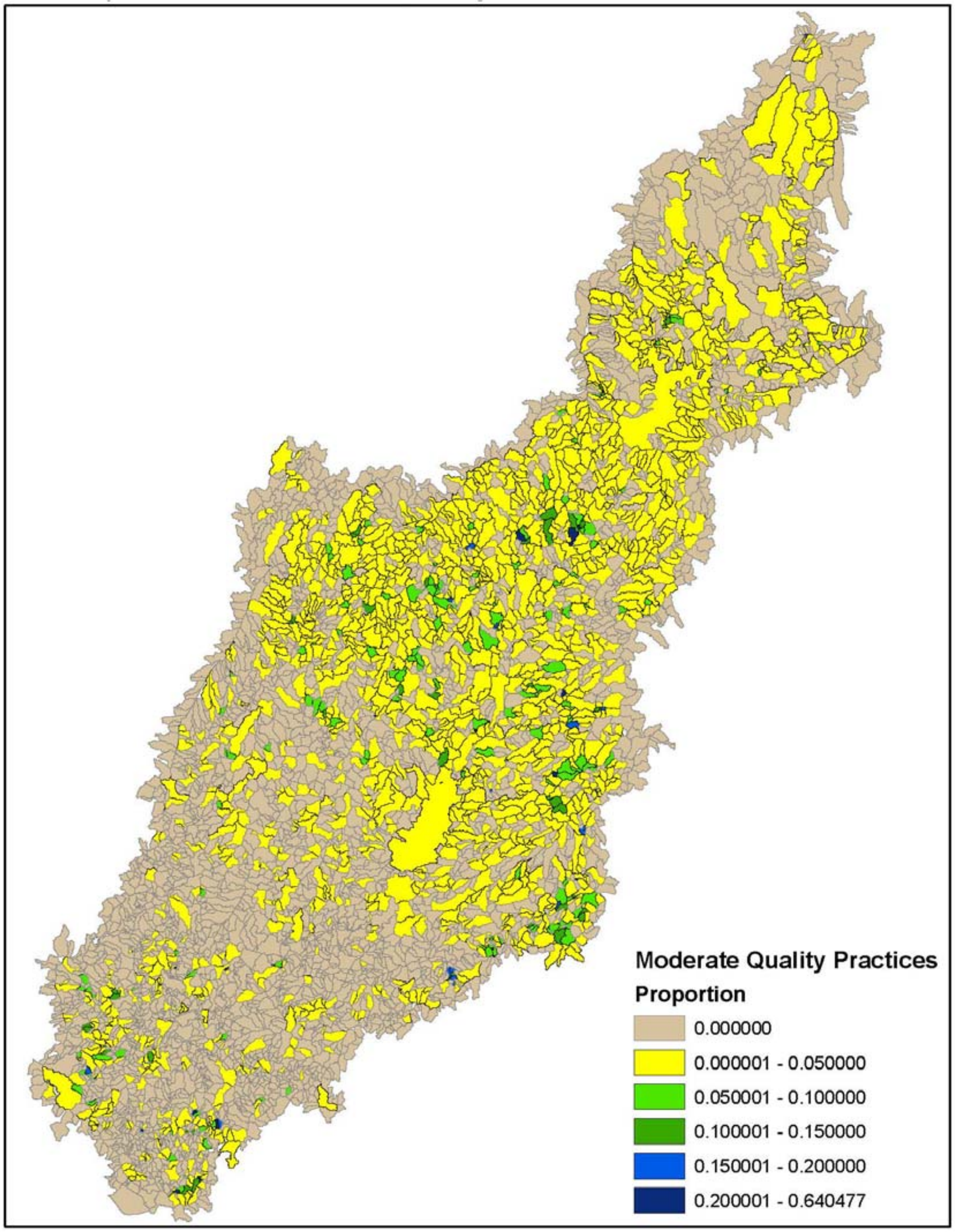

Figure 4b. Proportion of local watershed containing land enrolled in the Conservation Reserve Program in the Kaskaskia River basin having practices with moderate expected reductions in runoff and/or loading of sediments and nutrients. These practices often focus on wildlife habitat rather than improving instream condition.

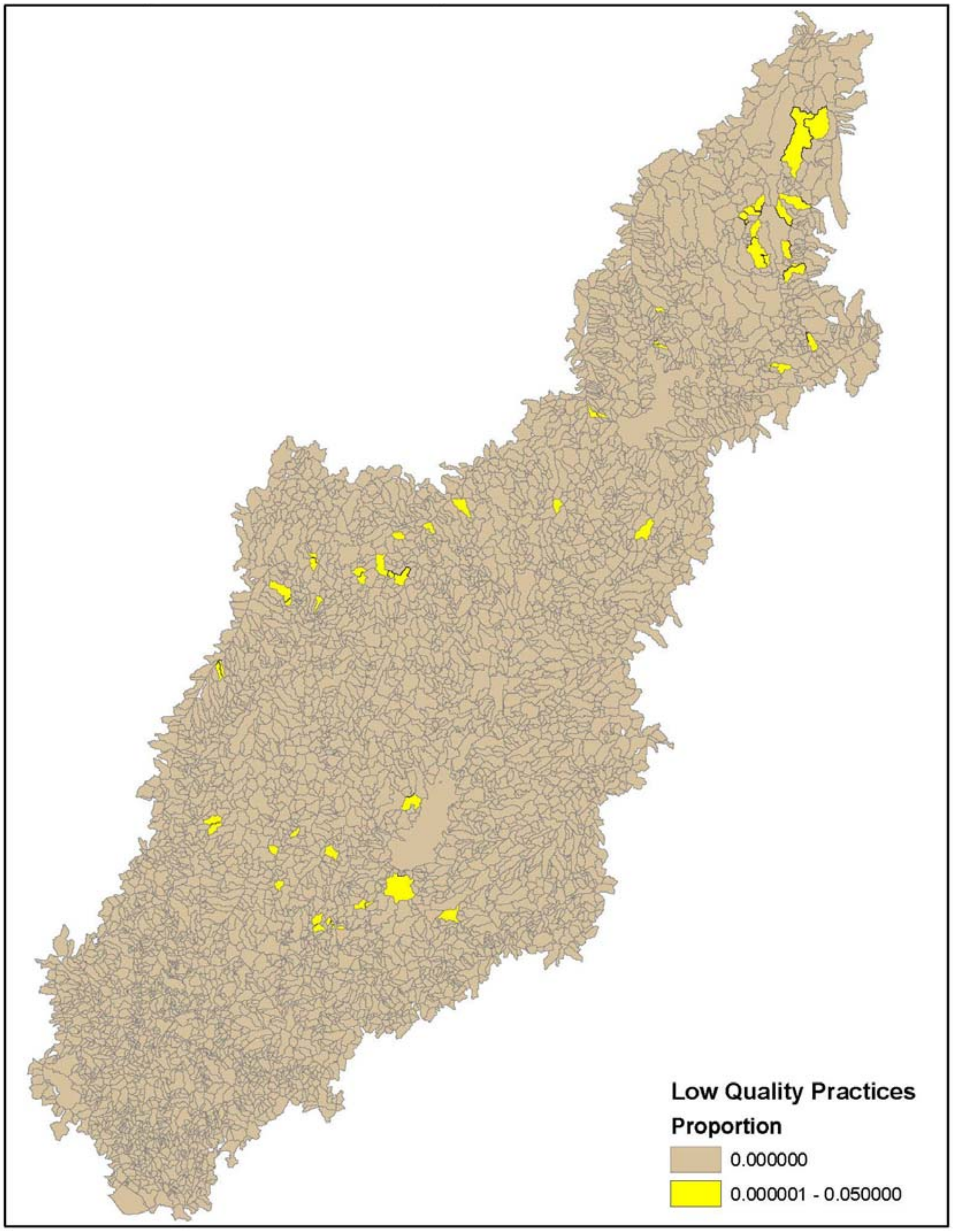

Figure 4c. Proportion of local watershed containing land enrolled in the Conservation Reserve Program in the Kaskaskia River basin having practices with low expected reductions in runoff and/or loading of sediments and nutrients. These practices often focus on wildlife habitat rather than improving instream condition.

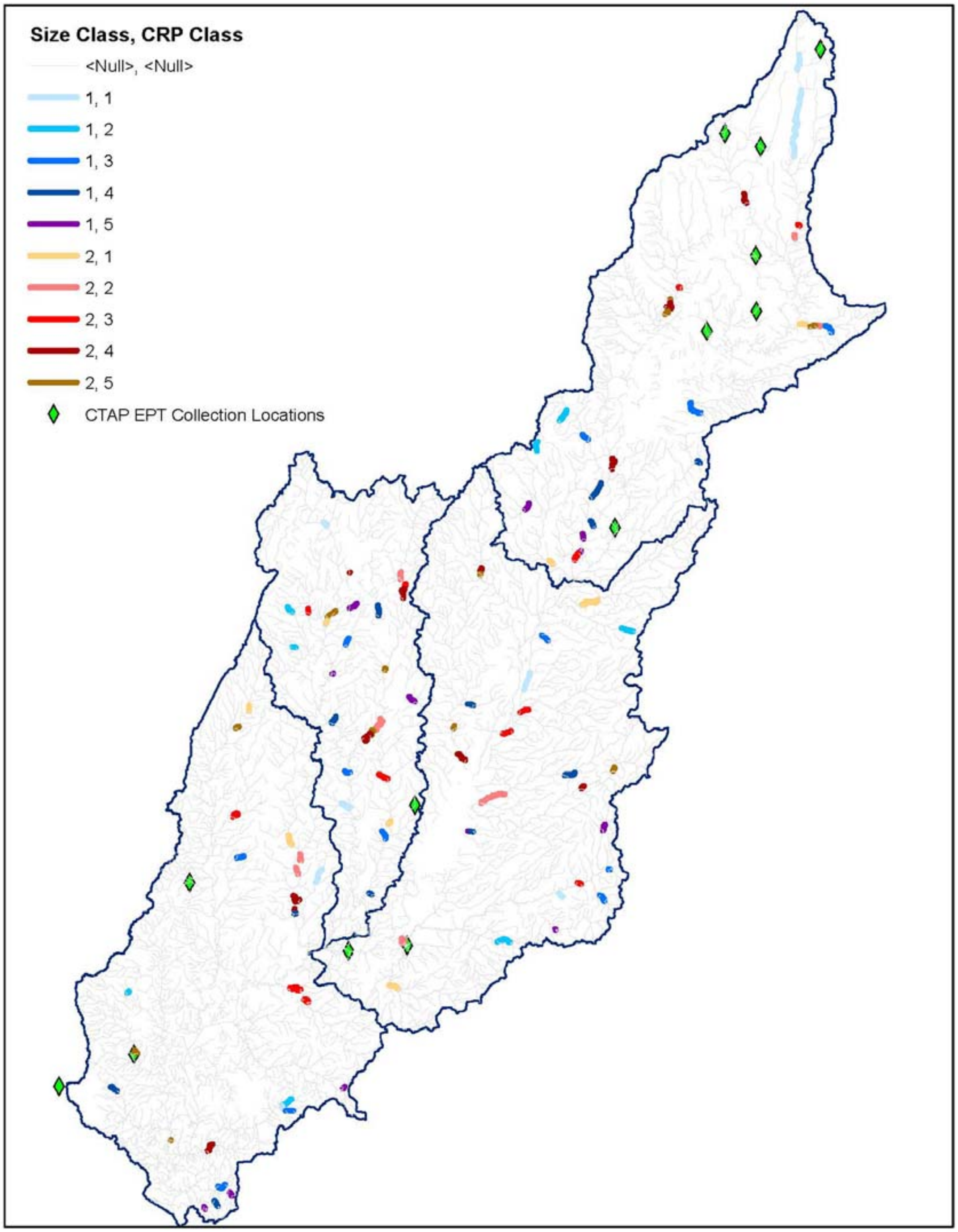

Figure 5. Sampling reaches selected for characterization of status and trends in the Kaskaskia River basin. Sampling locations were randomly selected based on three strata: HUC8, stream size (small, moderate), proportion of CRP/CREP lands in the watershed (see Figure 3a for CRP/CREP classes).

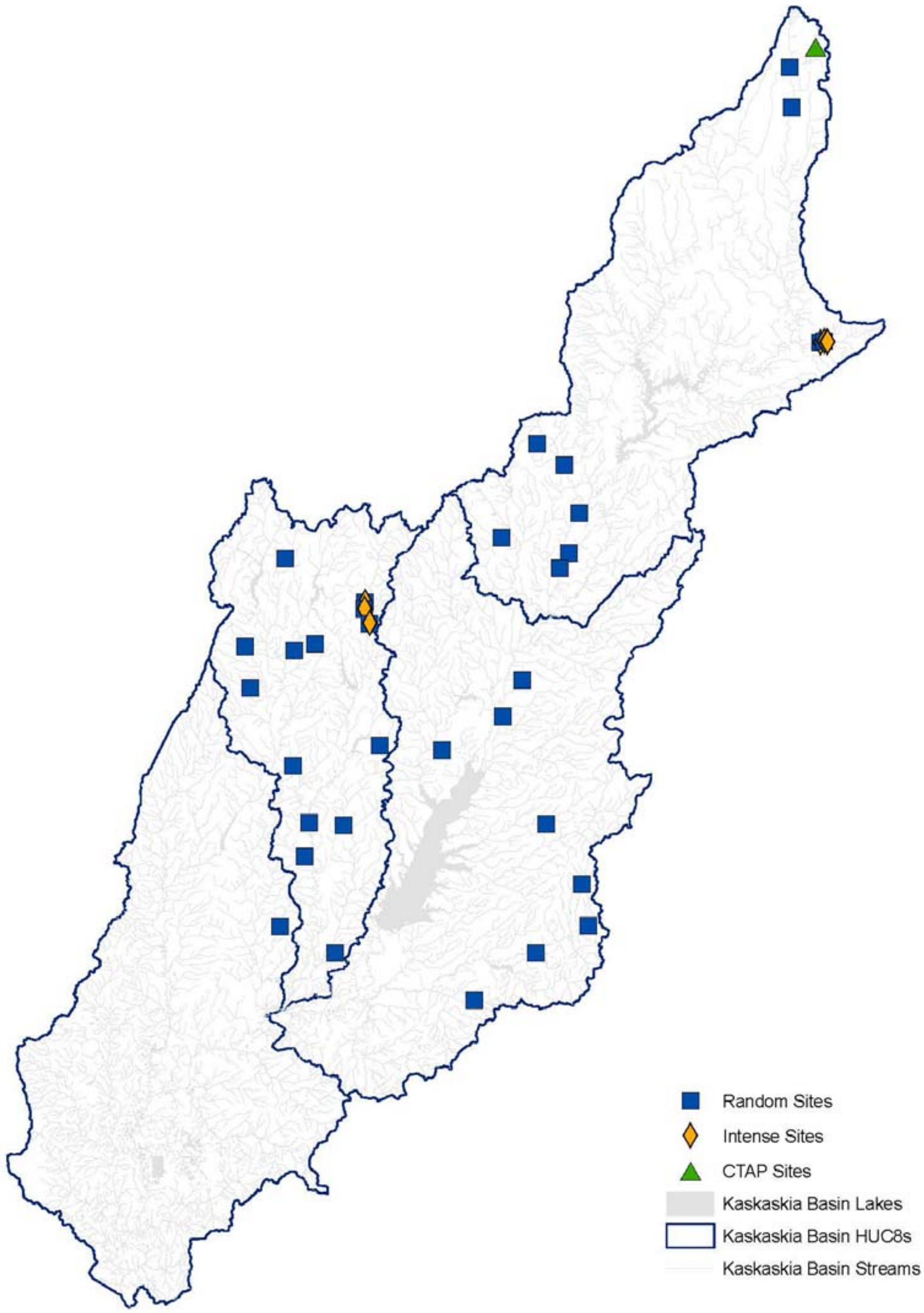

Figure 6. Locations of basin-wide status and trends sites visited in the Kaskaskia River basin during the summer 2013 sampling program. Intensive fish sampling reaches and one CTAP site visited during 2013 sampling program also depicted.

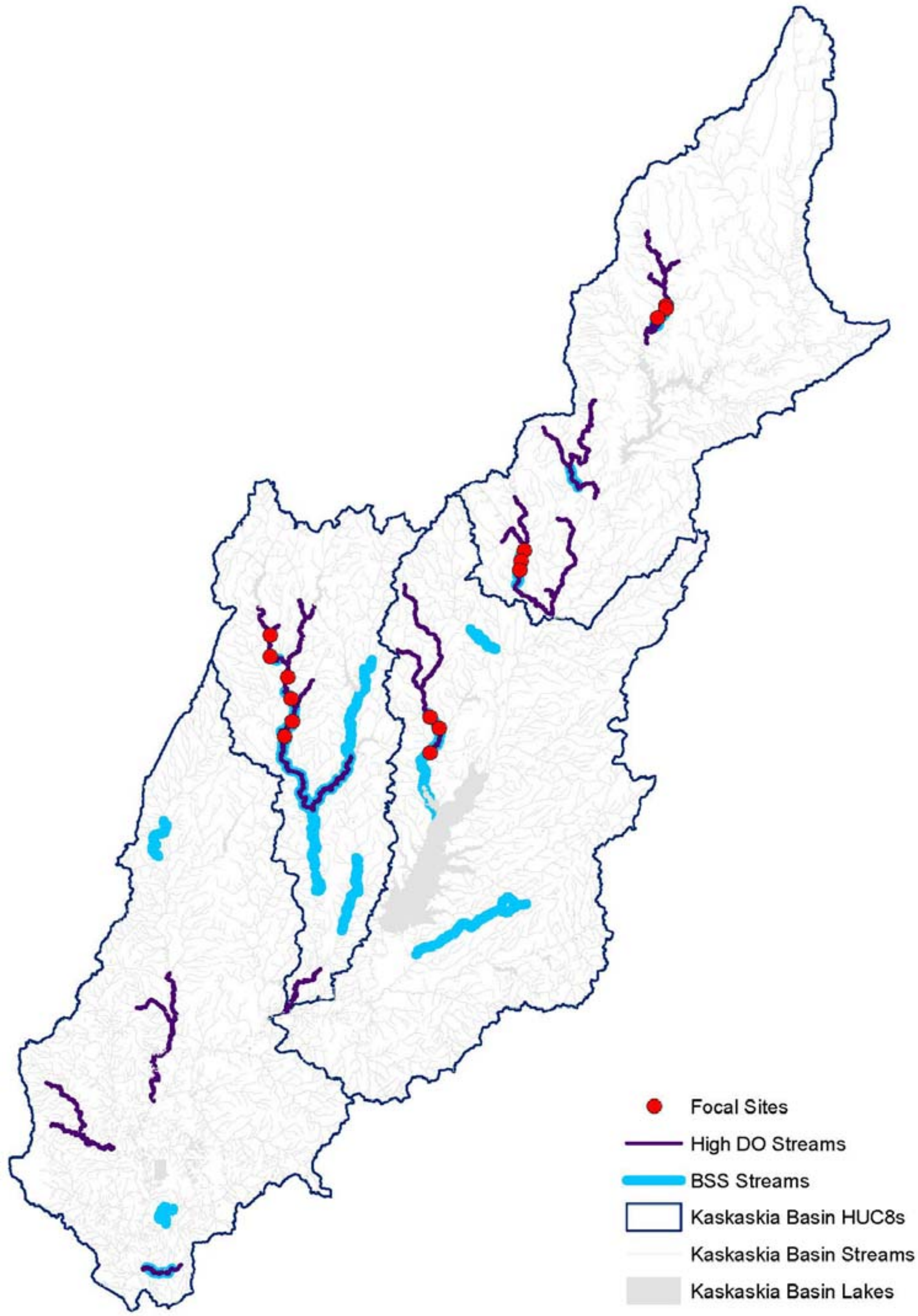

Figure 7. Enhanced Dissolved Oxygen reaches and Biologically Significant Stream segments in the Kaskaskia River basin. Focal sites were selected to characterize the physical and chemical habitat of these stream reaches.

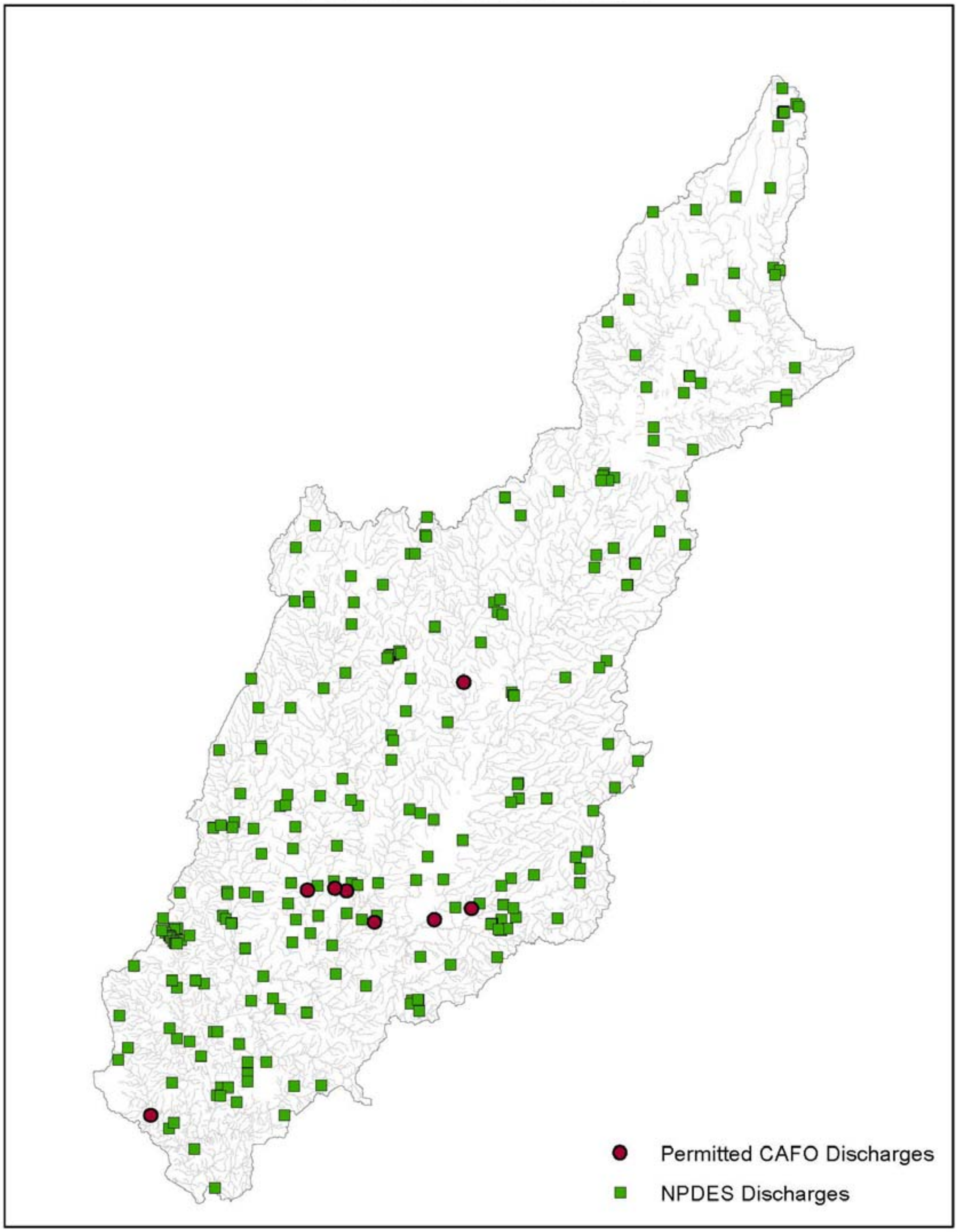

Figure 8. Locations of NPDES and permitted CAFO dischargers in the Kaskaskia River basin.

Appendix B

Illinois CREP Assessment 2013

This is a brief summary of the avian research conducted during the spring and summer of 2013 at randomly selected locations within CREP easements.

During the second year of our assessment of the CREP program in Illinois we continued point counts at all locations sampled in 2012 and added nest searching for shrubland species at 8 easements. Easements were located in Brown, Christian, Fulton, Hancock, Knox, Logan, Menard, McDonough, and Sangamon counties. Conservation practices sampled included CP4D, CP3A, CP23, and CP22. On the ground habitat types were forest (7%), grassland (44%), and shrubland (49%). Average easement size was 28.2 acres and the range was 7.34–194.16 acres. We conducted 573-point counts at 191 CREP easements. Bird detections were similar in species composition to our 2012 surveys (results below). During nest searches we found 127 Bell's Vireo, 44 Willow Flycatcher, 50 Brown Thrasher, 39 American Robin, 34 Gray Catbird, 33 Field Sparrow, and 15 Northern Cardinal active nests.

Species list in order of most detected to least detected (with more than 50 detections):

Common Yellowthroat
Red-Winged Blackbird
Indigo Bunting
Field Sparrow*
American Goldfinch
Dickcissel*
Northern Cardinal
American Robin
Song Sparrow
Gray Catbird
American Crow
Mourning Dove
Blue Jay
Northern Bobwhite*
Red-Bellied Woodpecker
Eastern Towhee
Eastern Wood Pewee
Warbling Vireo
Willow Flycatcher
Brown-Headed Cowbird
Baltimore Oriole
Yellow-Billed Cuckoo*
Rose-Breasted Grosbeak
Ring-Necked Pheasant
Cedar Waxwing
Eastern Kingbird
Bell's Vireo*

House Wren
Downy Woodpecker
Tufted Titmouse
Great-Crested Flycatcher
Barn Swallow
***Listed as Species in Greatest Need of Conservation for Illinois**

Other species in Greatest Need of Conservation for Illinois we detected in small numbers were: Red-Headed Woodpecker, Henslow's sparrow, Grasshopper Sparrow, Sedge Wren, Black-billed Cuckoo, Northern Flicker, and Yellow-Breasted Chat.

Vegetation:

Species encountered at CREP sites reveal that most of the plants are native, though these species are disturbance tolerant and considered weedy. Native annual weeds like common and giant ragweed, tall boneset, and annual fleabane were encountered at many sites. Common goldenrod, found at every site, is a quick growing; native perennial herb that readily colonizes disturbed soil. Other weedy native, perennials included panicled aster and hairy aster. Woody natives with a somewhat weedy habit included silver maple, eastern cottonwood, and green ash (*Fraxinus pennsylvanica).*

Native plant species were generally more abundant than non-native species, but invasive species like reed canary grass, field thistle, and Amur honeysuckle were present on some sites. Compared to randomly selected wetland and grassland sites sampled as part of the Critical Trends Assessment Program (CTAP), the CREP sites were more botanically rich and diverse, but as sites mature without management or disturbance, plant diversity is expected to decline.

Appendix C

Monitoring and Evaluation of Sediment and Nutrient Delivery to the Illinois River: Illinois River Conservation Reserve Enhancement Program (CREP)

by
Illinois State Water Survey
Illinois Department of Natural Resources

Prepared for the
Office of Resource Conservation,
Illinois Department of Natural Resources

November 2013

This report was printed on recycled and recyclable papers.

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Monitoring and Evaluation of Sediment and Nutrient Delivery to the Illinois River: Illinois River Conservation Reserve Enhancement Program (CREP)

by
Illinois State Water Survey
Illinois Department of Natural Resources

1. Introduction

The Illinois River Conservation Reserve Enhancement Program (CREP) was initiated as a joint federal/state program with the goal of improving water quality and wildlife habitat in the Illinois River basin. Based on numerous research and long-term data, the two main causes of water quality and habitat degradations in the Illinois River were known to be related to sedimentation and nutrient loads. Based on this understanding, the two main objectives of the Illinois River CREP were stated as follows:

1) Reduce the amount of silt and sediment entering the main stem of the Illinois River by 20 percent.

2) Reduce the amount of phosphorous and nitrogen loadings to the Illinois River by 10 percent.

To assess the progress of the program towards meeting the two goals, the Illinois Department of Natural Resources (IDNR) and the Illinois State Water Survey (ISWS) are developing a scientific process for evaluating the effectiveness of the program. The process includes data collection, modeling, and evaluation. Progress made so far in each of these efforts is presented in this report.

Acknowledgments

The work upon which this report is based was supported by funds provided by the Office of Resource Conservation, Illinois Department of Natural Resources. Ms. Debbie Bruce and Richard Mollahan managed the project for IDNR and provided the proper guidance and support to design and operate the monitoring program and the associated research. Their continued support and guidance is greatly appreciated.

Several Illinois State Water Survey staff participated and contributed towards the successful accomplishment of project objectives. Jim Slowikowski and Kip Stevenson are responsible for the data collection and analysis. Laura Keefer was responsible for analysis of the

land use data . Jas Singh and Yanqing Lian were responsible for the development of the watershed models. Vern Knapp provided the analyses on variability and trends in precipitation and streamflow in the Illinois River basin. Momcilo Markus analyzed the Illinois Environmental Protection Agency nutrient data for analyses of long-term trends. Sangeetha Chandrasekaran analyzed the Benchmark Sediment Monitoring data for long-term trend analysis. Patti Hill prepared the draft and final reports.

2. Monitoring and Data Collection

The monitoring and data collection component consist of a watershed monitoring program to monitor sediment and nutrient for selected watersheds within the Illinois River basin and also to collect and analyze land use data throughout the river basin. Historically, there are a limited number of sediment and nutrient monitoring stations within the Illinois River basin, and most of the available records are of short duration. For example, figure 2-1 shows all the active and inactive sediment monitoring stations within the Illinois River basin prior to the start of monitoring for CREP. Out of the 44 stations shown in the map, only 18 stations had records longer than 5 years and only 8 stations had more than 10 years of record. Therefore the available data and monitoring network was insufficient to monitor long-term trends especially in small watersheds where changes can be observed and quantified more easily than in larger watersheds.

To fill the data gap and to generate reliable data for small watersheds, the Illinois Department of Natural Resources funded the Illinois State Water Survey to initiate a monitoring program that will collect precipitation, hydrologic, sediment, and nutrient data for selected small watersheds in the Illinois River basin that will assist in making a more accurate assessment of sediment and nutrient delivery to the Illinois River.

Sediment and Nutrient Data

Five small watersheds located within the Spoon and Sangamon River watersheds were selected for intensively monitoring sediment and nutrient within the Illinois River basin. The locations of the watersheds and the monitoring stations are shown in figures 2-2 and 2-3 and information about the monitoring stations is provided in table 2-1. Court and North Creeks are located within the Spoon River watershed, while Panther and Cox Creeks are located within the Sangamon River watershed. The Spoon River watershed generates the highest sediment per unit area in the Illinois River basin, while the Sangamon River watershed is the largest tributary watershed to the Illinois River and delivers the largest total amount of sediment to the Illinois River. The type of data collected and the data collection methods have been presented in detail in the first progress report for the monitoring program (Demissie et al., 2001) and in the Quality Assurance Project Plan (QAPP) given in Appendix A. This report presents the data that have been collected and analyzed at each of the monitoring stations.

Table 2-1. Sediment and Nutrient Monitoring Stations Established for the Illinois River CREP

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
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

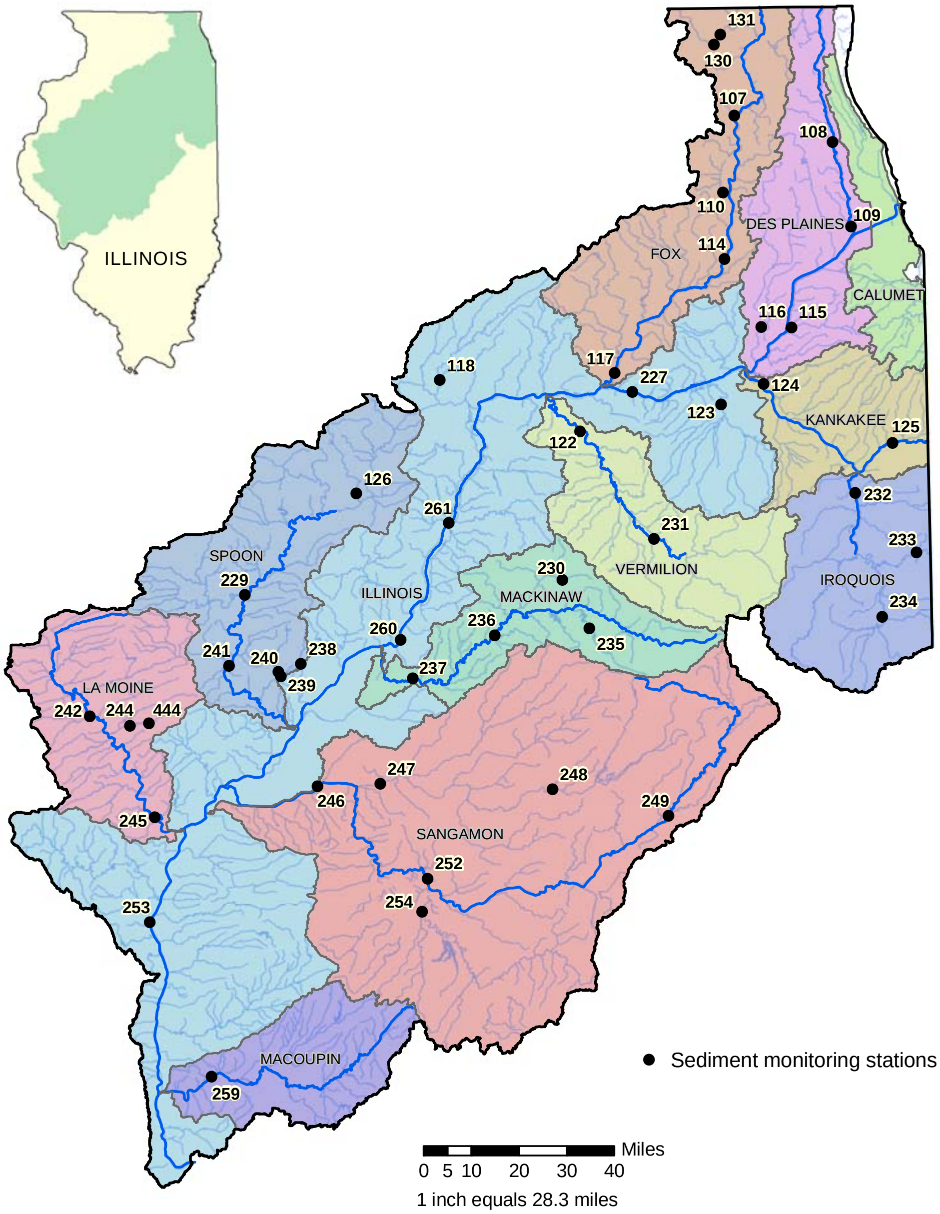


Figure 2-1. Locations of available in-stream sediment data within the Illinois River watershed, 1981-2000

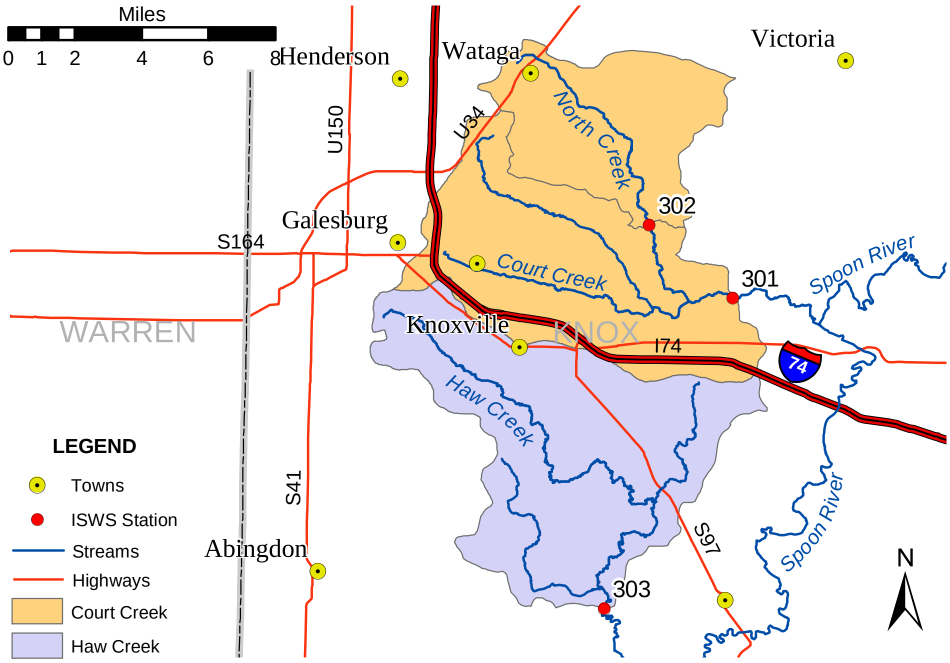


Figure 2-2. Location of monitoring stations in Court and Haw Creek watersheds

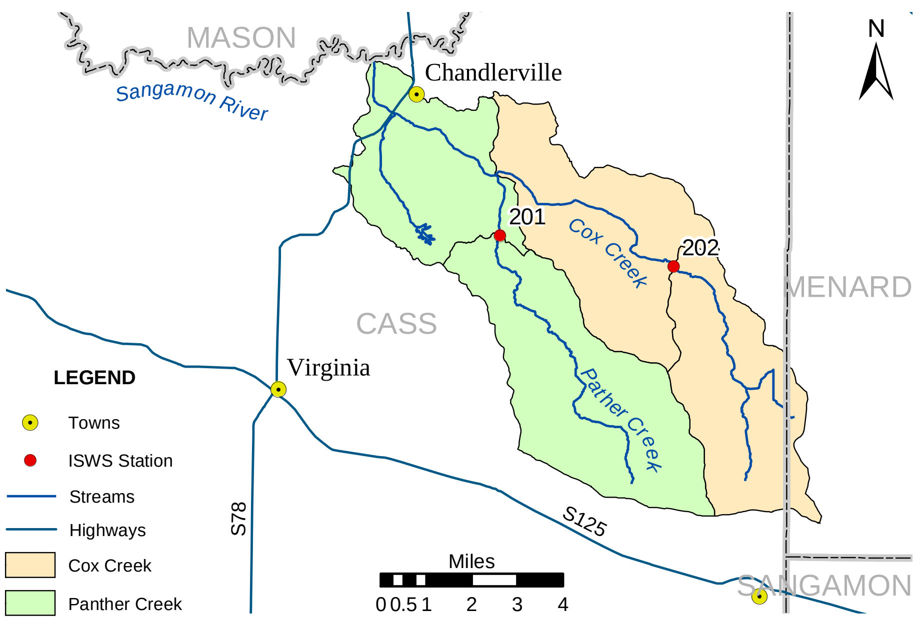


Figure 2-3. Location of monitoring stations in Panther and Cox Creek watersheds

Sediment Data

The daily streamflow and suspended sediment concentrations observed at all the five monitoring stations from Water Year 2000 to Water Year 2012 are given in Appendix B and C. Examples of the frequency of data collection are shown in figures 2-4 and 2-5 for the Court Creek Station. A summary of statistics for all stations showing the mean, medium, minimum maximum, 25^{th} percentile, and 75^{th} percentile are given in table 2-2. Over 25,259 samples have been collected and analyzed at the five monitoring stations since the monitoring program was initiated. As can be seen in the figures, suspended sediment concentrations are highly variable throughout a year and also from year to year depending on the climatic conditions. It is also evident that sediment concentrations are the highest during storm events resulting in the transport of most of the sediment during storm events. Therefore, it is extremely important that samples are collected frequently during storm events to accurately measure sediment loads at monitoring stations.

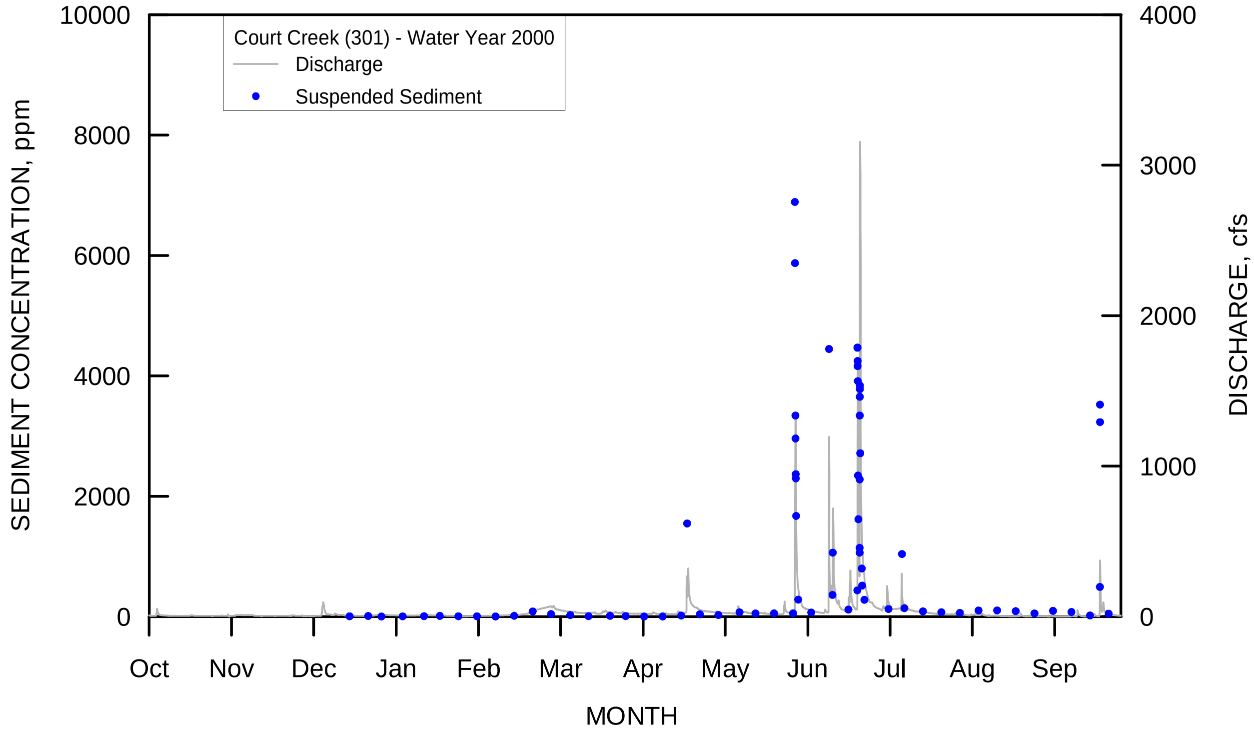
Nutrient Data

All the nutrient data collected and analyzed from Water Year 2000 through Water Year 2012 at the five monitoring stations are given in Appendices D and E. The nutrient data are organized into two groups: nitrogen species and phosphorous species. The nitrogen species include nitrate-nitrogen (NO_3-N), nitrite-nitrogen (NO_2-N), ammonium-nitrogen (NH_4-N), and total Kjedahl nitrogen (TKN). The phosphorous species include total phosphorous (TP), total dissolved phosphorous (TDP), and orthophosphate (P-ortho). Over 4,653 samples have been collected and analyzed for nitrate (NO_3-N), ammonium (NH_4-N) and orthophosphate (P-ortho). In addition, more than 2,480 samples have been analyzed for nitrate (NO_2-N), total Kjeldahl nitrogen (TKN), total phosphorous (TP), and total dissolved phosphorous (TDP). Examples of the type of data collected for the nitrogen species are shown in figure 2-5, while those for the phosphorous species are shown in figure 2-6. A summary statistics for all stations showing the mean, median, minimum, maximum, 25^{th} percentile, and 75^{th} percentile are given in table 2-2.

Data for the nitrogen species at all five monitoring stations show that the dominant form of nitrogen transported by the streams is nitrate-N. During storm events, the concentration of TKN rises significantly, sometimes exceeding the nitrate-N concentration. TKN is highly correlated to suspended sediment concentrations.

One significant observation that can be made from the data is the consistently higher concentrations of nitrate-N at Panther Creek and Cox Creek (tributaries to the Sangamon River) than at Court Creek, North Creek, and Haw Creek (tributaries of the Spoon River).

Data for the phosphorous species at all five monitoring stations show that most of the phosphorous load is transported during storm events. Concentrations of total phosphorous are the highest during storm events and relatively low most of the time. This is very similar to that shown by sediment and thus implies high correlations between sediment and phosphorous concentrations and loads. In terms of phosphorous concentrations, it does not appear there is any significant difference between the different monitoring stations from the Spoon and Sangamon River watersheds.



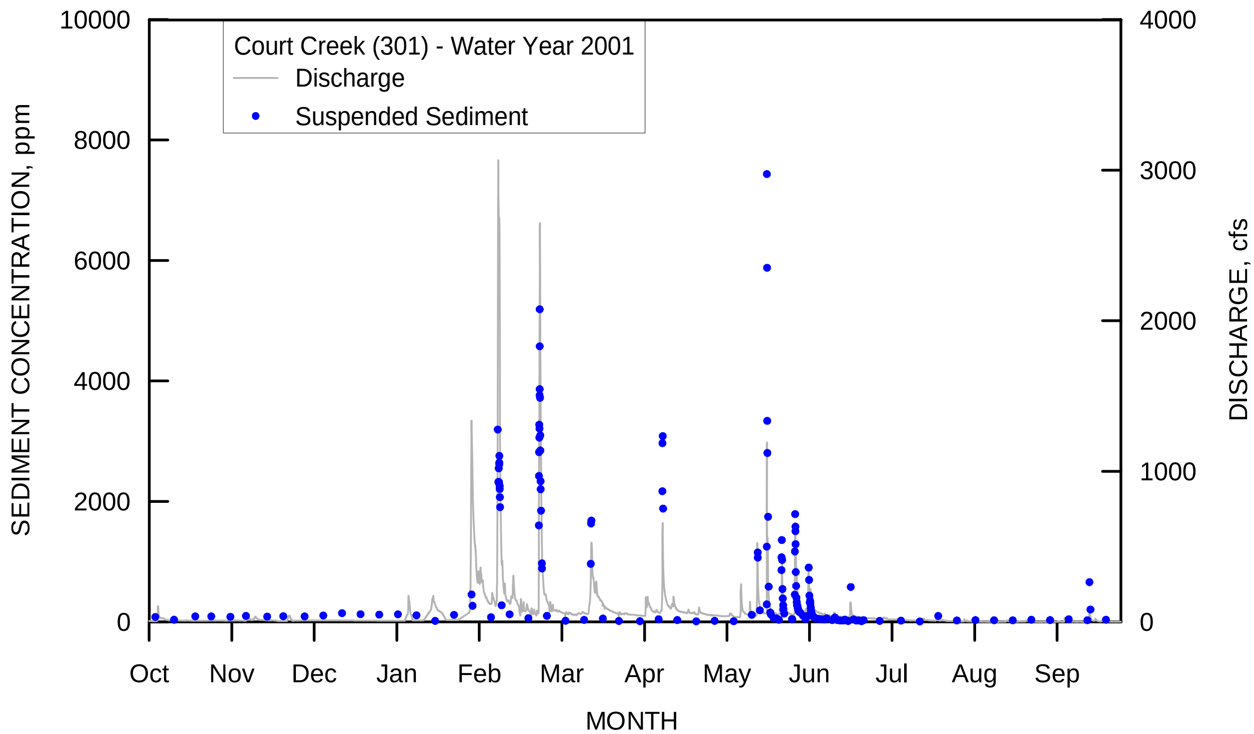


Figure 2-4. Suspended sediment concentrations and water discharge at Court Creek (301) for Water Years 2000 and 2001

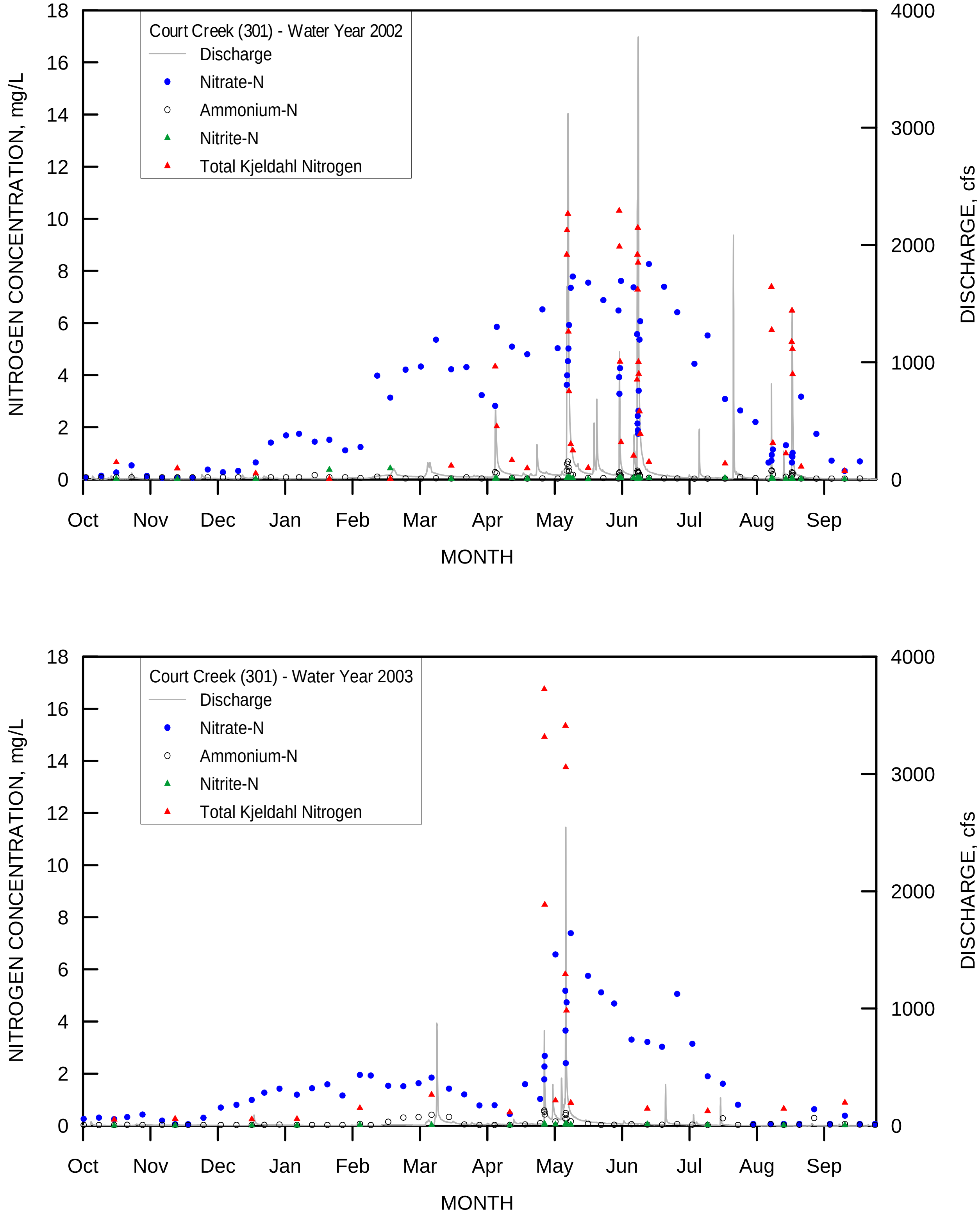
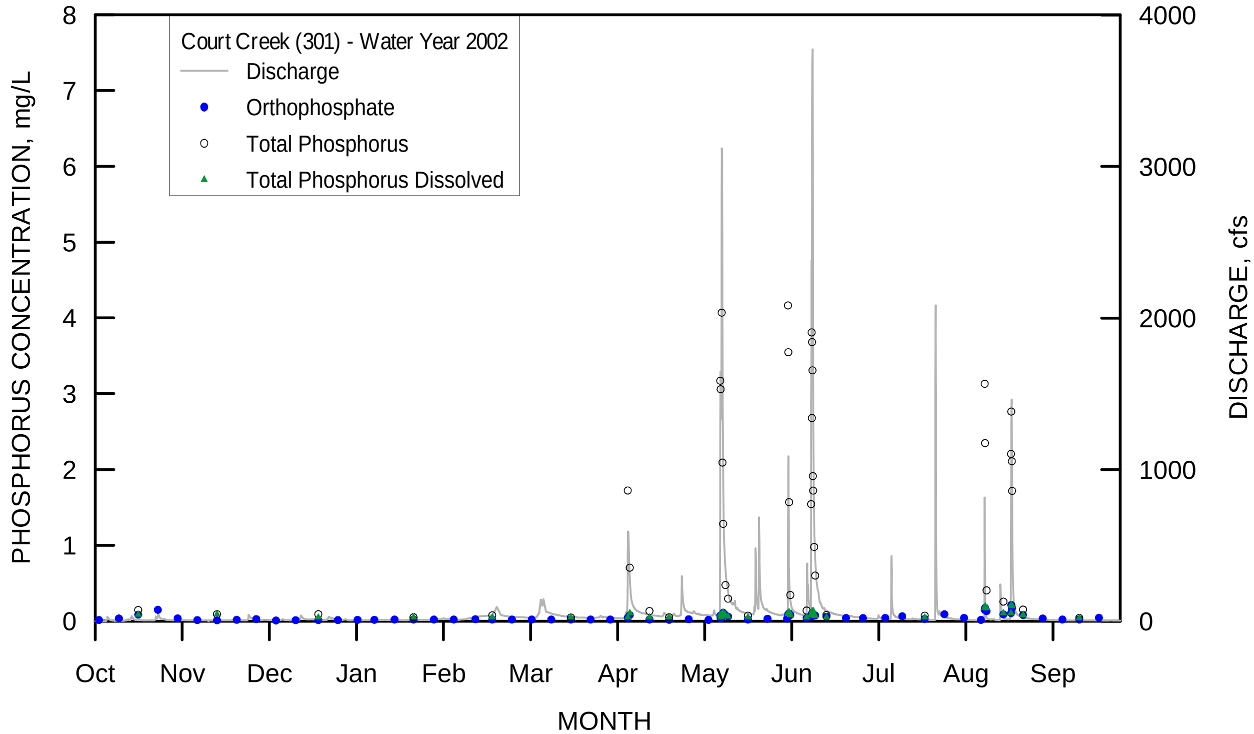


Figure 2-5. Concentrations of nitrogen species and water discharge at Court Creek (301) for Water Years 2002 and 2003

Table 2-2. Summary Statistics for Water Years 2000–2012. All concentrations in mg/L

	NO3-N	*oPO4-P*	*NH4-N*	*NO2-N*	*TKN*	*t-P*	*t-P-Dissolved*	*SSC*
Panther Creek (Station 201)								
Count	843	843	843	408	408	408	408	5104
Mean	3.94	0.12	0.10	0.03	2.41	1.04	0.17	879.3
Median	3.35	0.08	0.06	0.02	1.00	0.33	0.12	123.8
Min	< 0.04	< 0.01	< 0.03	< 0.01	< 0.12	< 0.03	< 0.03	1.47
Max	14.76	1.31	5.99	0.19	23.99	11.21	1.38	48289.0
25th Percentile	0.23	0.05	0.05	0.01	0.45	0.12	0.07	51.7
75th Percentile	6.60	0.14	0.08	0.04	3.18	1.36	0.20	432.8
Cox Creek (Station 202)								
Count	877	877	877	422	422	422	422	4371
Mean	5.58	0.21	0.74	0.05	3.71	1.15	0.31	692.4
Median	5.24	0.10	0.07	0.04	1.45	0.44	0.18	142.9
Min	< 0.04	< 0.01	< 0.03	< 0.01	< 0.14	< 0.04	< 0.03	0.95
Max	19.83	7.81	300.33	1.26	390.37	29.10	8.21	22066.5
25th Percentile	0.88	< 0.06	< 0.06	0.02	0.57	0.16	0.09	66.5
75th Percentile	9.08	0.22	0.20	0.06	3.50	1.32	0.37	396.0
Court Creek (Station 301)								
Count	993	993	993	561	560	560	560	4590
Mean	3.06	0.07	0.14	0.04	2.50	0.85	0.11	666.3
Median	2.93	0.05	0.07	0.03	1.33	0.35	0.09	116.3
Min	< 0.04	< 0.003	< 0.03	< 0.01	0.23	0.03	< 0.03	1.93
Max	11.37	0.69	0.90	0.13	18.69	6.58	0.71	13632.0
25th Percentile	0.94	0.03	< 0.06	< 0.02	0.64	0.11	0.05	47.5
75th Percentile	4.84	0.08	0.17	0.05	3.36	1.17	0.13	558.5
North Creek (Station 302)								
Count	983	983	983	551	551	551	551	5666
Mean	3.12	0.07	0.14	0.04	2.30	0.79	0.12	487.5
Median	2.96	0.04	0.07	0.03	1.11	0.30	0.09	91.3
Min	< 0.04	< 0.003	< 0.03	< 0.01	0.23	< 0.04	< 0.03	0.36
Max	12.66	1.05	1.55	0.19	17.95	6.69	1.07	15137.1
25th Percentile	0.72	0.02	< 0.06	0.02	0.60	0.11	0.05	36.9
75th Percentile	4.95	0.09	0.15	0.05	2.53	0.90	0.14	269.3
Haw Creek (Station 303)								
Count	957	957	957	538	538	538	538	5528
Mean	4.54	0.08	0.13	0.05	2.40	0.81	0.12	572.6
Median	4.56	0.06	0.07	0.04	1.42	0.41	0.09	160.6
Min	< 0.04	0.004	< 0.03	< 0.01	0.23	0.04	< 0.03	2.17
Max	12.59	0.71	1.07	0.21	16.75	5.92	0.95	9878.8
25th Percentile	1.99	0.03	< 0.06	0.02	0.64	0.14	0.06	53.1
75th Percentile	6.77	0.09	0.14	0.06	3.10	1.10	0.13	610.0



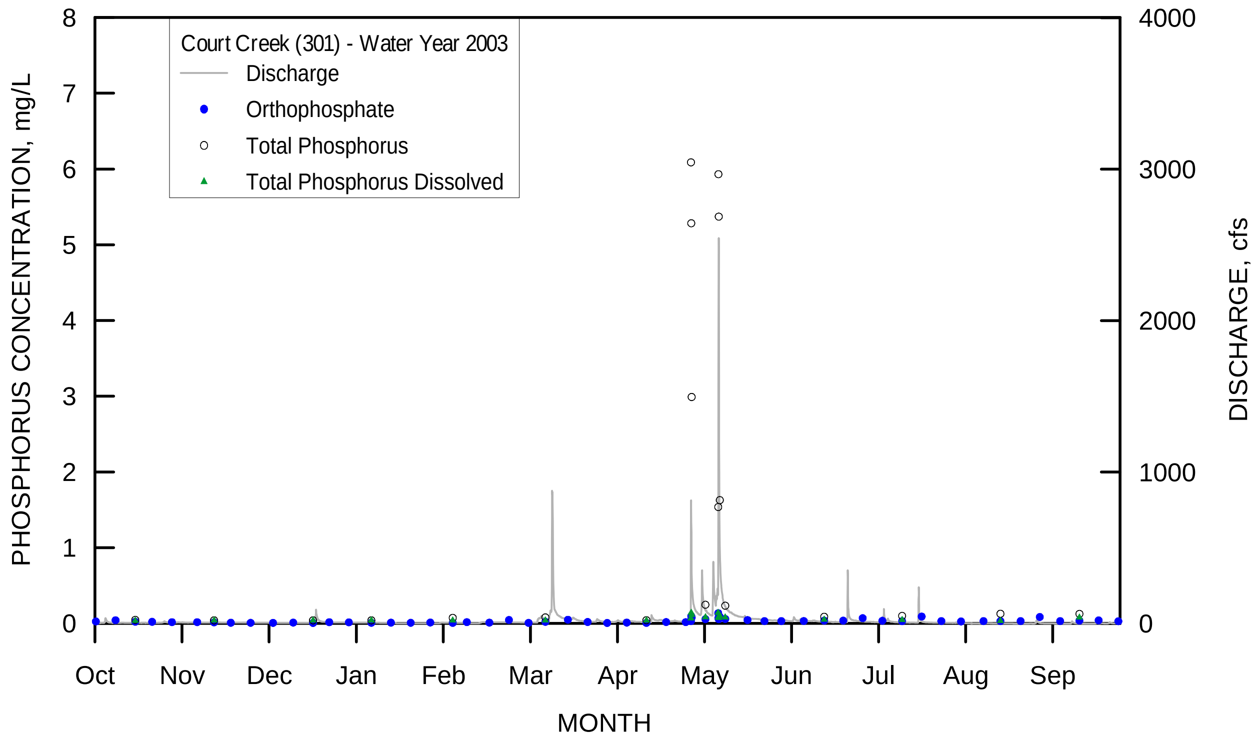


Figure 2-6. Concentrations of phosphorous species and water discharge at Court Creek (301) for Water Years 2002 and 2003

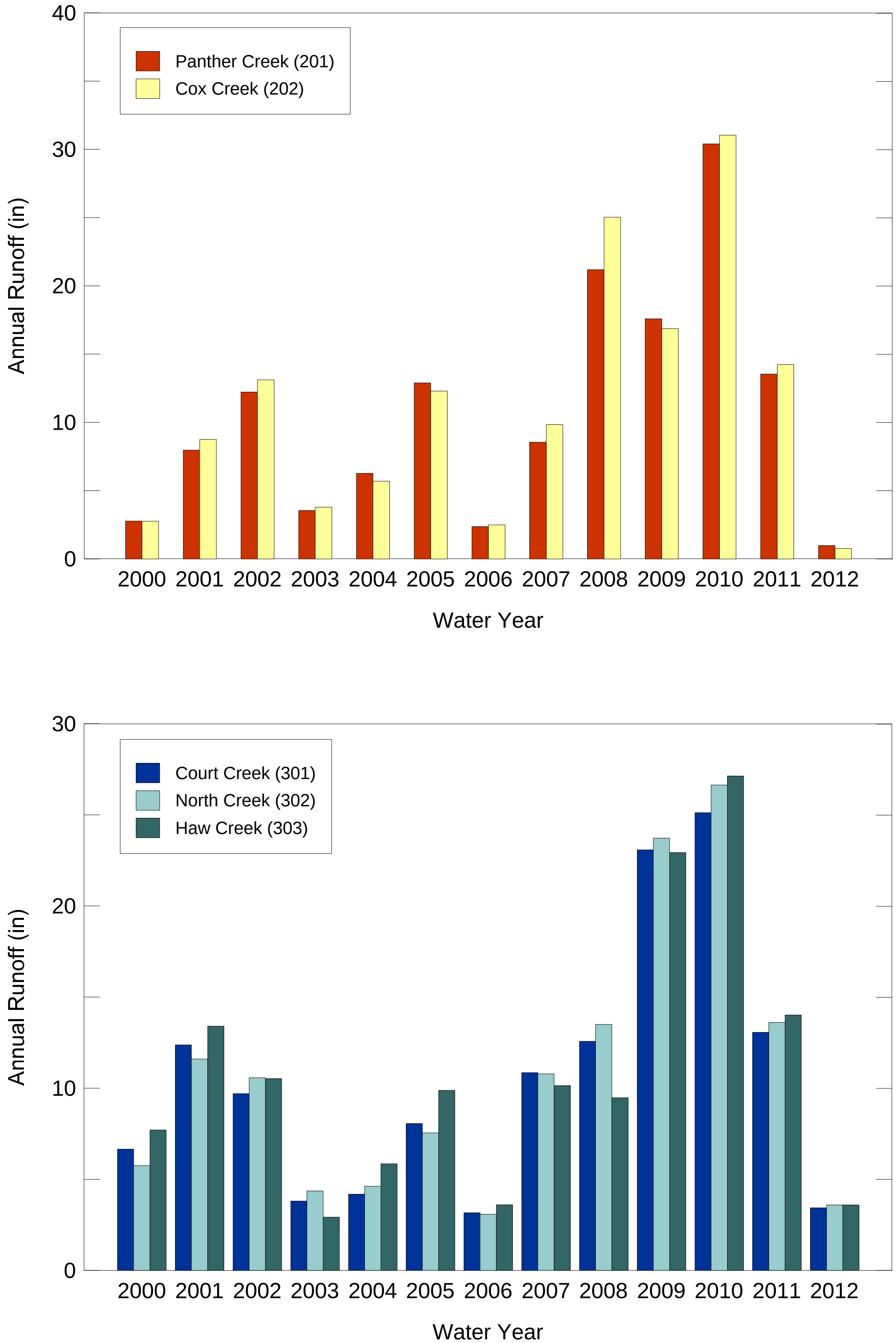


Figure 2-7. Annual runoff at the five CREP monitoring stations

Sediment and Nutrient Loads

The sediment and nutrient concentrations and water discharges are used to compute the amount of sediment and nutrient transported past monitoring stations. Based on the available flow and concentration data, daily loads are computed for sediment and the different species of nitrogen and phosphorous. The daily loads are then compiled to compute monthly and annual loads. Results of those calculations are summarized in tables 2-3 to 2-7 for each of the five monitoring stations. Each table presents the annual water discharge, sediment load, nitrate-N load, and the total phosphorous load for one of the stations. Similar calculations have been made for the other species of nitrogen and phosphorous, but are not included in the summary tables. The annual sediment loads are highly correlated to the water discharge, and thus the wetter years, 2001, 2002, 2005, 2007, 2008, 2009, 2010 and 2011 generated more sediment at all stations as compared to drier years, 2000, 2003, 2004, 2006, and 2012. The annual sediment loads ranged from a low of 149 tons in WY2012 at Cox Creek to a high of 174,742 tons in 2009 at Court Creek. The nitrate-N loads ranged from a low of 1.8 tons in 2012 at Cox Creek to a high of 585 tons in WY2010 at Haw Creek. The total phosphorous loads ranged from a low of 0.2 tons in 2012 at Cox Creek to a high of 117.6 tons in 2010 at Court Creek. For comparison purposes, the runoff, sediment, nitrate-N, nitrite-N, ammonium-N, Kjeldahl-N, total phosphorous, total dissolved phosphorous, and total ortho-phosphate phosphorous loads (for the five monitoring stations) are shown in figures 2-8 to 2-15. In terms of the total annual loads, the larger watersheds, Court and Haw, consistently carry higher sediment and nutrient loads than Panther and Cox Creeks. However, per unit area Panther and Cox generate more sediment than Court, North, and Haw Creeks.

Table 2-3. Summary of Annual Water Discharges, Sediment and Nutrient Loads at Court Creek Monitoring Station (301)

		Load		
Water Year	*Water discharge (cfs)*	*Sediment (tons)*	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	11880	26527	131.2	35.0
2001	22100	43633	274.8	39.2
2002	17320	62898	203.7	47.9
2003	6805	21749	59.9	18.3
2004	7459	7359	76.0	7.5
2005	14400	18831	207.5	20.4
2006	5650	7897	84.3	6.5
2007	19376	48974	240.8	46.8
2008	22442	41077	265.4	45.6
2009	41207	174742	429.6	116.9
2010	44836	146202	425.9	117.6
2011	23311	55337	270.9	43.3
2012	6129	4145	36.7	4.8

Table 2-4. Summary of Annual Water Discharges, Sediment and Nutrient Loads at North Creek Monitoring Station (302)

Water Year	*Water discharge (cfs)*	*Load*		
		Sediment (tons)	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	4009	6969	42.8	10.4
2001	8091	16747	102.9	12.7
2002	7372	29269	97.8	24.2
2003	3039	11422	32.9	9.1
2004	3224	2038	37.7	2.4
2005	5266	6061	76.3	7.7
2006	2151	4179	36.2	3.4
2007	7524	16702	99.3	14.3
2008	9416	19762	119.0	21.0
2009	16544	62806	167.9	45.2
2010	18577	66501	167.4	52.7
2011	9491	25979	105.4	25.2
2012	2506	2207	14.9	2.

Table 2-5. Summary of Annual Water Discharges, Sediment and Nutrient Loads at Haw Creek Monitoring Station (303)

Water Year	*Water discharge (cfs)*	*Load*		
		Sediment (tons)	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	11433	21283	162.2	32.0
2001	19878	49580	322.0	58.0
2002	15603	44221	256.5	42.8
2003	4337	5908	41.7	8.3
2004	8676	10914	143.4	12.6
2005	14661	18047	281.4	18.5
2006	5341	5770	113.7	6.0
2007	15032	20127	262.5	23.9
2008	14054	16396	227.0	25.5
2009	34003	104081	506.4	85.9
2010	40230	92974	585.2	85.4
2011	20788	37379	372.5	34.3
2012	5326	2185	55.1	3.3

Table 2-6. Summary of Annual Water Discharges, Sediment and Nutrient Loads at Panther Creek Monitoring Station (201)

		Load		
Water Year	*Water discharge (cfs)*	*Sediment (tons)*	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	1236	4342	13.8	4.4
2001	3550	9839	84.9	5.1
2002	5440	34596	101.8	16.4
2003	1578	2955	26.4	1.8
2004	2787	7820	52.5	5.8
2005	5743	13793	112.2	10.2
2006	1053	2694	22.5	2.5
2007	3809	13410	75.4	10.6
2008	9437	83924	123.1	46.7
2009	7833	30921	117.7	13.9
2010	13539	56979	124.8	25.7
2011	6033	16786	72.8	9.9
2012	437	105	2.5	0.2

Table 2-7. Summary of Annual Water Discharges, Sediment and Nutrient Loads at Cox Creek Monitoring Station (202)

		Load		
Water Year	*Water discharge (cfs)*	*Sediment (tons)*	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	894	4153	10.3	5.7
2001	2833	9626	77.9	5.5
2002	4242	23207	100.6	16.1
2003	1226	1827	29.6	1.7
2004	1844	4597	45.3	3.7
2005	3976	8132	109.0	8.8
2006	806	3662	19.3	1.6
2007	3181	10105	81.5	7.2
2008	8097	73678	154.7	31.4
2009	5459	16331	135.9	8.6
2010	10040	27283	155.9	17.5
2011	4607	14021	91.5	9.6
2012	246	149	1.8	0.2

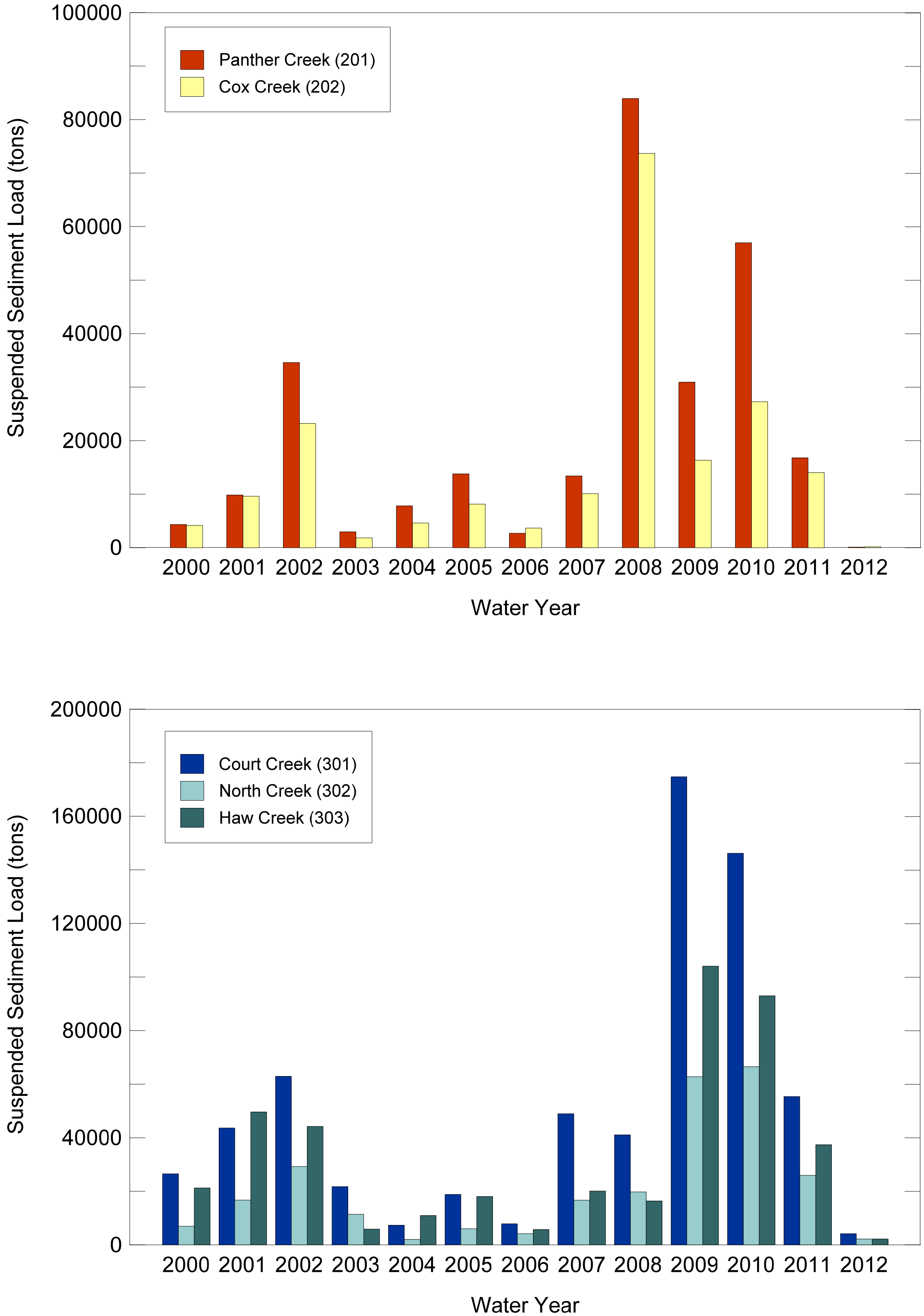
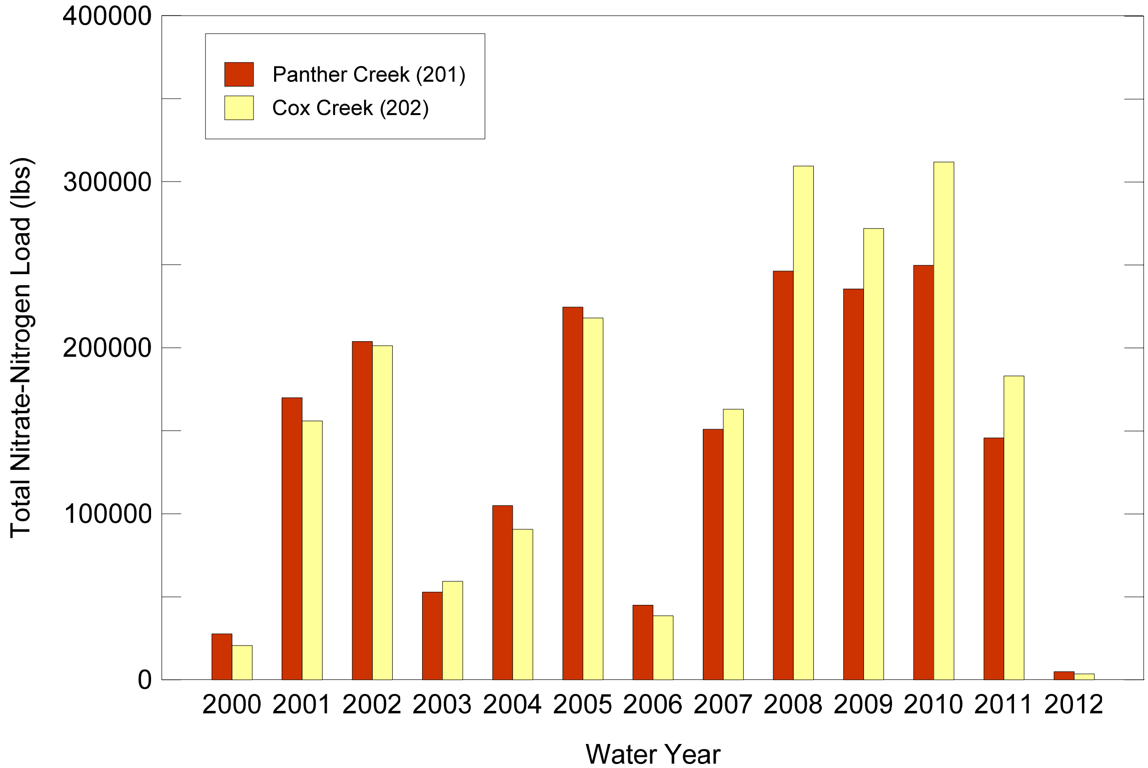


Figure 2-8. Annual suspended sediment loads at the five CREP monitoring stations



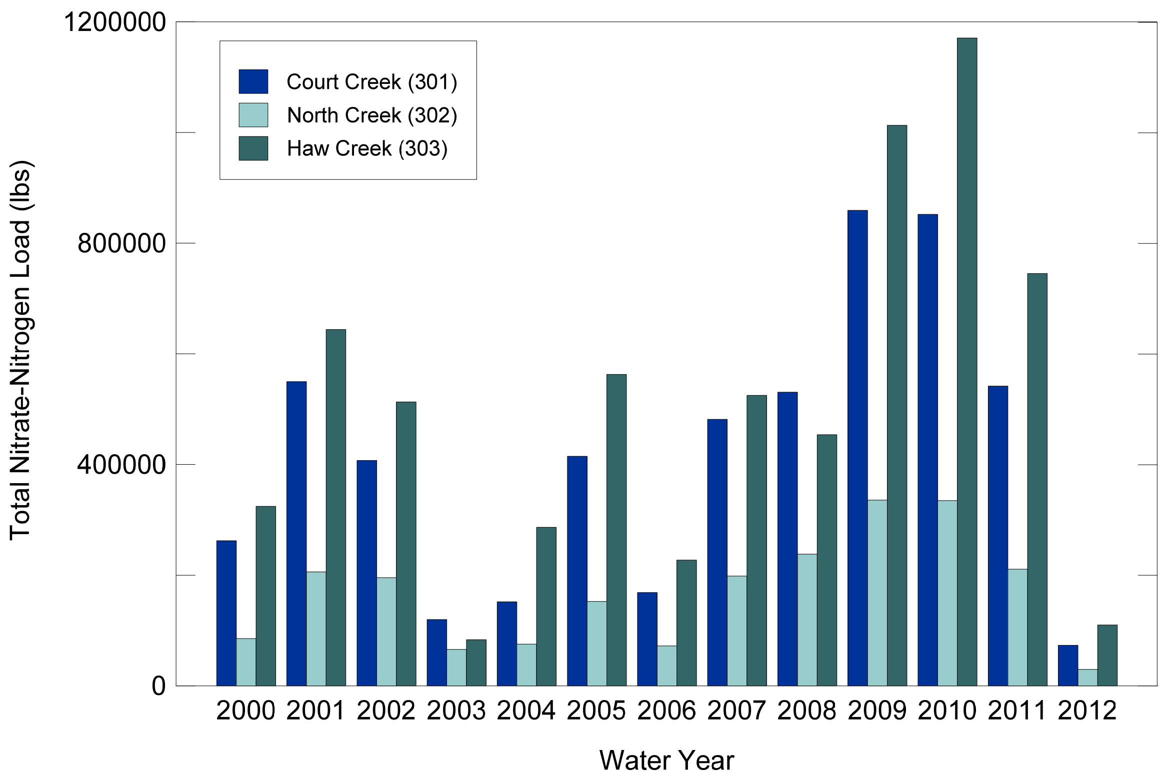


Figure 2-9. Annual nitrate-N loads at the five CREP monitoring stations

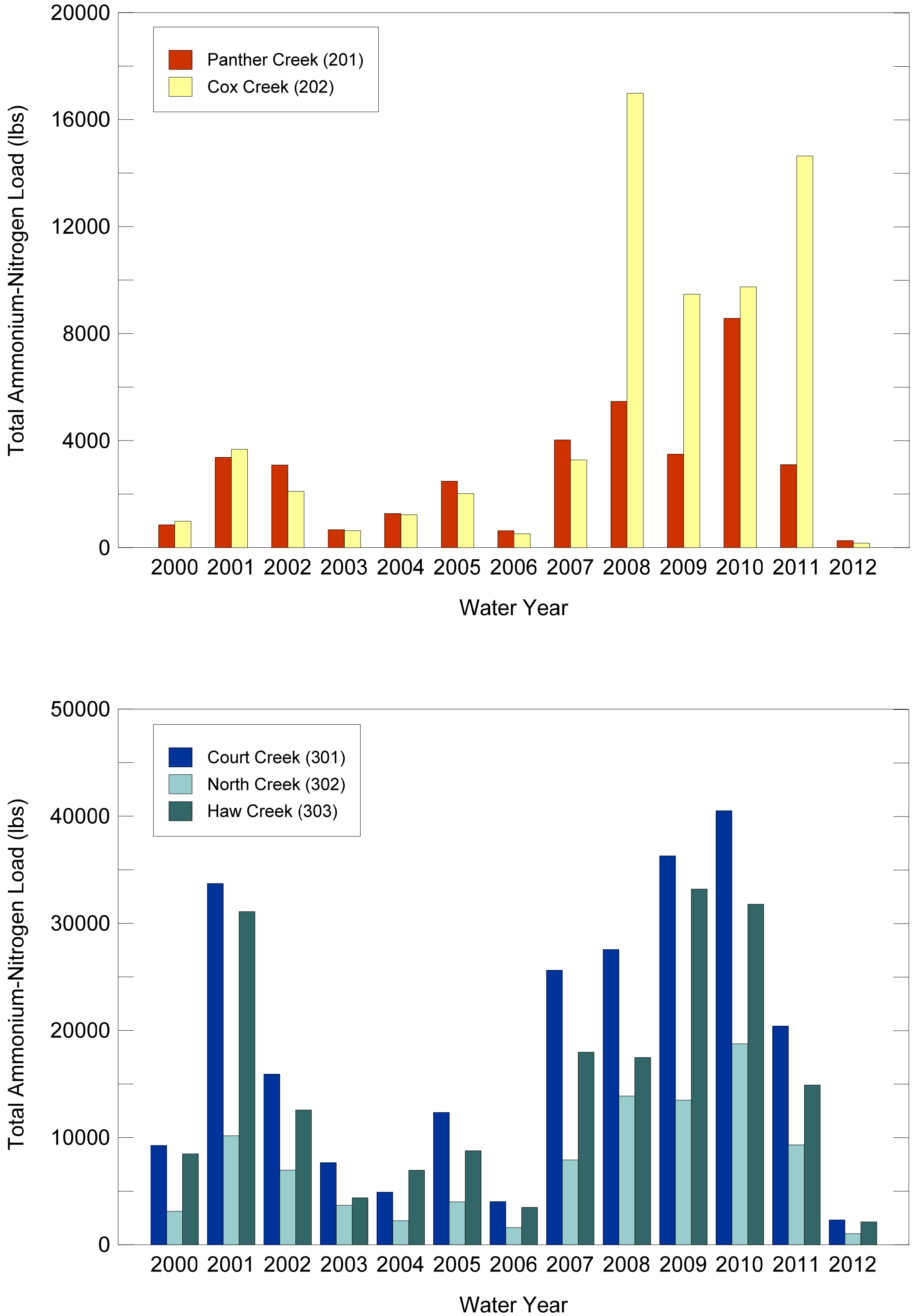


Figure 2-10. Annual ammonium-N loads at the five CREP monitoring stations

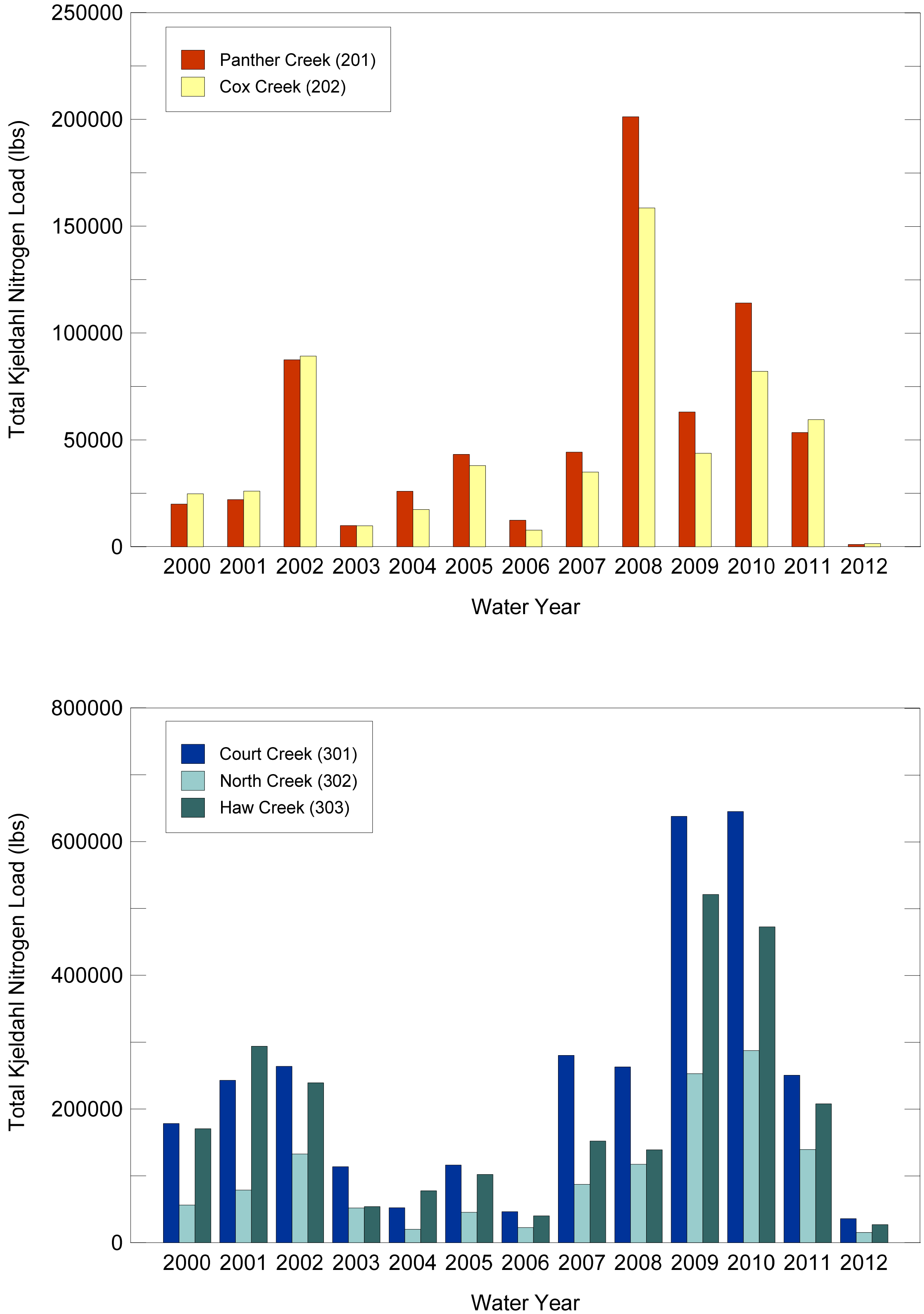


Figure 2-11. Annual Kjeldahl nitrogen loads at the five CREP monitoring stations

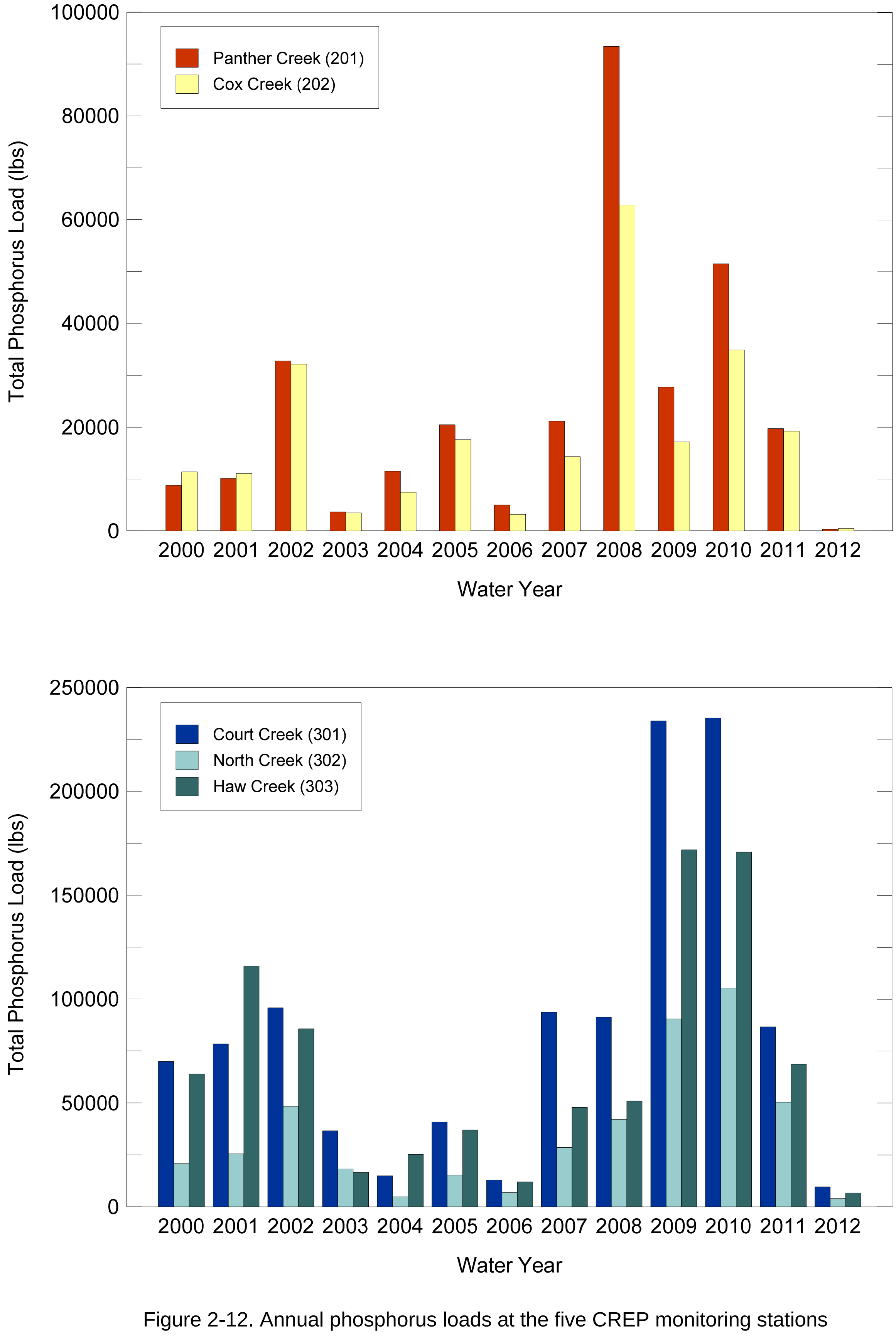
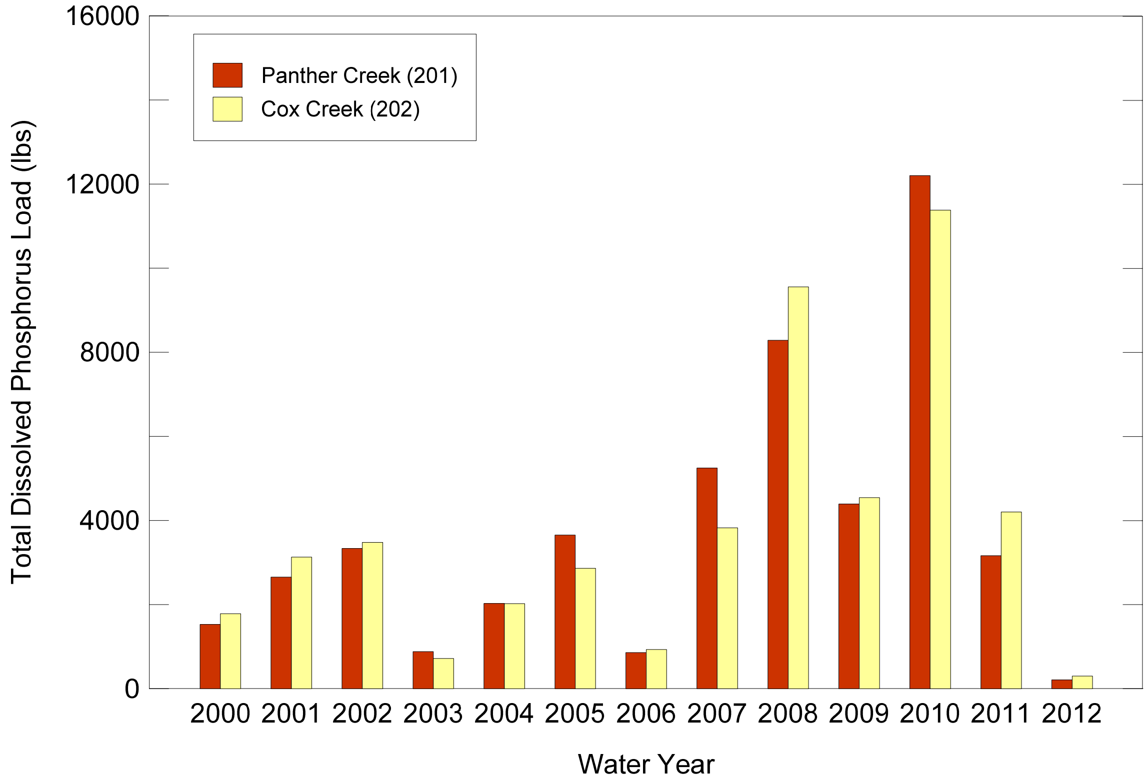


Figure 2-12. Annual phosphorus loads at the five CREP monitoring stations



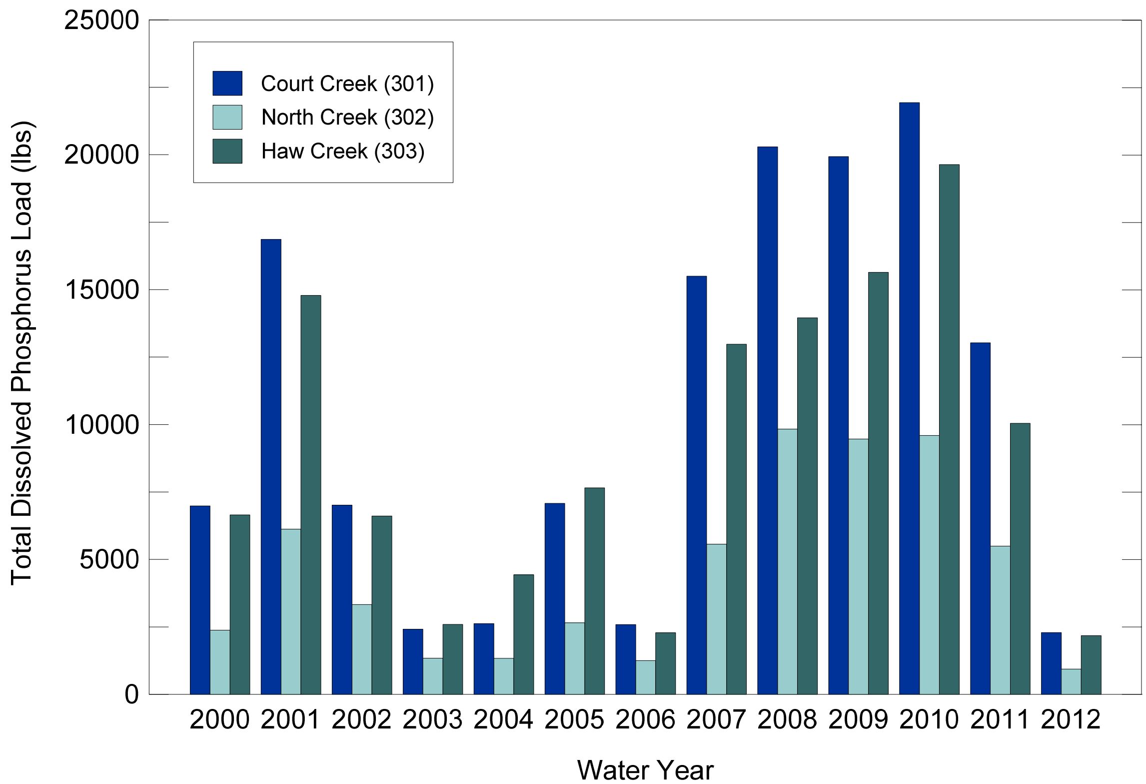


Figure 2-13. Annual dissolved phosphorus loads at the five CREP monitoring stations

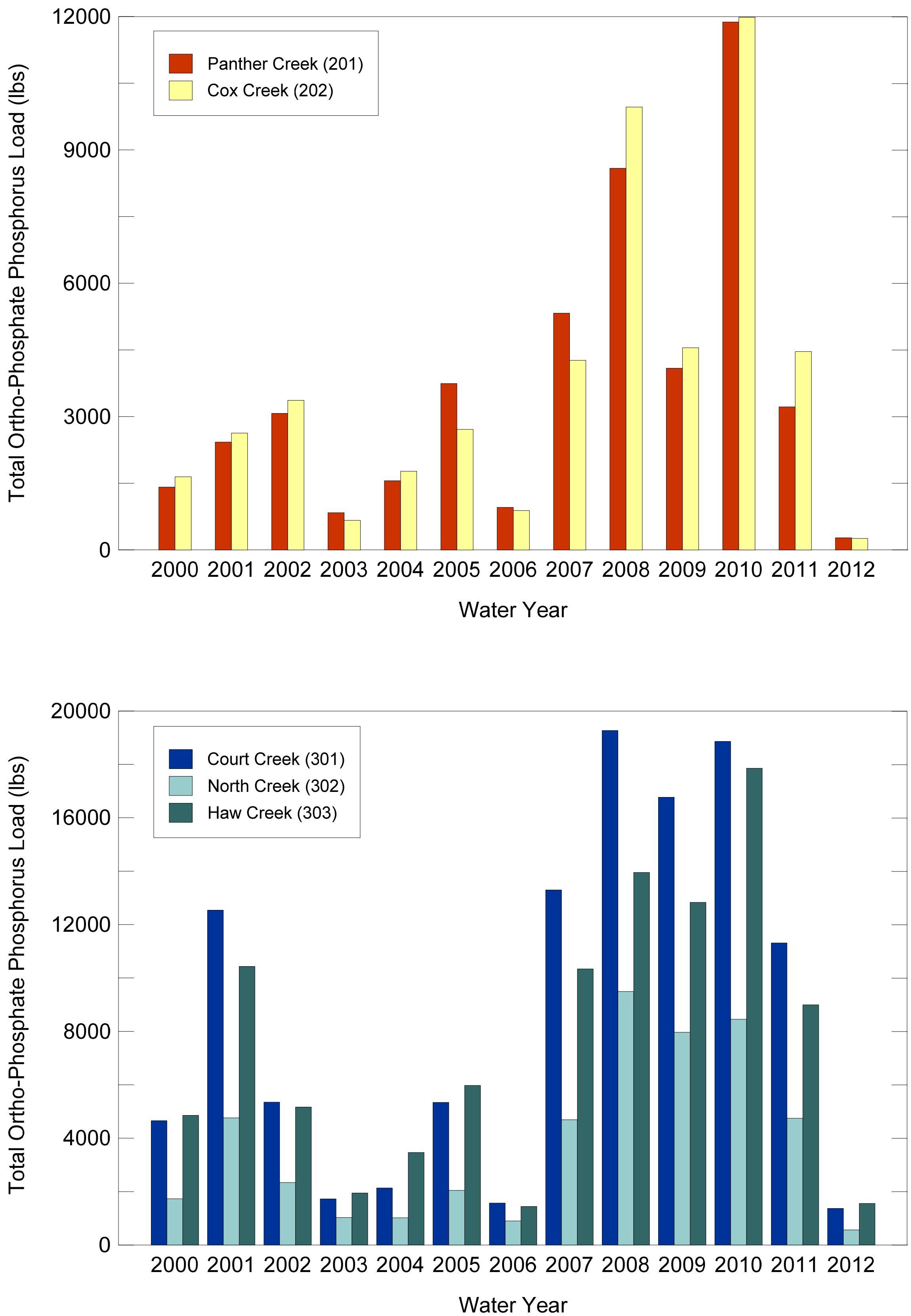


Figure 2-14. Annual ortho-phosphate phosphorous loads at the five CREP monitoring stations

Sediment and Nutrient Yields

To compare the different watersheds in terms of the amount of sediment and nutrient generated per unit area from each of the watersheds, the annual sediment and nutrient yields were computed by dividing the total annual load with the drainage area in acres for each of the monitoring stations. The results are provided in table 2-8 for sediment yield, table 2-9 for nitrate-N yield, and table 2-10 for total phosphorous. Sediment yields range from a low of 0.12 tons/acre for station 302 in WY2004 to a high of 9.57 tons/acre for station 202 in WY2008. Because of the high level of variability from year to year the average sediment yield for the nine years of data collection are compared in figure 2-15. The stations are arranged in order of their drainage area, with the station with the smallest drainage area (202) on the left and the station with the largest area (301) on the right. As can be seen in the figure, on the average the stations with the smaller drainage areas (202 and 201) yield higher sediment (about 2.0 ton/acre) than the stations with the larger areas (302, 303, 301) that yield less than 1.15 tons/acre.

Nitrate-N yields vary from a low of 0.5 lbs/acre for station 201 in WY2012 to a high of 40.5 lbs/acre for station 202 in WY2010. For comparison purposes the average annual nitrate-N yield for the five stations is shown in figure 2-17. In general the stations with smaller drainage areas generate more nitrate per unit area than those with larger drainage areas, except for station 303 that is generating similar amounts as station 201 that has a smaller area.

Total phosphorous yields vary from a low of 0.03 lbs/acre for station 201 in WY2012 to a high of 8.81 lbs/acre for station 201 in WY2008. For comparison purposes, the average annual total phosphorous yield for the five stations is shown in figure 2-18. Similar to the nitrate-N yield, the stations with the smaller drainage areas generate more total phosphorous per unit area than those with larger drainage areas.

Table 2-8. Sediment Yield in tons/acre for the CREP Monitoring Stations

	CREP sediment yield (tons/ac)				
Water Year	*201*	*202*	*301*	*302*	*303*
2000	0.41	0.54	0.62	0.42	0.60
2001	0.93	1.25	1.03	1.01	1.40
2002	3.26	3.01	1.48	1.76	1.25
2003	0.28	0.24	0.51	0.69	0.17
2004	0.74	0.60	0.17	0.12	0.31
2005	1.30	1.06	0.44	0.37	0.51
2006	0.25	0.48	0.19	0.25	0.16
2007	1.27	1.31	1.15	1.01	0.57
2008	7.92	9.57	0.97	1.19	0.46
2009	2.92	2.12	4.11	3.78	2.95
2010	5.38	3.54	3.44	4.01	2.63
2011	1.58	1.82	1.3	1.57	1.06
2012	0.01	0.02	0.10	0.13	0.06
Avg.	2.02	1.97	1.19	1.25	0.93

Table 2-9. Nitrate-N Yield in lbs/acre for the CREP Monitoring Stations

	CREP nitrate-nitrogen yield (lbs/ac)				
Water Year	*201*	*202*	*301*	*302*	*303*
2000	2.6	2.7	6.2	5.2	9.2
2001	16.0	20.2	12.9	12.4	18.2
2002	19.2	26.1	9.6	11.8	14.5
2003	5.0	7.7	2.8	4.0	2.4
2004	9.9	11.8	3.6	4.5	8.1
2005	21.2	28.3	9.8	9.2	15.9
2006	4.2	5.0	4.0	4.4	6.4
2007	14.2	21.2	11.3	12.0	14.9
2008	23.2	40.2	12.5	14.3	12.9
2009	22.2	35.3	20.2	20.2	28.7
2010	23.6	40.5	20.0	20.2	33.2
2011	13.7	23.8	12.8	12.7	21.1
2012	0.5	0.5	1.7	1.8	3.1
Avg.	13.5	20.3	9.8	10.2	14.5

Table 2-10. Total Phosphorus Yield in lbs/acre for the CREP Monitoring Stations

	CREP total phosphorus yield (lbs/ac)				
Water Year	*201*	*202*	*301*	*302*	*303*
2000	0.83	1.48	1.65	1.25	1.81
2001	0.95	1.44	1.84	1.53	3.28
2002	3.09	4.17	2.25	2.92	2.43
2003	0.34	0.45	0.86	1.10	0.47
2004	1.09	0.97	0.35	0.29	0.72
2005	1.93	2.28	0.96	0.92	1.05
2006	0.47	0.42	0.31	0.41	0.34
2007	2.00	1.86	2.20	1.72	1.35
2008	8.81	8.16	2.15	2.53	1.44
2009	2.62	2.23	5.50	5.45	4.87
2010	4.86	4.53	5.54	6.35	4.84
2011	1.86	2.50	2.04	3.03	1.94
2012	0.03	0.06	0.23	0.24	0.19
Avg.	2.2	2.4	2.0	2.1	1.9

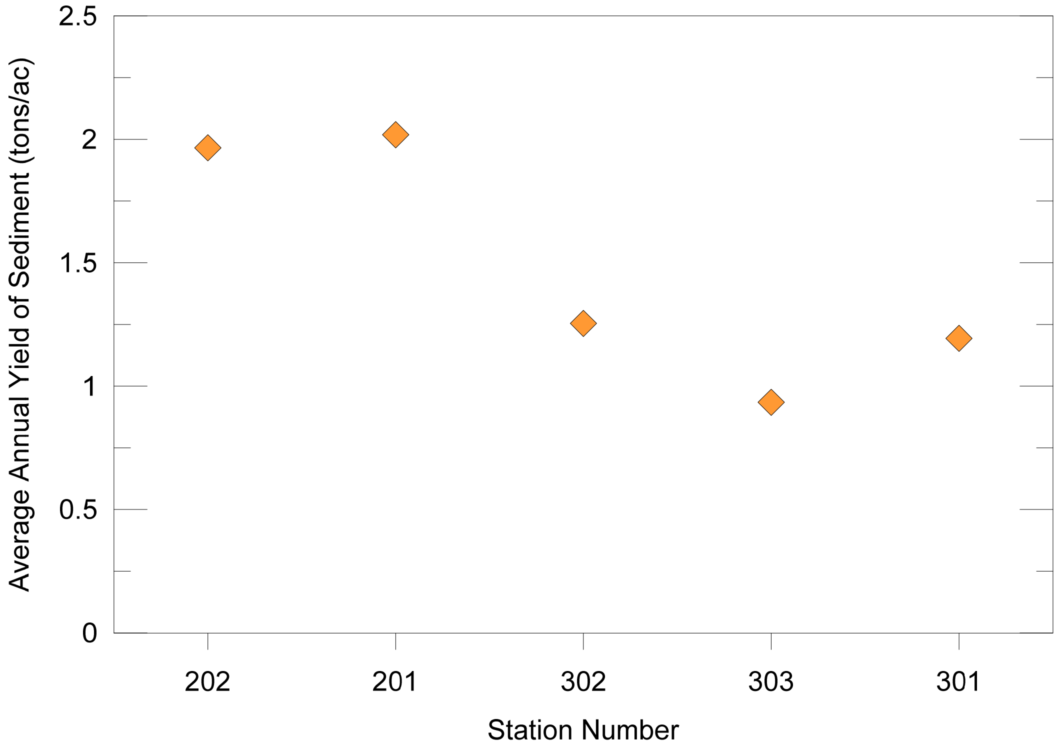


Figure 2-15. Average annual sediment yield in tons/acre for the CREP monitoring stations

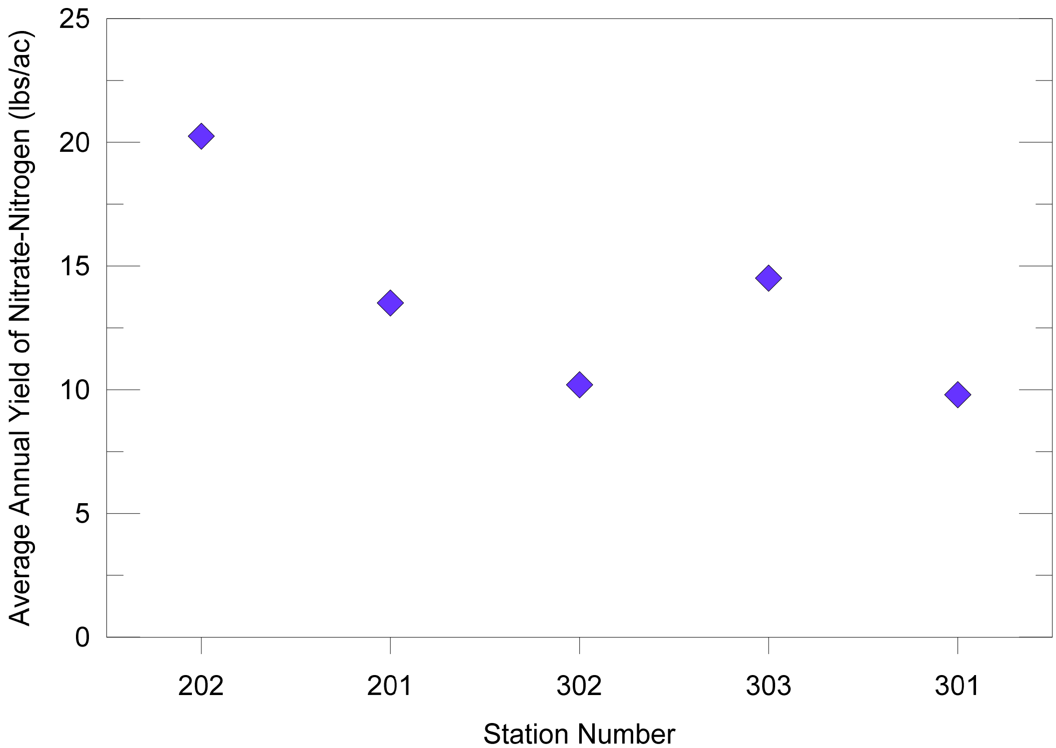


Figure 2-16. Average annual nitrate-N yield in lbs/acre for the CREP monitoring stations

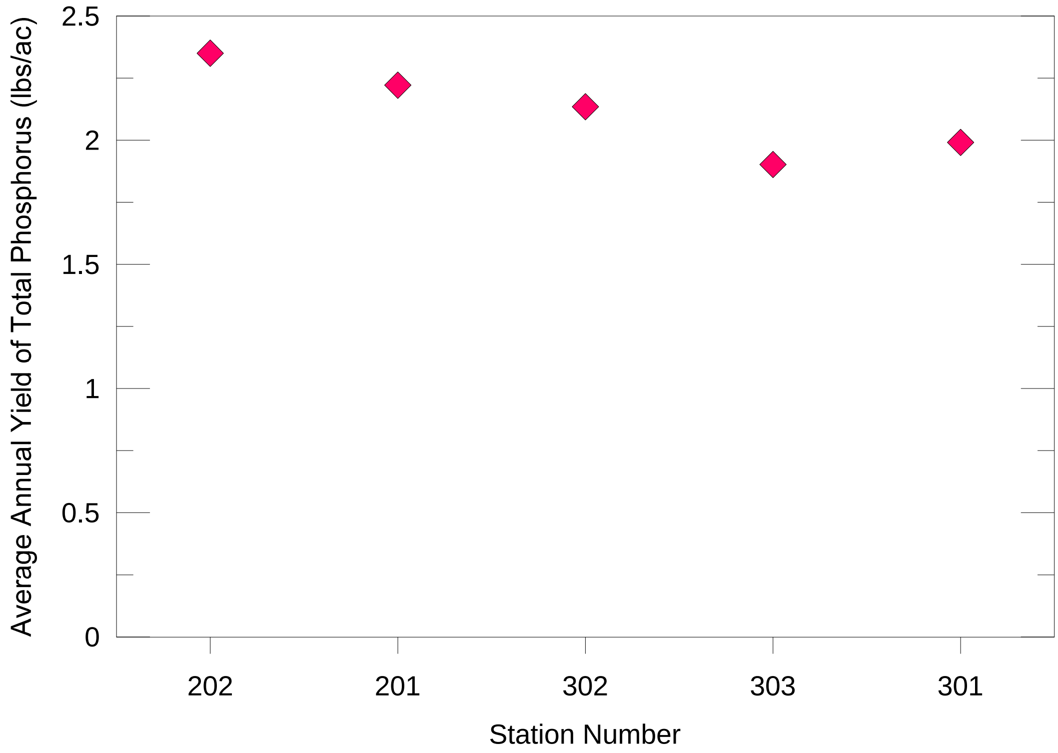


Figure 2-17. Average annual total phosphorous yield in lbs/acre for the CREP monitoring stations

Additional CREP Data Collection Efforts

In addition to the CREP monitoring in the Court/Haw and Panther/Cox watersheds, that was initiated in 1999, several additional monitoring efforts have been initiated by the ISWS through the CREP project in order to provide additional information on the role BMPs in reducing sediment and nutrient yields and to better define the context of existing CREP data on a larger watershed scale.

During September of 2006 in response to significant CREP enrollments and an intensive restoration effort by the Natural Resources Conservation Service (NRCS), two additional monitoring stations (table 2-11) were installed in the Cedar Creek watershed, located in the Spoon River basin (figure 2-18). Station 306 is located on the right descending bank of the mainstem of Cedar Creek where it intersects CR 000 E in Fulton County (border with Warren Co). The second gage, station 305, is located near the left descending bank of Swan Creek, a major tributary of Cedar, where it flows beneath CR 000 E Fulton County, approximately 2.1 miles south of the Cedar Creek (306) gage.

Table 2-11. Additional CREP Monitoring Stations in the Spoon River Watershed

Station ID	*Name*	*Drainage area*	*Location*	*Watershed*
305	Swan Creek	98.1 sq mi (254 sq km)	N 40.67700 W 090.44391	Spoon River
306	Cedar Creek	146.2 sq mi (379 sq km)	N 40.70847 W 090.44540	Spoon River
RG39	Rain Gage 39	NA	N40.79145 W090.49999	Spoon River

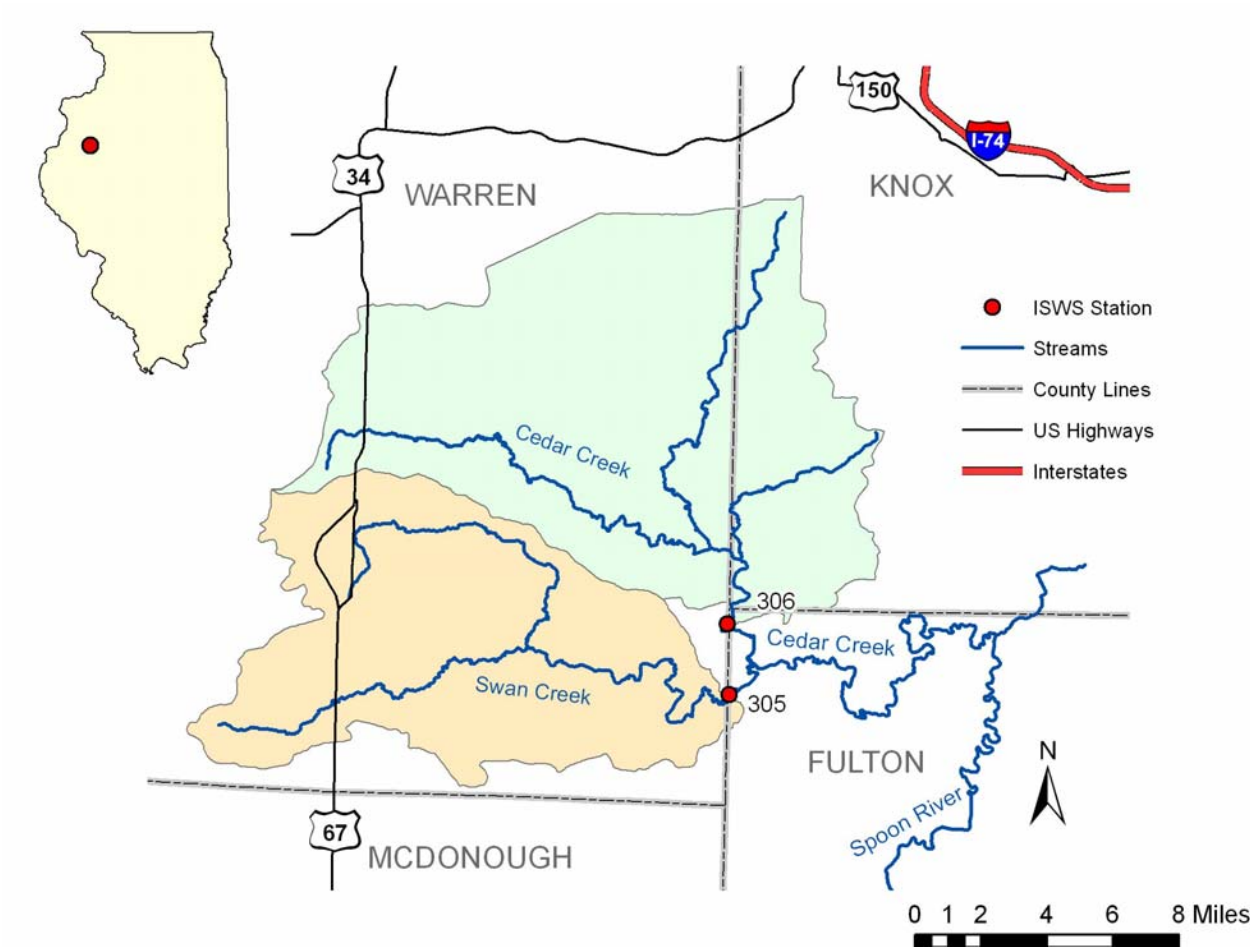


Figure 2-18. Locations of monitoring stations in the Cedar and Swan watersheds

Both watersheds are located in the Galesburg Plain physiographic region. The topography is flat to gently rolling and the soils are primarily loess. Stream channels and associated floodplains are heavily dissected with stream channels commonly being incised into the floodplain. Both watersheds are mostly rural with agriculture the predominant land use. Pasture and woodlands are also common due to the topography introduced by the dissected stream channels.

Both gages became operational near the end of WY2006 (9/15/2006) and are instrumented and operated as are all CREP gages, in accordance to the CREP QAPP (Appendix A). Both stations utilize a pressure transducer to determine stage, log data on a 15 minute time step and are equipped with an ISCO automated pump sampler slaved to the stage sensor in order to augment manual discrete sampling efforts. Thirty-eight and thirty-three discharge measurements have been collected at stations 305 and 306 respectively in an effort to establish a reliable rating in as short a time as possible. Based on provisional data, summary statistics for suspended sediment concentration data is provided in table 2-12.

In addition to the two streamgages the ISWS has installed a recording raingage immediately east of CR1500E and approximately 0.5 mi north of CR1100N in Warren Co. The raingage is a modified Belfort equipped with a linear potentiometer, in order to provide a digital output, and can be operated throughout the year. Raingage deployment and maintenance as well as the download and reduction of precipitation data can be found in the CREP QAPP (Appendix A).

ISWS field staff began suspended sediment sampling at two U.S. Geological Survey (USGS) gages located on the mainstem of the Spoon River on 3/29/2004. Samples are collected weekly at both sites with additional samples collected during runoff events. Sampling at London Mills (05569500) is done from the Route 116 bridge where the USGS gaging station is located. Sediment sampling at Seville (05570000) is done approximately 1 mile downstream of the current USGS gage location on State Route 95. Current USGS sediment data are also collected at this location. As of 9/30/12, 568 samples have been collected at London Mills while 521 samples have been collected at Seville. Summary statistics for suspended sediment concentration data collected through WY2012 are presented for each station in Table 2-13.

Table 2-12. Suspended Sediment Concentration Data (mg/L) for Swan and Cedar Creeks

	Swan (305)	*Cedar (306)*
Count (number)	3515	3623
Mean	380.1	471.3
Max	7872.6	8101.8
Min	1.99	1.59
Median	137.1	132.6
25th Percentile	49.3	51.0
75th Percentile	416.3	462.7

Table 2-13. Suspended Sediment Concentration Data (mg/L) for London Mills and Seville

	London Mills (05569500)	*Seville (05570000)*
Count (samples)	568	521
Mean	296.1	293.1
Max	4952.7	4730.7
Min	1.91	3.93
Median	116.0	122.2
25th Percentile	49.9	58.8
75th Percentile	285.7	266.7

3. Land Use Practices

Land Cover

The Illinois River Basin is nearly 16 million acres with a diverse range of land covers. The extent of these land covers is illustrated in figure 3-1 using the Land Cover of Illinois 1999-2000 inventory (Luman and Weicherding, 1999). This database is a product of a cooperative, interagency initiative between the U. S. Department of Agriculture National Agricultural Statistics Service (NASS), Illinois Department of Agriculture (IDA), and Illinois Department of Natural Resources (IDNR) to produce statewide land cover. The database contains 23 land cover that are grouped into 5 categories: agricultural land, forested land, urban land, wetland, and other. The agricultural land category lists corn, soybeans, winter wheat, other small grains and hay, winter wheat/soybeans, other agricultural land, and rural grassland due to the times of year the satellite imagery was taken.

The Illinois River Basin is dominated by agricultural land, comprising of 77% of the basin (figure 3-2). Corn and soybean acreage accounts for most of the agricultural land cover. Urban and forested land are the next highest with 10% and 9%, respectively. This is attributed to the areas of Chicago and surrounding urban communities, as well as the City of Peoria. Wetlands, surface water, and other combine to 4% of the remaining acreage in the Illinois River Basin. The Spoon and Sangamon River watershed area is 30% of the Illinois River Basin and the Spoon River watershed is a third of the size of the Sangamon River watershed. As can be seen in figures 3-3 and 3-4, the Spoon and Sangamon River watersheds show similar trends in land cover as the Illinois River Basin. Agricultural land cover, especially corn and soybeans, accounts for over 80% of the land area in each watershed. The largest difference between the Spoon and Sangamon watersheds is the Spoon has 10% more forested land cover than the Sangamon. Otherwise, they are similar in all other categories.

Land Use Practices

Outside of natural factors such as the physical settings and climate variability, land use practices are the main driving factors that affect watershed's hydrology, erosion, sedimentation, and water quality. It is therefore important to document and analyze changes in land use practices in a given watershed to properly understand and explain changes in its hydrology, water quality, and the erosion and sedimentation process. The Illinois River basin has undergone significant changes in land use practices during the last century. These changes have been used to explain degradation in water quality and aquatic habitat along the Illinois River. In recent years, there have been significant efforts at the local, state, and federal level to improve land use practices by implementing conservation practices throughout the watershed. The Illinois River CREP is a course of major state and federal initiatives to significantly increase conservation and restoration practices in the Illinois River basin.

Historical agricultural land use practices and the recent conservation efforts including CREP are briefly discussed in the following paragraphs.

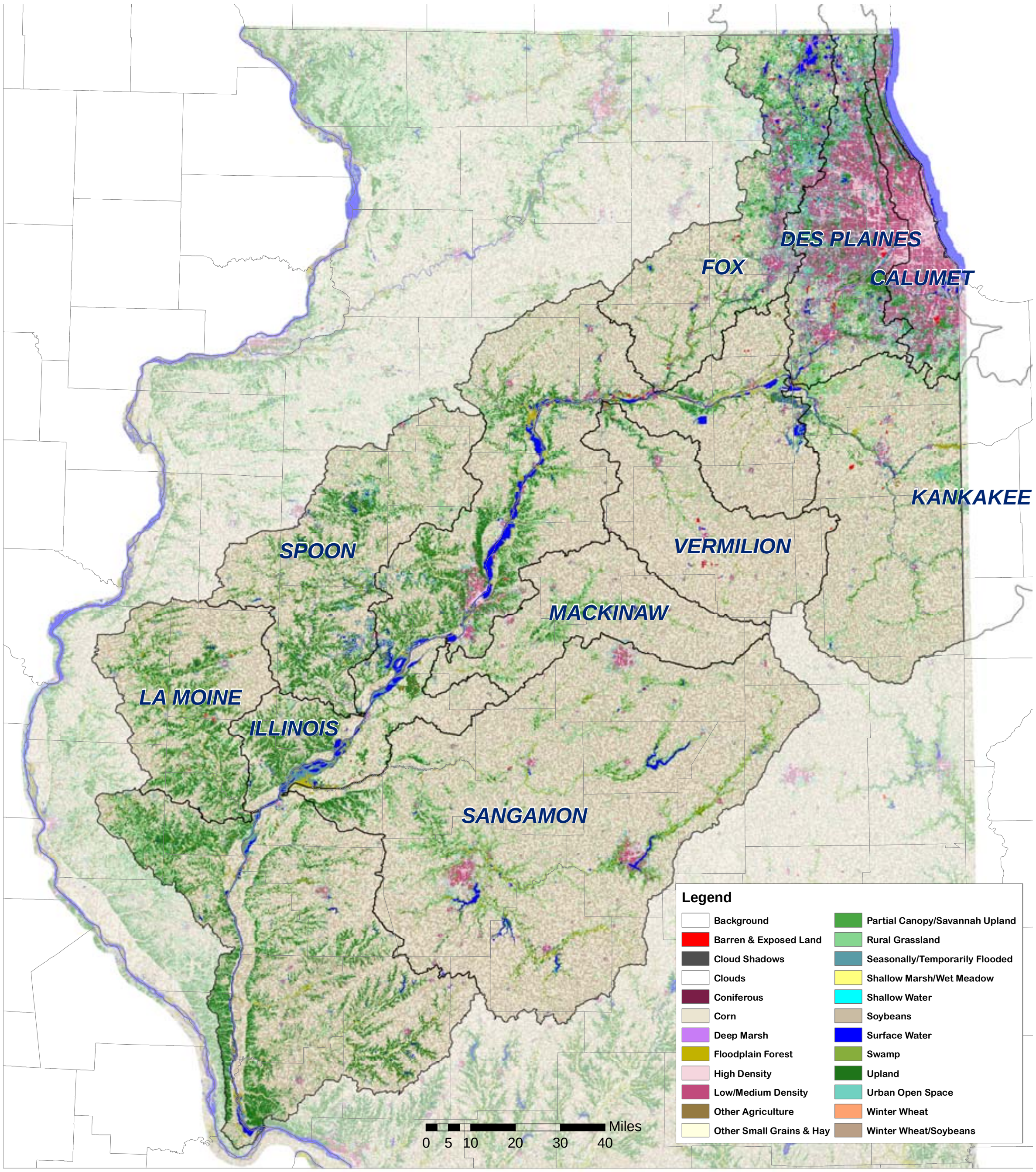


Figure 3-1. Land cover of the Illinois River Basin (Luman and Weicherding, 1999)

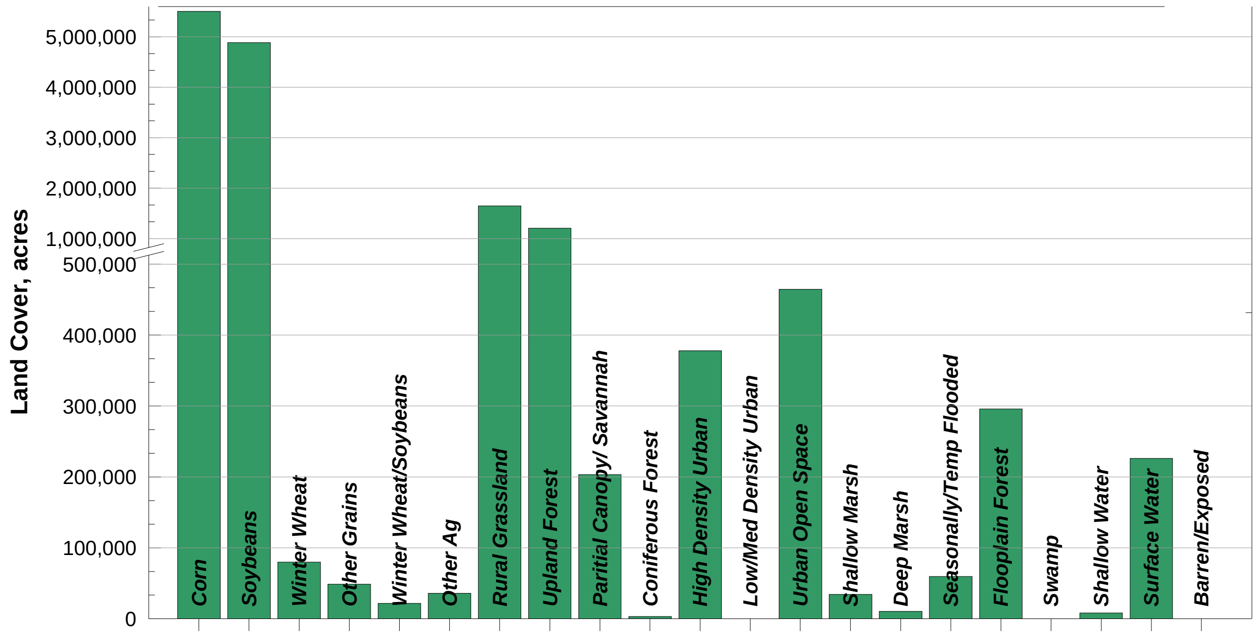


Figure 3-2. Land cover acreages in the Illinois River basin

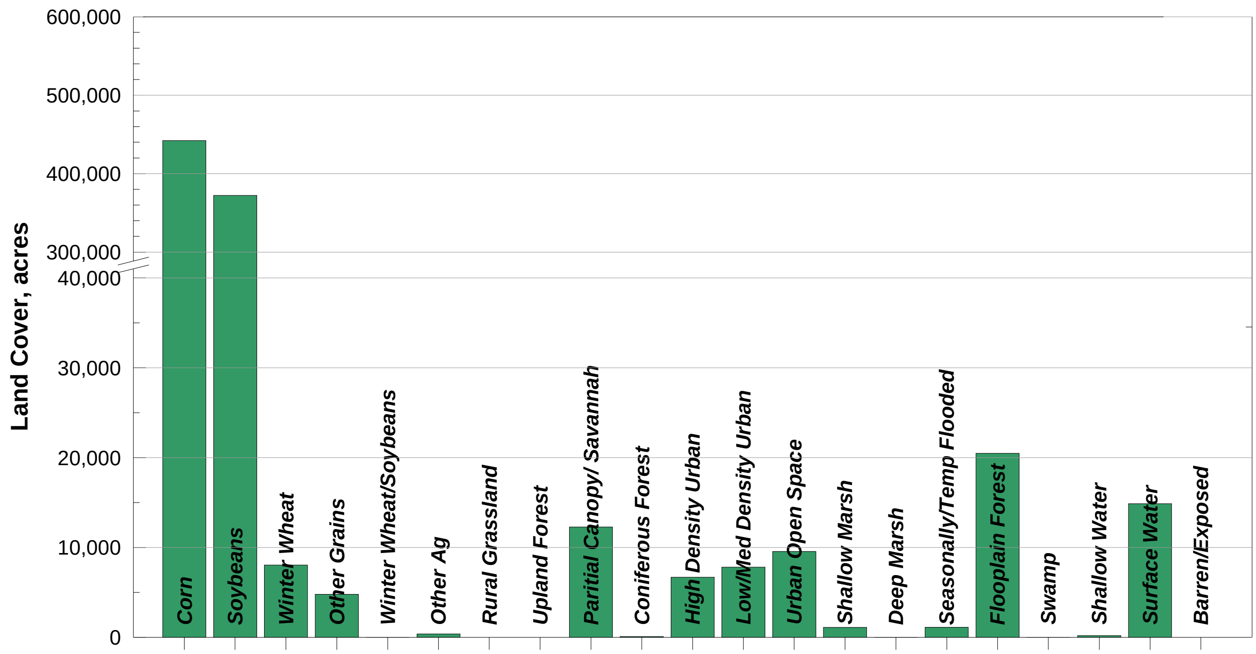


Figure 3-3. Land cover acreages in the Spoon River watershed

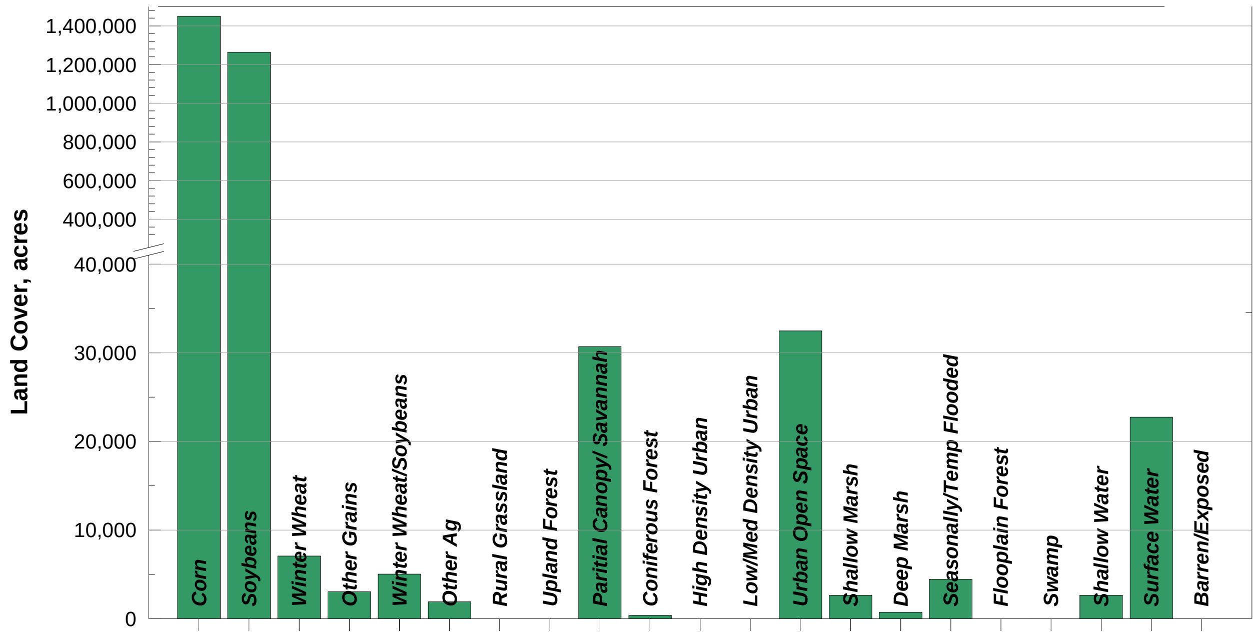


Figure 3-4. Land cover acreages in the Sangamon River watershed

Historical Agricultural Land Use Trends in Illinois

To provide a historical perspective to changes in land use practices in the Illinois River basin, we have compiled and analyzed historical land use data from different sources for the whole state. The earliest land use data is based on the Illinois Agricultural Statistics (IAS) records. The IAS data shows that in 1866 approximately 23 percent of the state's land area was in agricultural crop production (figure 3-5). In 2006, agricultural production has increased to 65 percent of the state's land. From 1866 through to the 1920s, crop production increased from 8 to 18 million acres mostly due to a three-fold increase in small grain (wheat, oats, and hay) acreage. In the 1920s small grain acreage began to decline in favor of soybeans. Essentially, from this period to present, a steady reversal in acreage has occurred between small grains and soybeans such that current soybean acreage is the same as was small grains were in the 1920s. From 1866 to 2006, total Illinois land area in crop production increased by more nearly tripled from 8 to 23 million acres. The dominant crops in 1866 were corn and small grains, whereas corn and soybeans (row crops) acreage was 93 percent of the total crop acreage in 2006. During the period of record (1866-2006), corn acreage has remained fairly steady at 9.3 million acres. Corn was harvested on 4.9 million acres in 1866 but increased to the long-term average acreage by 1881. Acreage peaked in 2005 at 12.1 million acres and was 11.3 million acres in 2006. From 1925 to 2006 crop acreage increased by 23 percent.

In 1925, IAS began delineating agricultural crop production data by county, rather than as a state total, which allows for the estimation of crop acreage by basins. The Illinois River Basin (IRB) is nearly half of the Illinois land area, and occupies over 18 million acres when the watershed area in the states of Indiana and Wisconsin are included. Figure 3-6 shows similar trends in crop production as was seen for the State of Illinois. In 1925, 51 percent (9.4 million acres) of the IRB land area was in crop production while in 2006, 56 percent (10.3 million acres)

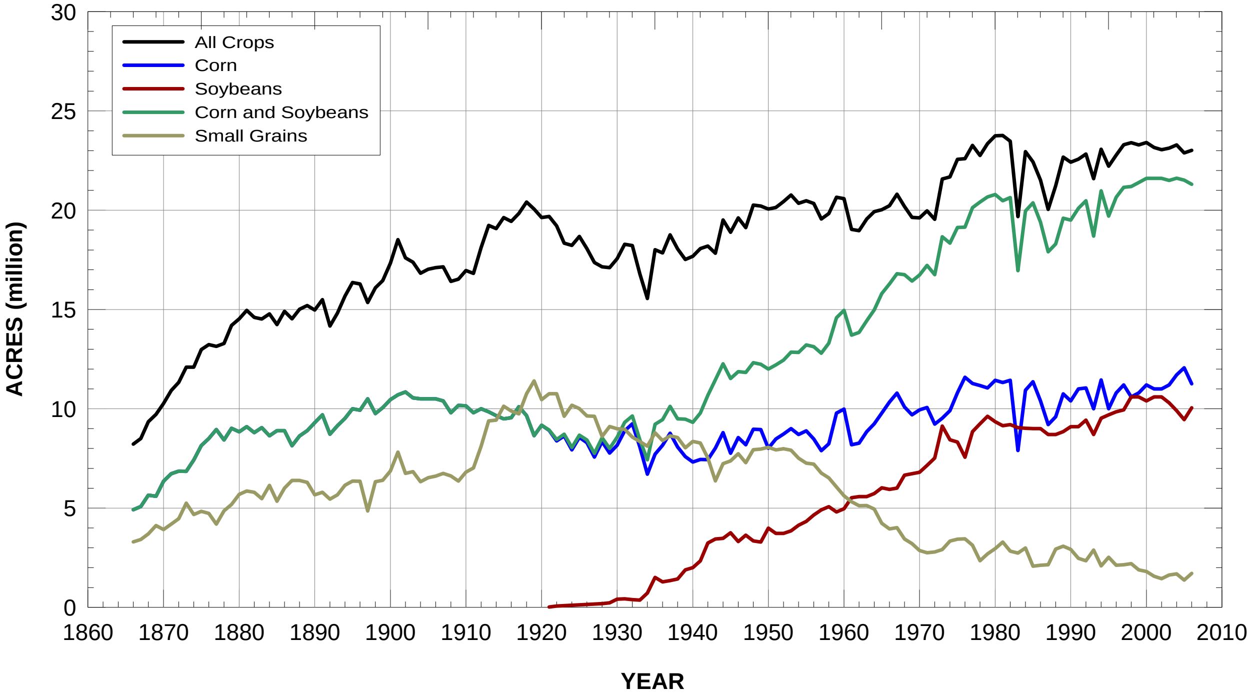


Figure 3-5. Acreage of agricultural land uses in State of Illinois (1866-2006)

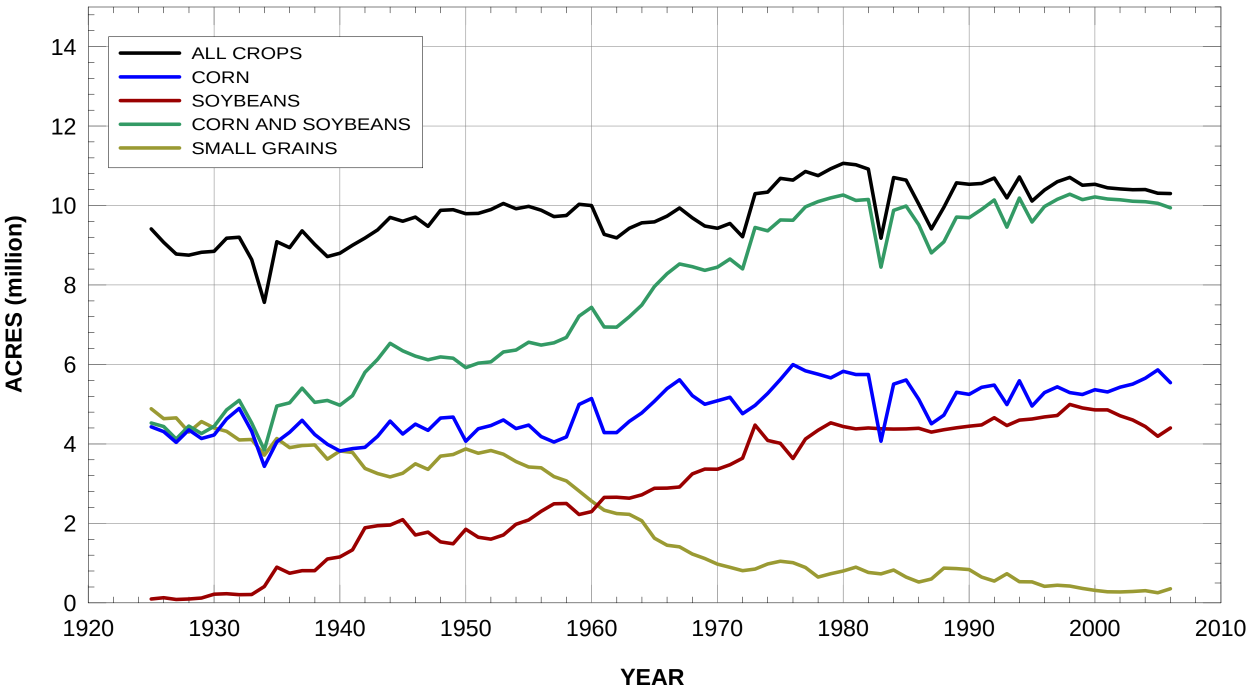


Figure 3-6. Acreage of agricultural land uses in Illinois River basin (1925-2006)

was in crop production. The same reversal of small grain and soybean acreage is also seen. Corn acreage is fairly steady for the period of record, averaging 4.8 million acres, increasing from 4.4 to 6.0 million acres from 1925 to 1976, and slightly decreasing to 5.5 million acres in 2006. Total IRB watershed area in crop production increased by 9 percent from 1925 to 2006 which is smaller than the 23 percent increase for the whole State of Illinois during the same period.

The Spoon River watershed is one of ten major tributaries to the Illinois River with a drainage area of 1.2 million acres (6.5 percent of the IRB drainage area). From 1925 to , watershed area in crop production increased from 54 to 66 percent. Figure 3-7 shows that the trends in corn, small grains, and soybeans are also similar. Corn and small grain acreage was 0.64 million acres in 1925 and in 2006 corn and soybeans were 0.75 million acres. Corn acreage increased by 0.19 million acres from 1925 to 1976 and then decreased by 0.09 million acres through 2006. The total Spoon River watershed area in crop production increased by 22 percent during 1925-2006 period and is only slightly below that of the increase in the State of Illinois and higher than the 9 percent increase for the IRB.

The Sangamon River watershed has a drainage area of 3.4 million acres (18.5 percent of the IRB drainage area). From 1925 to 2006, watershed area in crop production increased from 67 to 78 percent. Figure 3-8 shows that the trends in corn, small grains, and soybeans are also similar to the IRB. Corn and small grain acreage was 2.2 million acres in 1925 and in 2006 corn and soybeans were 2.6 million acres. Corn acreage increased by 0.37 million acres from 1925 to 2006. The total Sangamon River watershed area in crop production increased by 17 percent during 1925-2006 period and is below that of the increase in the State of Illinois and higher than the 9 percent increase for the IRB.

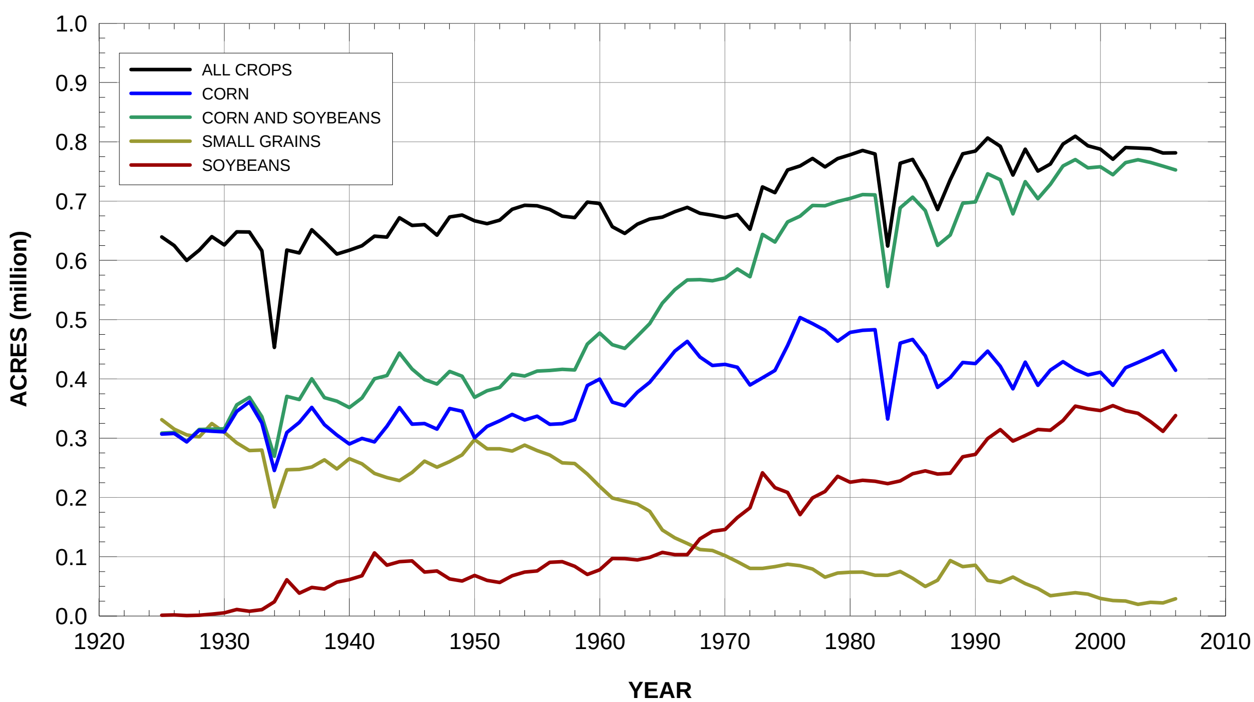


Figure 3-7. Acreage of agricultural land uses in Spoon River watershed (1925-2006)

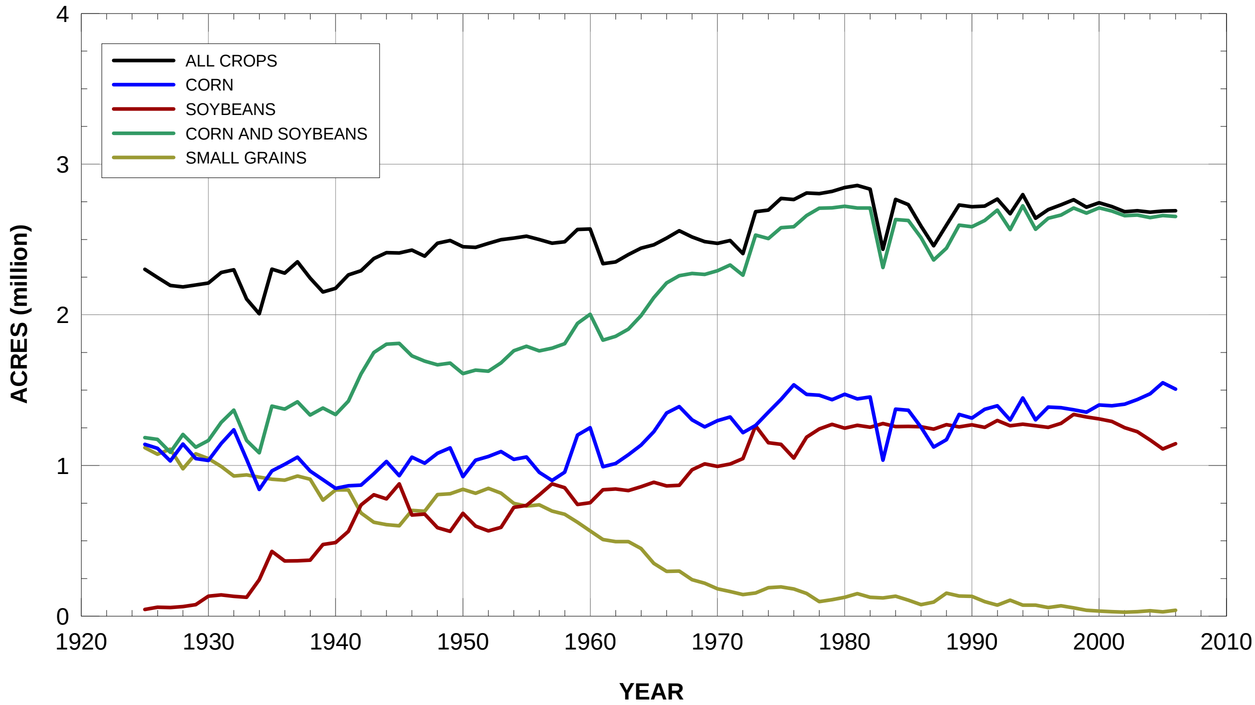


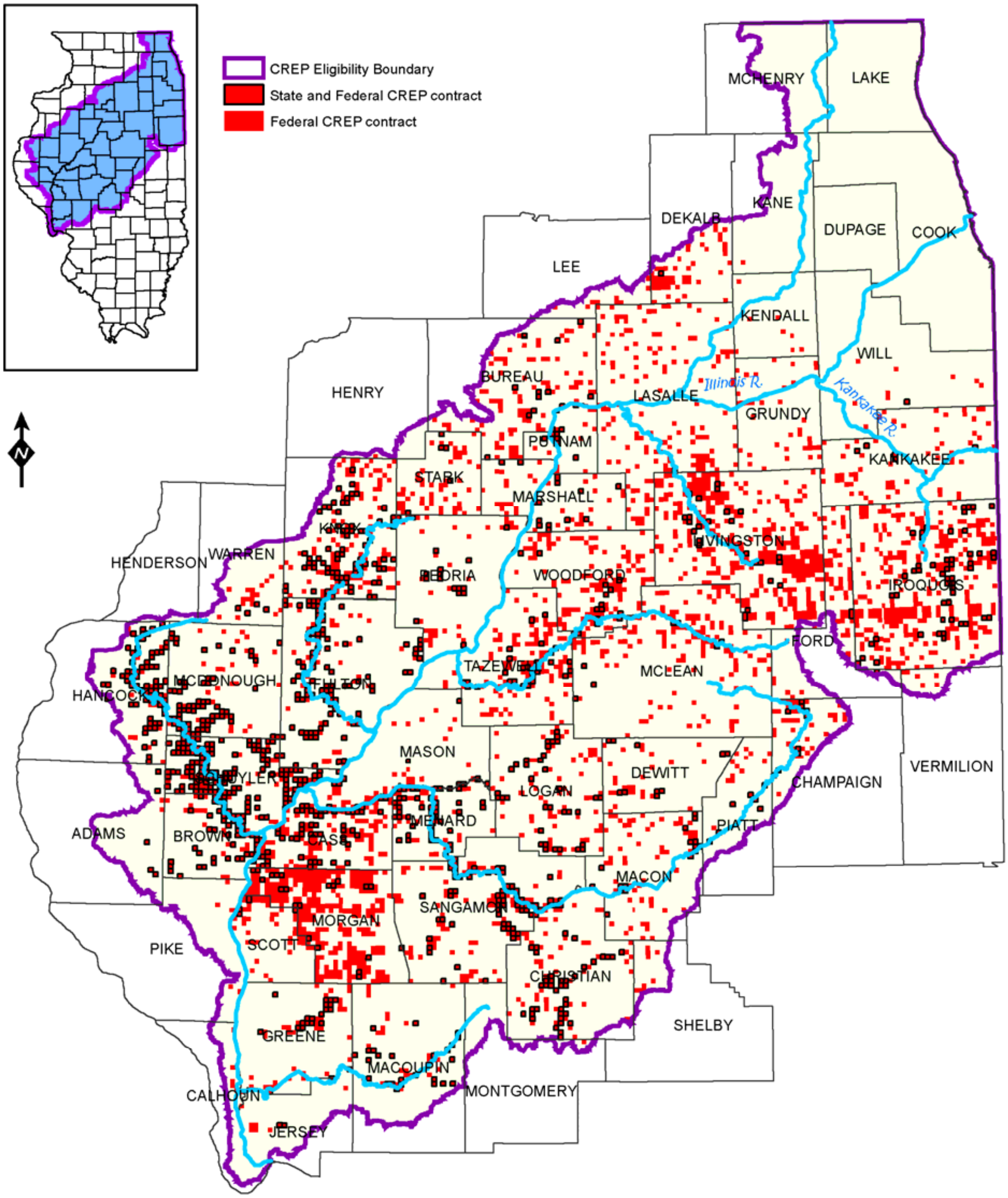
Figure 3-8. Acreage of agricultural land uses in Sangamon River watershed (1925-2006)

Overall, total crop acres within the Sangamon and Spoon River watersheds steadily increased from 1925 to the early 1980s and then remained steady through 2006. The Illinois River Basin and the entire State of Illinois show the same trend for total crop acres.

Conservation Practices

There has been a significant increase in the implementation of conservation practices in Illinois in recent years with CREP making a major contribution. IDNR has established different programs to document and track conservation practices in Illinois. The major initiative is known as the Illinois Conservation Practices Tracking System (ICPTS). The ICPTS is developing "a comprehensive database documenting the precise location, nature, and planned duration of conservation practices being implemented through Illinois CREP as well as other conservation incentive programs within the Illinois River basin," (State of Illinois, Department of Natural Resources, 2002). The database will be very useful for assessing and evaluating the effectiveness of different programs in meeting their objectives. The land use data from the database will be used along with the sediment and nutrient data being collected under the monitoring program to evaluate how conservation practices are influencing sediment and nutrient delivery to the Illinois River. Two examples of information and data on land use are shown in figures 3-9 and 3-10

Figure 3-9 shows the location of approved Illinois CREP contracts from the USDA and state of Illinois from 1999 through 2007. With this type of information it will be possible to identify areas where there has been significant participation in the CREP program and where changes in sediment and nutrient delivery should be expected. The information will provide important input data to the watershed models that are being developed to evaluate the impact of



Source: IDNR (2007)

Figure 3-9. State and Federal CREP contract locations.

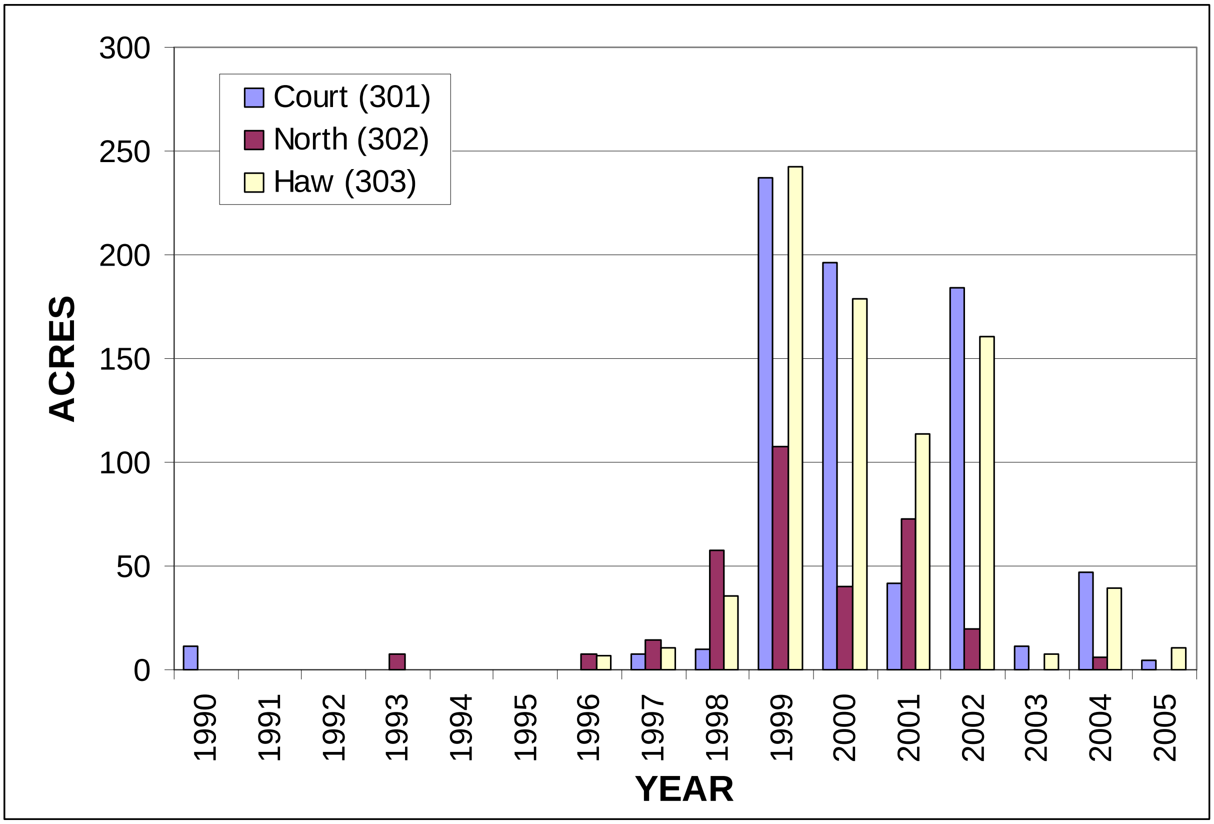


Figure 3-10. Acres of conservation practices installed in Court and Haw Creek watersheds over time

land use changes on sediment and nutrient delivery. It is also possible to extract much more detailed land use information as shown in figure 3-10 where the total acres in conservation practices are provided for small watersheds like Court and Haw Creeks on annual basis. The data shows the significant rate of increase in conservation practices in the Court and Haw Creek watersheds since 1997. This type of data will be extremely useful for assessing and evaluating the effectiveness of CREP and other conservation practices.

The Water Survey is analyzing changes in conservation practices in the Illinois River Basin since the initiation of CREP in 1998. The conservation practices data is compiled by the IDNR and USDA-FSA. The CREP conservation practices installed in the entire Illinois River Basin, as well as a more detailed conservation practice database for the four intensively monitored watersheds, is being analyzed to investigate relationships between sediment loadings and changes in conservation practices. Overall, IDNR reports that as of August 2007, 125,030 acres have been awarded by USDA-FSA CREP program with over 8,000 acres pending approval. The State of Illinois CREP program has awarded 78,288 acres with approximately 4,500 acres pending in county Soil and Water Conservation offices. More detailed information on CREP acres is available through 2005 with analysis of 2006-2007 in progress. Therefore, below are some statistics of the conservation practices through 2005:

Illinois River Basin

- Conservation practice acres within the Illinois River Basin (IRB):
  - The IRB has approximately 153,000 acres of conservation practices installed since 1999.
  - The majority of the CREP acres (91 percent) are located in the Illinois River Valley and the La Moine, Sangamon, Spoon, and Iroquois River subwatersheds.
  - There are 16 different conservation practices (table 3-1) being used in the IRB CREP program. Five of the 16 practices account for 94 percent of the total CREP acres.
  - Wetland restoration (CP23) is the most used conservation practices covering nearly 38 percent of the total CREP acres in the IRB. This is followed by riparian buffer (CP22), permanent wildlife habitat, noneasement (CP4D), filter strips (CP21), and hardwood trees (CP3A) at 25, 15, 11, and 5 percent, respectively.
- Conservation practice acres within each subwatershed:
  - Distribution of conservation practices installed varies between subwatersheds.
  - Wetland restoration is the dominant conservation practice in the Illinois River Valley and the La Moine, Iroquois, and Kankakee River subwatersheds (47, 65, 52, and 45 percent, respectively).
  - In the Sangamon River subwatershed 32 percent of the conservation practices were riparian buffers and 25 percent in permanent wildlife habitat (noneasment).
  - In the Spoon River subwatershed, the dominant conservation practices installed were wetland restoration and riparian buffers at 29 and 30 percent of the total CREP acres.

Table 3-1. Description of Conservation Practices Used in the Illinois River Basin CREP

Practice code	*Practice description*
CP1	Establishment of permanent introduced grasses and legumes
CP2	Establishment of permanent native grasses
CP3	Tree planting
CP3A	Hardwood tree planting
CP4B	Permanent wildlife habitat (corridors), noneasement
CP4D	Permanent wildlife habitat, noneasement
CP5A	Field windbreak establishment, noneasement
CP8A	Grass waterways, noneasement
CP9	Shallow water areas for wildlife
CP11	Vegetative cover - trees - already established
CP12	Wildlife food plot
CP16A	Shelterbelt establishment, noneasement
CP21	Filter strip
CP22	Riparian buffer
CP23	Wetland restoration
CP25	Rare and declining habitat

CREP Monitoring Watersheds

Court/Haw Creeks (Knox County)

- The Court and Haw Creek watersheds have a total of 1896 acres of conservation practices installed under CREP and CRP. These acres are located in the watershed area being monitored by the ISWS at three separate locations (figure 1-2). Court Creek (301) has 767 acres, North Creek (302) has 323 acres, and Haw Creek (303) has 806 acres.
- Almost 70 percent of the conservation practice acres in the Court (301) and North (302) watersheds are riparian buffer, wetland restoration, and filter strips. Permanent wildlife habitat, riparian buffer, and filter strips account for 61 percent of the conservation practices in the Haw (303) watershed.
- Most of the conservation practice acres in the three watersheds were installed between 1999 and 2002 (figure 3-10).

Panther/Cox Creeks (Cass County)

- The Panther and Cox Creek watersheds have 887 acres of conservation practices.
  - Approximately 147 acres (16 percent) have been installed above the two ISWS streamgages.
  - Panther (201): 129 acres
  - Cox (202): 18 acres
- Nearly all the conservation practices installed in the watershed upstream of Panther (201) has been riparian buffers (126 acres) funded by CREP.
- The 18 acres of conservation practices installed above Cox (202) were cool/warm season grass/shrubs and grass waterways funded by CREP, CRP, and WHIP (Wildlife Habitat Incentives Program).

Variability and Trends in Precipitation and Streamflow

Results of a short-term monitoring program have to be viewed with respect to the climatic and hydrologic conditions under which the data was collected. Under ideal conditions, which rarely happen, the monitoring period would include a combination of wet, dry, and normal climatic conditions that represent the range of variability in climatic and hydrologic conditions in the watershed. The influence of climatic and hydrologic conditions on the data collected has been taken into consideration, especially when different datasets collected at different times and conditions are combined or compared. The Illinois River basin, as any major watershed, has experienced significant variability in precipitation and streamflow over the last century and recent periods. Data collection for the CREP program started in 1999 to provide a perspective as to how the current monitoring period compares to the long-term variability of precipitation and stramflows within the Illinois River basin. Historical precipitation and streamflow data are analyzed and presented in this segment of the report.

Climate and hydrologic records from the past 100 years in Illinois show considerable long-term variability. These variabilities and trends were analyzed for two stations on the Illinois River and six tributary stations in the Illinois River basin (figure 3-11). Figure 3-12

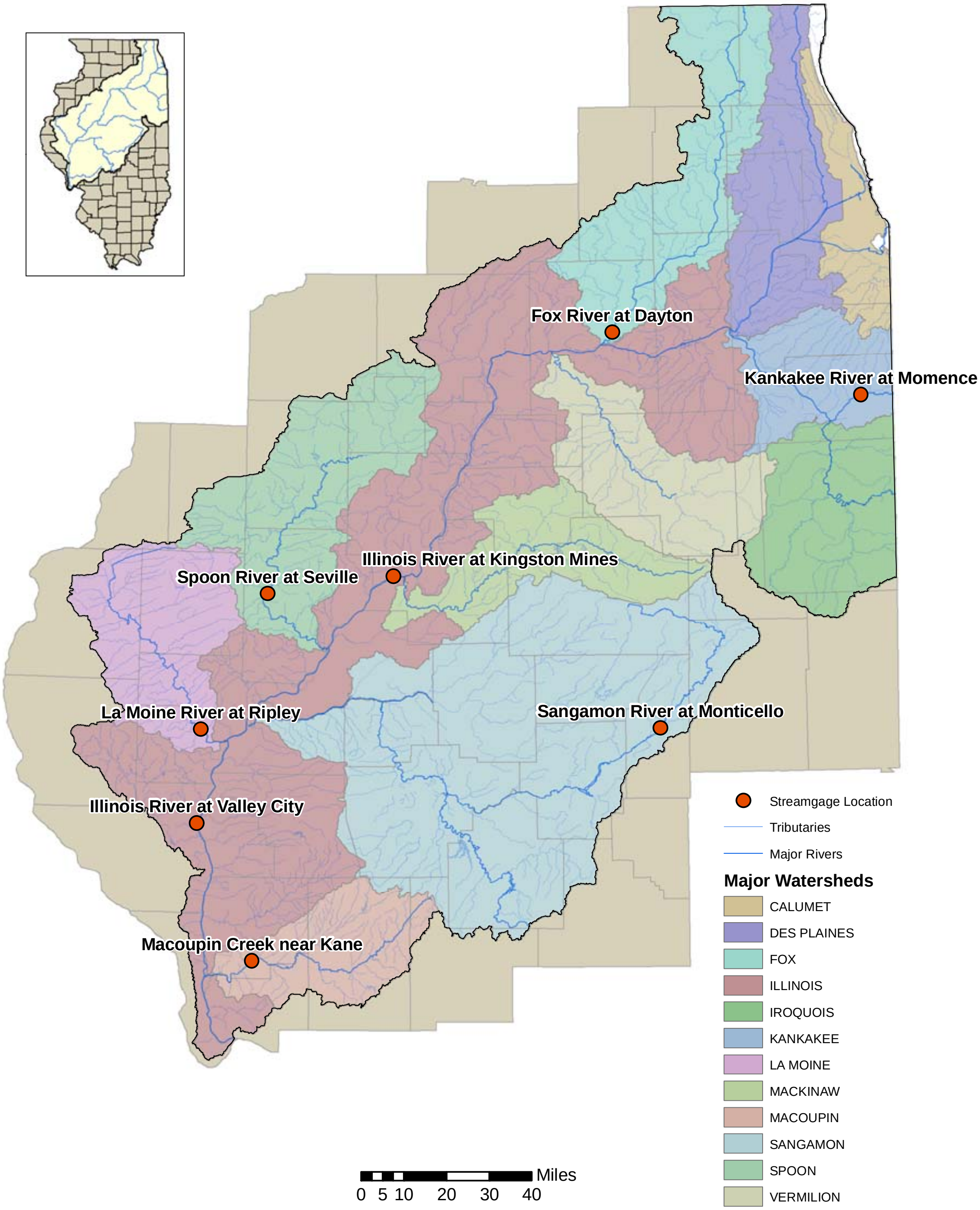


Figure 3-11. Location of streamgaging stations with long-term data used in the analysis of variability and trends

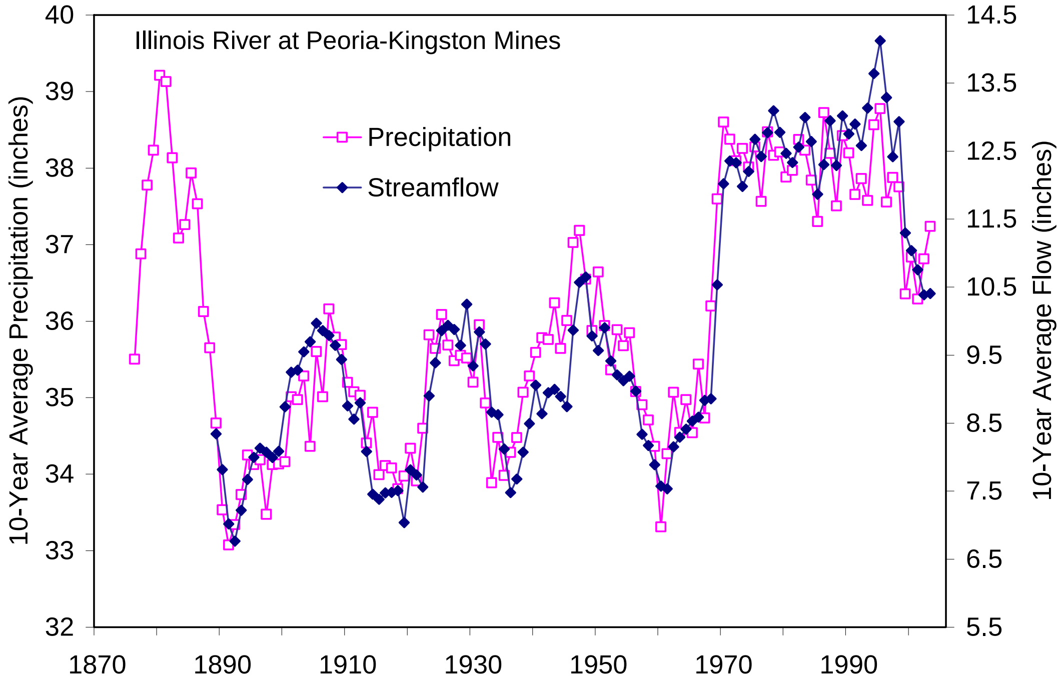


Figure 3-12. Ten-year average precipitation and streamflow,
Illinois River at Peoria-Kingston Mines

compares average precipitation and streamflow for the Upper Illinois River watershed since the 1880s, as expressed in moving 10-year average values. Similar comparisons are shown in figures 3-13 to 3-18 for the Fox, Kankakee, Spoon, Sangamon, LaMoine, and Macoupin subwatersheds, respectively, but for shorter time periods as limited by the available gaging records. Figure 3-19 for the entire Illinois River Basin (at the Valley City streamgage) is nearly identical to figure 1 except for the period of record. The 10-year average precipitation and streamflow values plotted in figures 3-12 to 3-19 represent the approximate midpoint of the 10 years; for example, the value for 1995 represents the average for 10 years from 1990-1999, the value for 1996 represents the average for the 10 years 1991-2000, and so forth. Streamflow values are expressed in inches of water spread uniformly over the entire watershed such that average streamflow can be compared directly with precipitation for the concurrent period. Streamflow values in figure 3-12 are computed from flow and stage records at Peoria prior to 1940 and at Kingston Mines since 1940.

Figure 3-12 shows that precipitation and streamflow in the Upper Illinois River watershed from 1970 to 1995 were considerably higher than at any other time in the 20th Century. Prior to 1895, precipitation for the Illinois River watershed is estimated from a small set of gaging records dating back to 1870. These precipitation records show that there was a decade of high precipitation in the late 1870s and early 1880s similar in magnitude to high precipitation amounts during 1970-1995. A comparison of 10-year average precipitation and streamflow amounts clearly shows that streamflow has been very closely related to concurrent precipitation throughout the past 125 years, with a correlation coefficient (*r*) of 0.958.

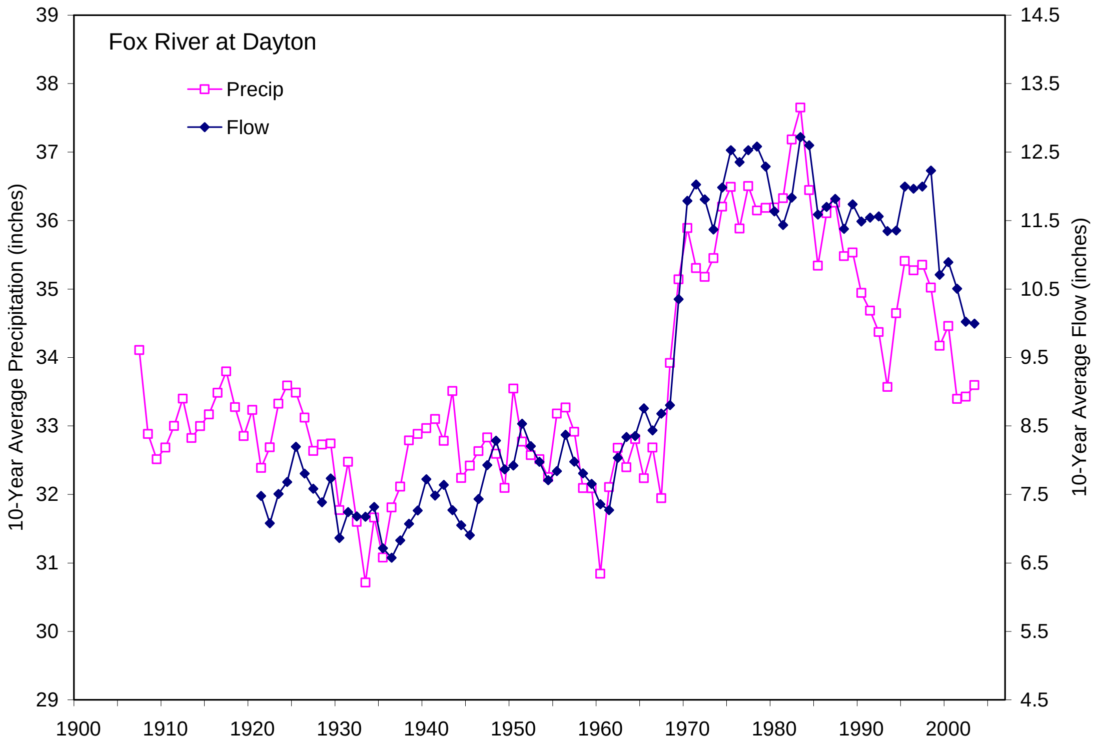


Figure 3-13. Ten-year average precipitation and streamflow, Fox River at Dayton

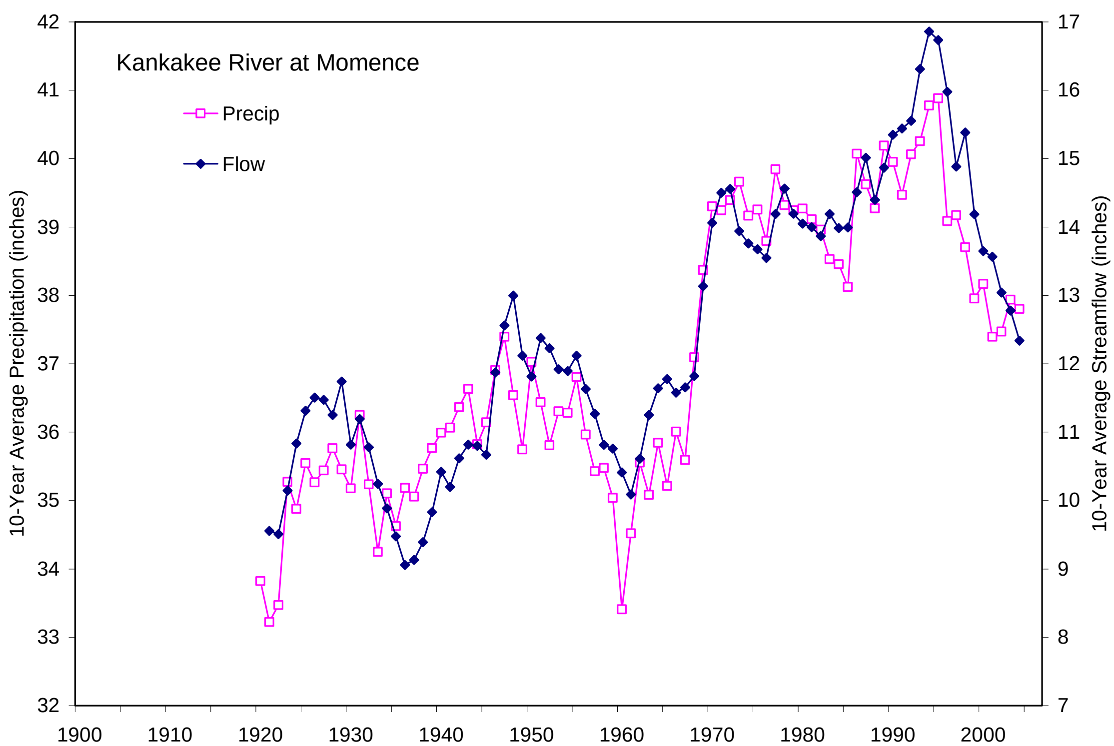


Figure 3-14. Ten-year average precipitation and streamflow, Kankakee River at Momence

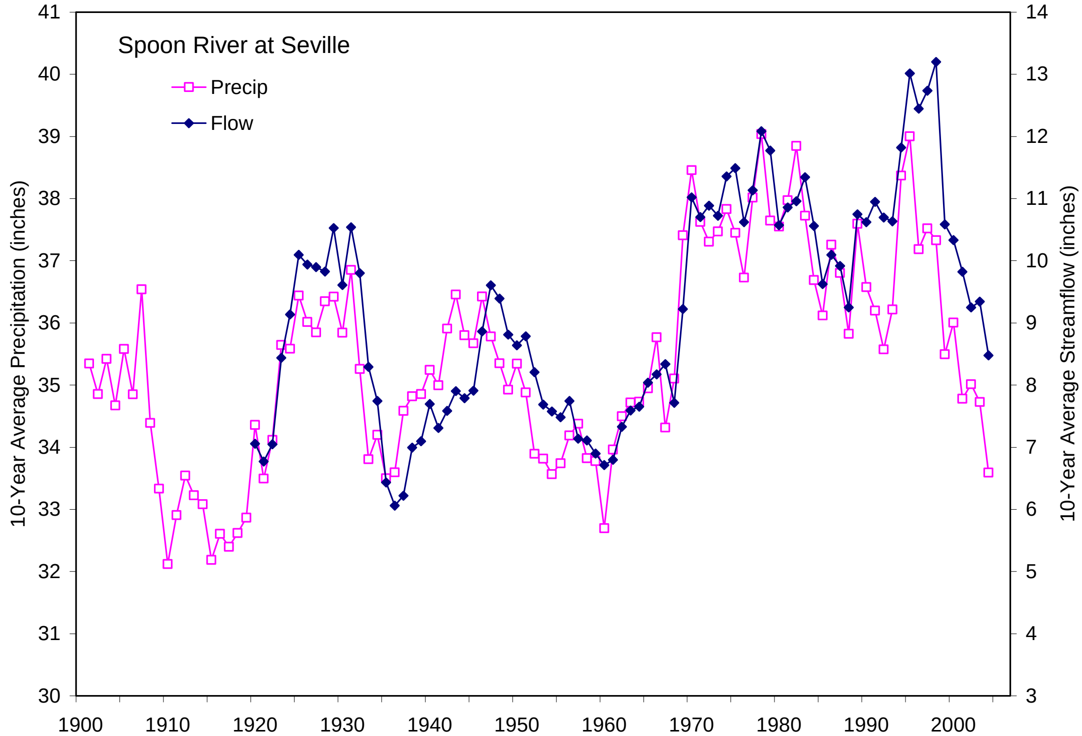


Figure 3-15. Ten-year average precipitation and streamflow, Spoon River at Seville

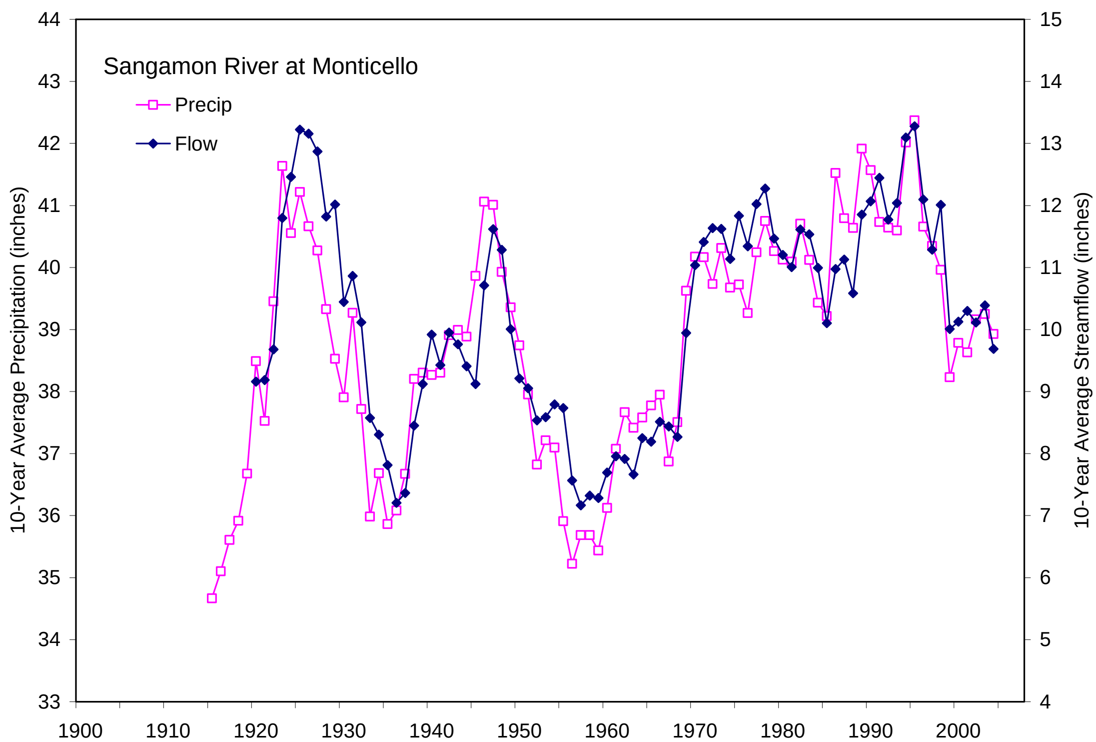


Figure 3-16. Ten-year average precipitation and streamflow, Sangamon River at Monticello

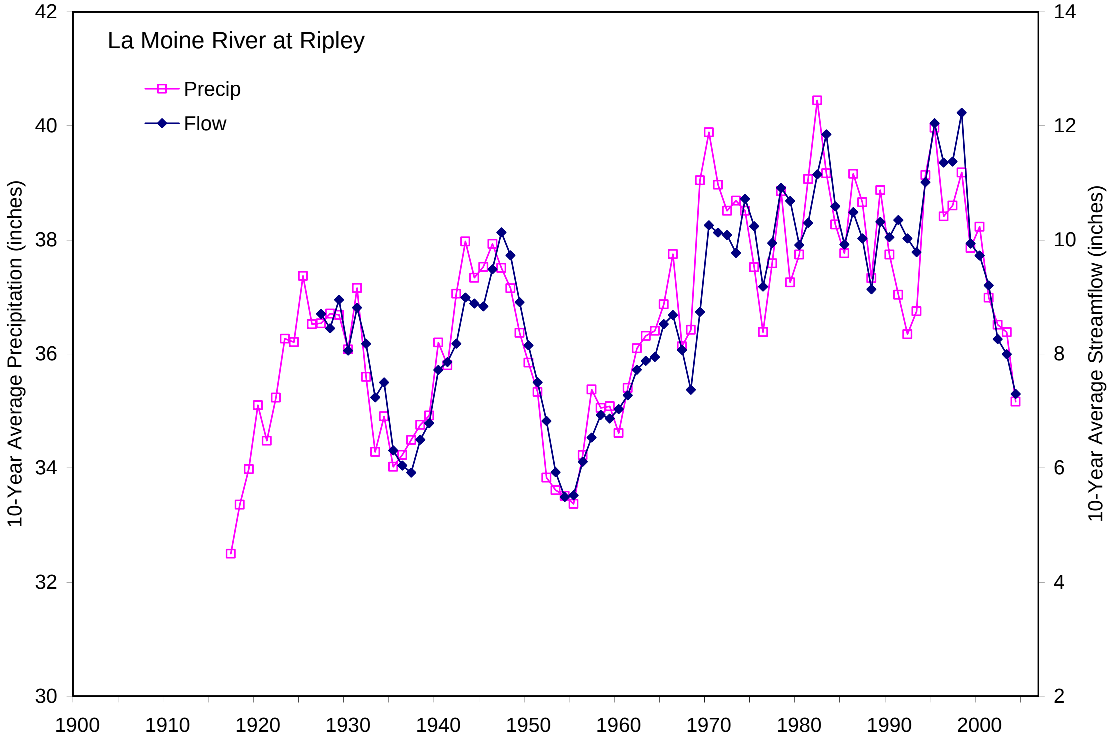


Figure 3-17. Ten-year average precipitation and streamflow, LaMoine River at Ripley

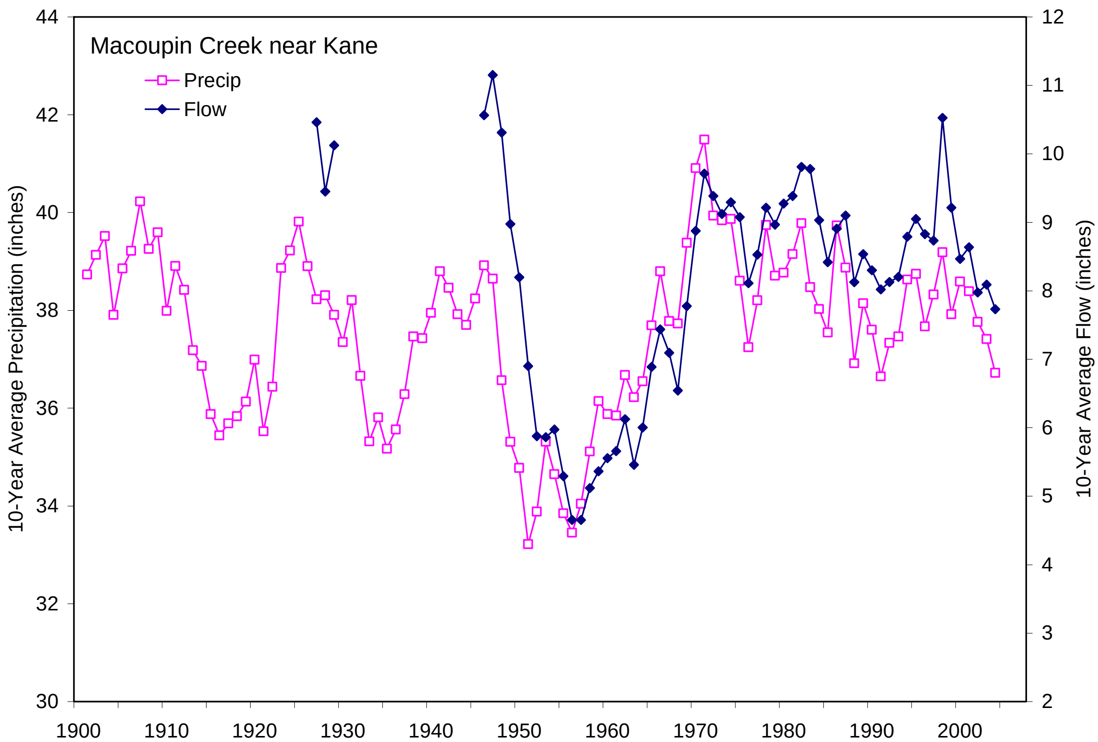


Figure 3-18. Ten-year average precipitation and streamflow, Macoupin Creek near Kane

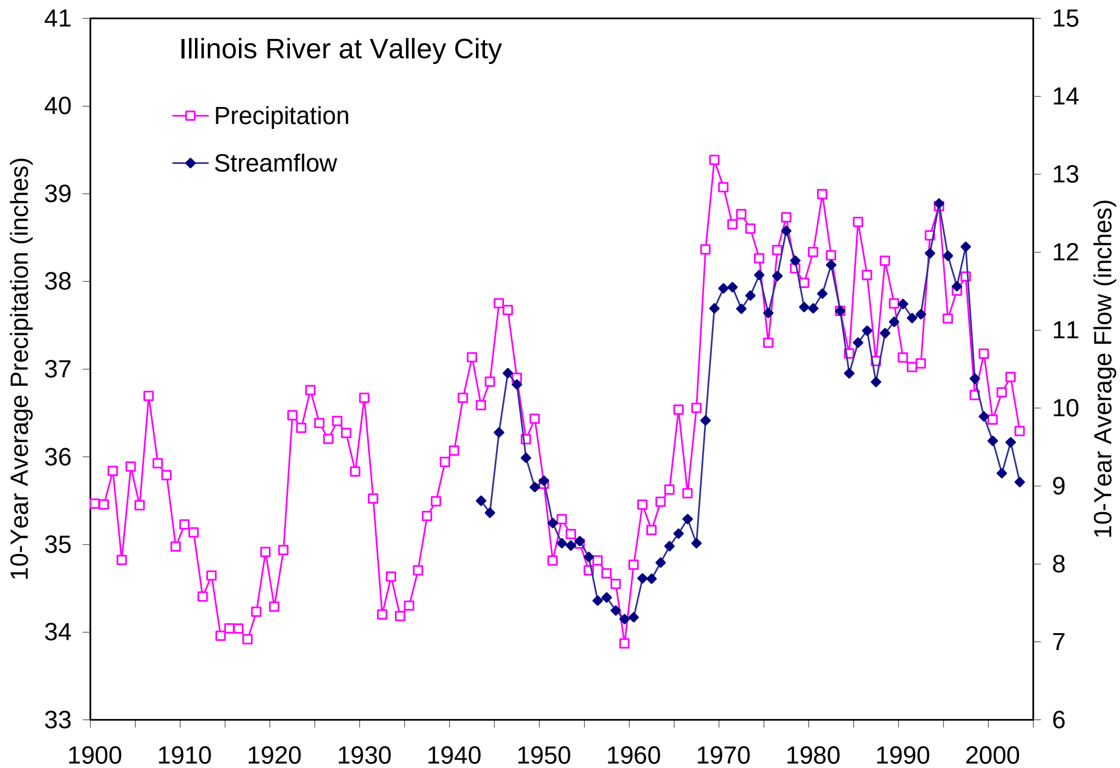


Figure 3-19. Ten-year average precipitation and streamflow, Illinois River at Valley City

Precipitation and streamflow trends shown in figure 3-12 are consistent with regional trends that have affected northern Illinois and much of the upper Midwest (Knapp, 2005). Statistical analyses of long-term streamflow records by Knapp (2005) using the Kendall tau-b trend statistic indicate that streamgage records in northern Illinois, eastern Iowa, and Minnesota all exhibit increasing trends in average streamflow (figure 3-20). Conversely, long-term flow records in the southern two-thirds of Illinois generally do not show significant increases in streamflow.

Figures 3-13 to 3-18 illustrate that trends in precipitation and streamflow vary across the Illinois River watershed. Increasing trends are particularly evident in the Upper Illinois River watershed and its two primary tributaries, the Fox and Kankakee River (figures 3-13 and 3-14). In contrast, the Macoupin, LaMoine, and Sangamon River subwatersheds, in the southern portion of the Illinois River basin, show much less or no overall trend in precipitation or streamflow — even though these records show considerable variation in precipitation and streamflow from decade to decade. The Spoon River watershed, having an intermediate location, shows an increasing trend in flow amount, but to a lesser degree than the Fox and Kankakee River watersheds located farther to the north. In all cases, there is a strong correlation between average precipitation and streamflow.

The significance of the trends is identified using the Kendall tau-b statistic. The Kendall tau-b statistical test provides a quantitative measure of trend, with a coefficient value of 0 indicating no trend and a value of 1 indicating an absolute increasing trend. For the 93-year flow

Figure 3-20. Locations of long-term streamflow gages (at least 89 years of record) showing statistically significant trends in mean annual flow in the eastern United States (from Knapp, 2005)

records dating back to 1915, a coefficient value greater than or equal to 0.115 indicates an increasing trend at a 90 percent confidence level, and a value greater than or equal to 0.162 indicates an increasing trend at a 98 percent confidence level. Table 3-2 shows the Kendall Tau-b trend coefficients computed for two time periods, 1915-2007 and 1970-2007. The 1915-2007 trend analyses for the Fox, Kankakee, and Upper Illinois (Peoria-Kingston Mines) flow records show increasing trends with very high levels of confidence. The 1915-2007 trend analysis for the Spoon River record shows an increasing trend, with roughly a 94 percent level of confidence. The flow records for the tributaries located farther south in the watershed do not show a significant trend (having less than an 80 percent level of confidence). The 1915-2007 trend coefficient for the Illinois River at Valley City is not shown because the flow record does not date back to 1915.

Although flow records from the northern half of the Illinois River watershed display an general increasing trend over their full period of record, a closer look indicates: 1) there was a geographically widespread and sizable jump in average flow amount between the 1960s and 1970s (this jump also occurred in the southern part of the basin to a lesser extent); and 2) for most locations there has been little or no additional increase since the 1970s. In fact, for most

Table 3-2. Kendall Tau-b Trend Statistics for Flow Records on the Illinois River and Major Tributaries

	Kendall Tau-b coefficient value period-of-record used in the analysis	
Streamgage record	*1915-2007*	*1970-2007*
Fox River at Dayton	0.294	-0.135
Kankakee River at Momence	0.316	-0.007
Illinois River at Peoria-Kingston Mines	0.315	-0.144
Spoon River at Seville	0.127	-0.127
Sangamon River at Monticello	0.087	-0.081
LaMoine River at Ripley	0.075	-0.166
Macoupin Creek near Kane*	-0.009	-0.081
Illinois River at Valley City**	------	-0.112

Notes:
* The periods of record for the Macoupin Creek gage near Kane are 1921-1933 and 1941-2007.
** The flow record at Valley City only extends back to 1939. The trend coefficient for the 1939-2007 period at Valley City, 0.162, is somewhat less than the trend coefficient for Peoria-Kingston Mines for the same time period (0.192).

locations, the average flows since 1995 have declined from the high flow levels that occurred from 1970 to 1995. Table 3-3 presents the average annual precipitation and streamflow amounts for the Illinois River and its major tributaries over the past 12 years (1996-2007) and compares these amounts to those for earlier periods (1915-1969 and 1970-1995) and to the overall long-term record. Except for the Kankakee River, the average flow from 1996-2007 for these rivers is much closer to the long-term average than it is to the higher flow amounts that were experienced from 1970 to 1995. Thus, with the exception of the Kankakee River watershed, it is reasonable to conclude that other flow records collected throughout the Illinois River watershed over the 1996-2007 timeframe may represent conditions similar to their expected long-term average condition.

Although it is not possible to predict how these trends will progress in the future, concerns expressed in previous decades regarding the potential for continued increases in flows throughout the Illinois River watershed (for example by Ramamurthy et al., 1989) for the time being may no longer be an issue. If anything, there may be growing concerns that the occurrence of drought periods such as existed prior to 1970 may become more frequent. This analysis does not specifically look at trends of flooding or low flows. However, for long-term gaging records in the Illinois River watershed, Knapp (2005) found that trends in high flows and low flows tended to be coincident and proportional to trends in average flow.

Table 3-3. Average Annual Precipitation and Streamflow (inches) for Different Periods of Record

Precipitation

Watershed	*1915-2007*	*1915-1969*	*1970-1995*	*1996-2007*
Fox	33.7	32.6	35.9	34.4
Kankakee	37.0	35.5	39.5	38.4
Upper Illinois (Peoria)	36.3	35.2	38.3	37.1
Spoon	35.7	34.9	37.7	34.8
Sangamon	38.9	38.1	40.7	38.9
LaMoine	36.6	35.8	38.6	35.9
Macoupin	37.4	37.0	38.6	36.9
Entire Illinois (Valley City)	36.5	35.6	38.3	36.6

Streamflow

Watershed	*1915-2007*	*1915-1969*	*1970-1995*	*1996-2007*
Fox	9.3	7.7	12.1	10.0
Kankakee	12.3	10.9	14.7	13.5
Upper Illinois (Peoria)	10.2	8.8	12.9	10.8
Spoon	9.1	8.0	11.3	9.2
Sangamon	10.4	9.5	12.4	10.1
LaMoine	8.7	7.7	10.7	8.2
Macoupin	8.4	8.1	9.1	7.8
Entire Illinois (Valley City)	9.8	8.4	11.7	9.5

4. Model Development and Application

The Illinois State Water Survey has been developing a watershed model for the Illinois River basin in support of the Illinois River Ecosystem project. In the initial phase, a hydrologic model of the entire Illinois basin has been developed and used to evaluate potential impacts of land use changes and climate variability on streamflow in the Illinois River basin. The model is based on the U.S. Environmental Protection Agency's BASINS 3.0 modeling system. The Hydrologic Simulation Program – FORTRAN or HSPF (Bicknell et al., 2001) which is part of BASINS was used to simulate the hydrology of the Illinois River basin. The HSPF is a comprehensive and dynamic watershed model that also has the capability to simulate water quality and sediment transport.

To make the model applicable for assessing and evaluating the impact of CREP and other land use changes on water quality and sediment transport, the Water Survey has been developing the sediment transport and water quality capabilities of the HSPF model for the Illinois River basin. The initial effort has focused on the Spoon River watershed (figure 4-1) where two of the four intensively monitored watersheds, Court and Haw Creek, are located. Streamflow, sediment, and water quality data being collected at three monitoring stations are being used to calibrate and test the model for the Spoon River watershed. Once the calibration and validation process are completed for the Spoon River watershed, the model parameters can be used to develop models for other similar watersheds to simulate the hydrology, sediment transport and water quality under different climatic and land use scenarios. Over time, as land use practices change significantly as a result of CREP and other conservation practices, the models being developed will provide the tools to evaluate and quantify changes in water quality and sediment delivery to the Illinois River.

The progress in model development for the Spoon River watershed is discussed in the following sections.

HSPF Model

The HSPF model is a conceptual, comprehensive, long term continuous simulation watershed scale model which simulates non-point source hydrology and water quality, combines it with point source contributions, and performs flow and water quality routing in the watershed and its streams. The HSPF model simulates land-surface portion of the hydrologic cycle by a series of interconnected storages – an upper zone, a lower zone, and a ground-water zone. The fluxes of water between these storages and to the stream or atmosphere are controlled by model parameters. The model uses a storage routing technique to route water from one reach to the next during stream processes.

For sediment simulation, the surface erosion component of the HSPF model performs processes such as sediment detachment from the soil matrix in the pervious land segments during rainfall event, washoff of this detached sediment, scour of the soil matrix, and reattachment or compaction of the sediment. Storage and washoff of sediments from the impervious surfaces is

Figure 4-1. Location of the Spoon River watershed

also considered. The sediment load and transport in the stream channel is dependent on the particle diameter, density, fall velocity, shear stress for deposition and scour, and erodibility. The noncohesive (sand) and cohesive (silt and clay) sediment transport is simulated in the model using different subroutines.

Nutrients in the watershed soil in the HSPF model are simulated either as attached to organic or inorganic solids, dissolved in the overland flow, or as concentrations in the subsurface flow reaching the streams laterally. For both nitrogen and phosphorous compounds, the processes simulated include immobilization, mineralization, nitrification/denitrification (nitrogen only), plant uptake, and adsorption/desorption. The nutrient loads from the watershed undergo further transformation in the stream reaches.

Model Input Data

The HSPF model requires spatial information about watershed topography, river/stream reaches, land use, soils, and climate. The hourly time-series of climate data required for hydrologic simulations using HSPF include precipitation, potential evapotranspiration (ET), potential surface evaporation, air temperature, dew-point temperature, wind speed, and solar radiation. The hourly precipitation data from the two ISWS gages, one each in Court Creek (ISWS31) and Haw Creek (ISWS32) watersheds, were used (figures 4-2 and 4-3). Daily precipitation data from the MRCC (Midwestern Regional Climate Center) gaging station at Galesburg (ID 113320) was also used after it was disaggregated into hourly data based on the hourly precipitation data from an ICN (Illinois Climate Network) station located in Monmouth (MON). The other time series of the climate inputs for the above three precipitation stations were obtained from the ICN station at Monmouth. Daily data from nine additional MRCC stations (figure 4-4) in or near the Spoon River watershed were also disaggregated into hourly data based on the hourly data from three stations at Peoria, Moline, and Augusta, as found in the BASINS database. These additional stations were used for the Spoon River watershed model.

For topographic inputs, the 30-meter Digital Elevation Model (DEM) raster dataset produced by the Illinois State Geological Survey (ISGS) and the United States Geological Survey (USGS) was used. The high resolution National Hydrography Dataset (NHD) developed by the USGS was used to provide stream/river reach information to the model. The land use data were obtained from the Illinois Department of Agriculture which is based on the satellite imagery of the State of Illinois acquired from three dates during the spring, summer, and fall seasons of 1999 and 2000. Land use in the study watersheds was classified as corn, soybean, rural grassland, forest, urban, wetland and other (figures 4-5, 4-6, and 4-7). The soils data were based on digitized County Soil Association Maps of the Knox County and the STATSGO dataset (figure 4-8). The soil type for various parts of the study watersheds were determined spatially from the digitized soils maps, but the parameters corresponding to the soil type were manually entered during development of the HSPF model.

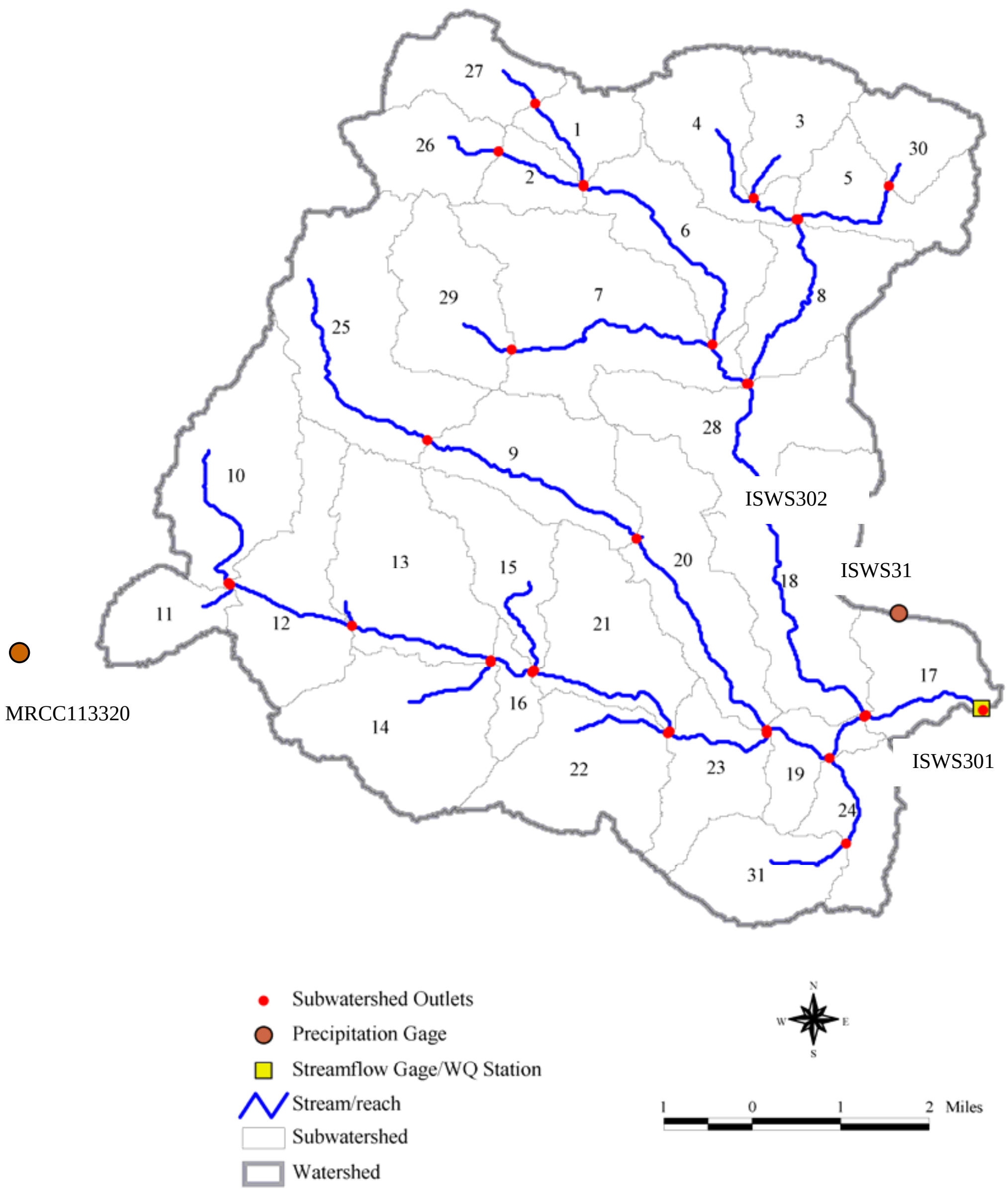


Figure 4-2. Schematic of the subwatershed and stream delineation, and precipitation gages used for the Haw Creek model

Figure 4-3. Schematic of the subwatershed and stream delineation, and precipitation gages used for the Haw Creek model

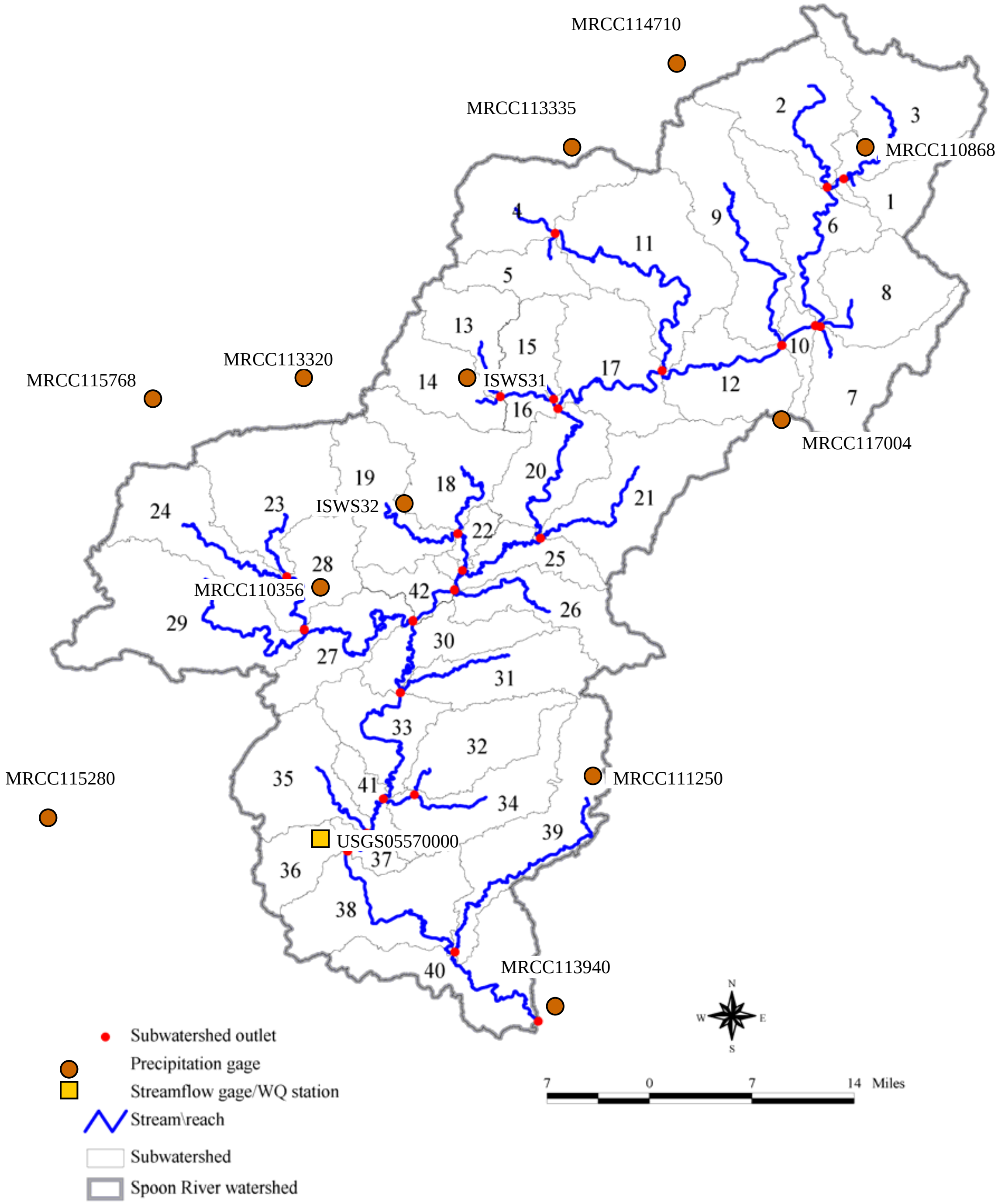


Figure 4-4. Schematic of the subwatershed and stream delineation, and precipitation gages used for the Spoon River watershed model

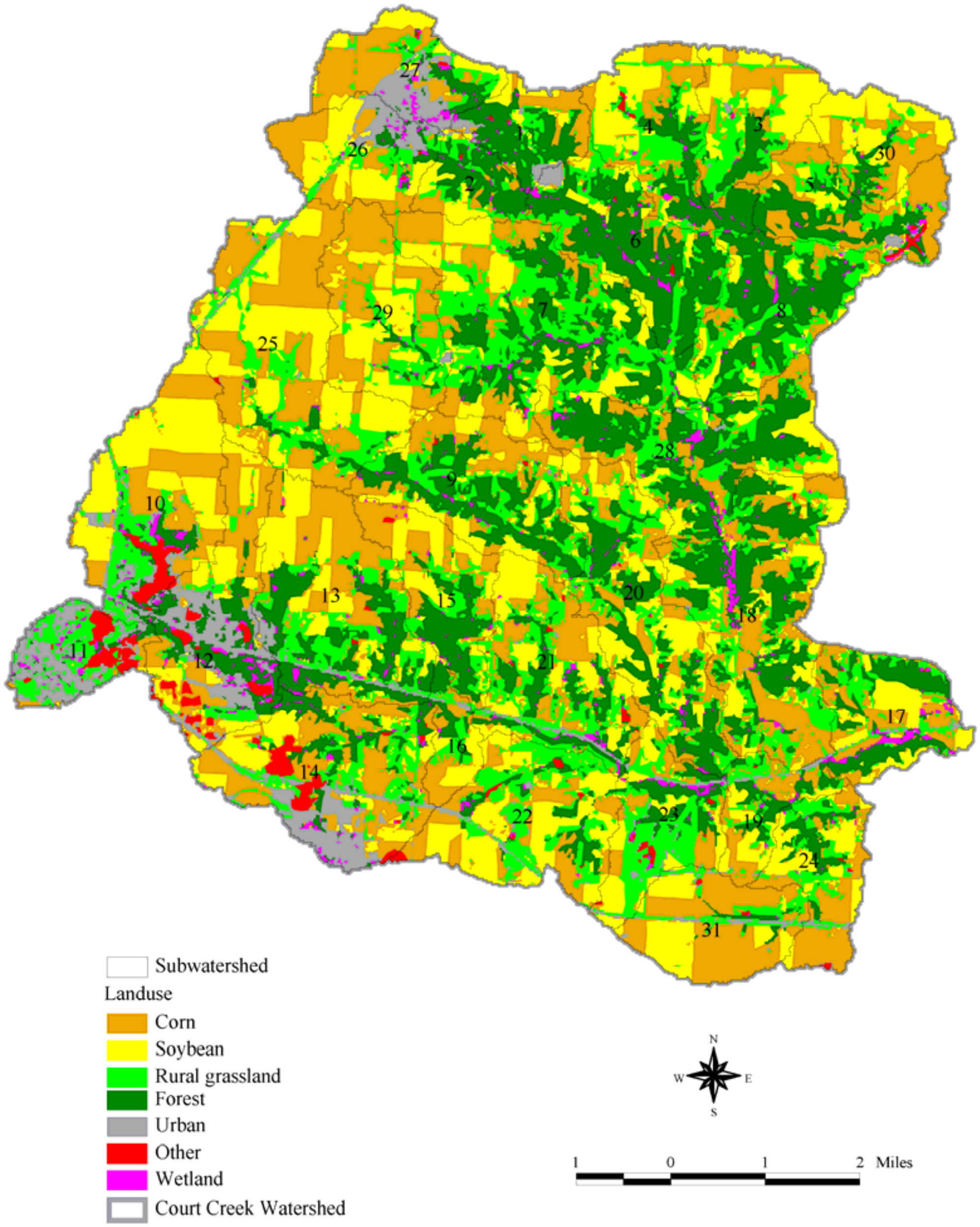


Figure 4-5. Land use in the Court Creek watershed

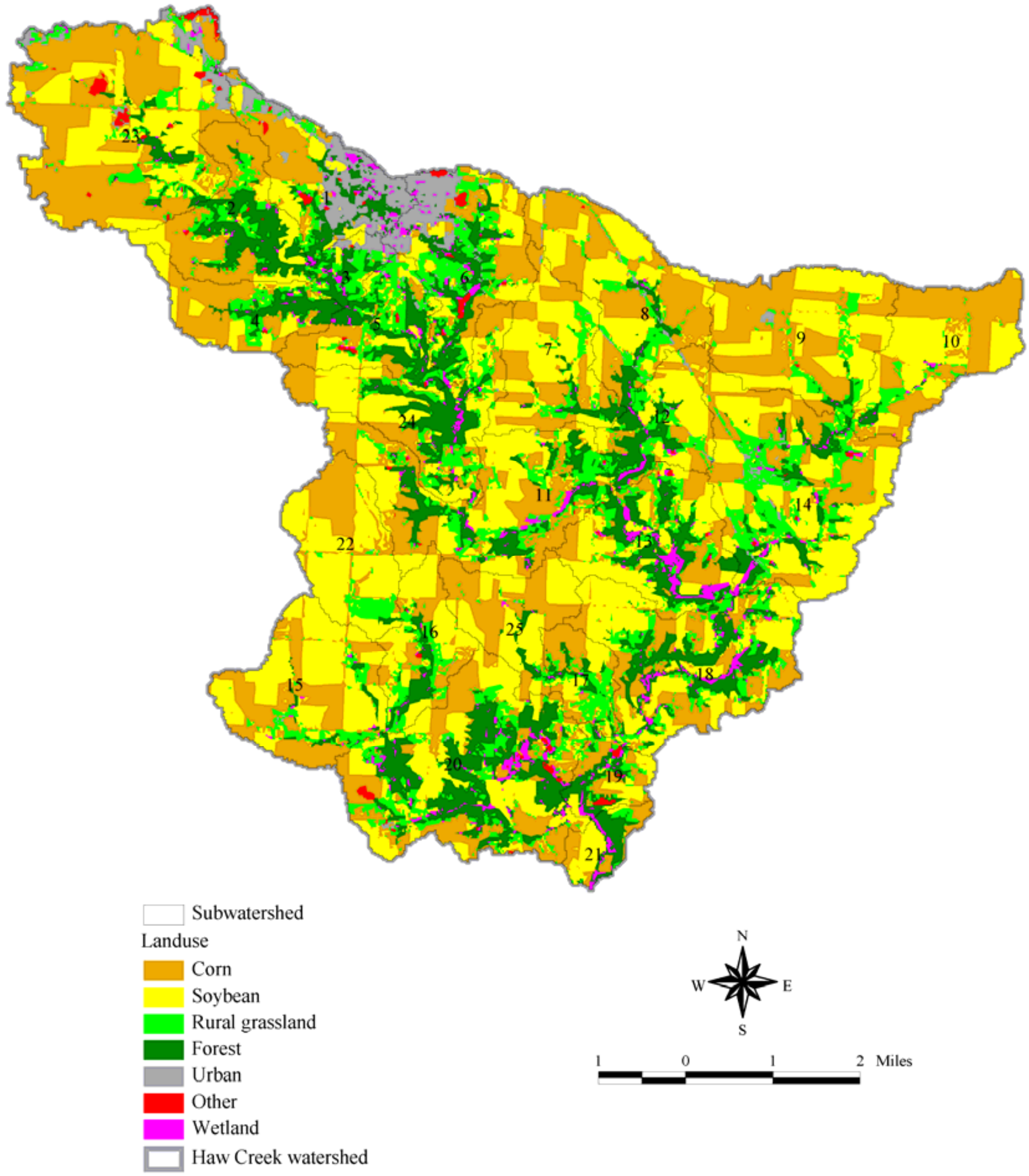


Figure 4-6. Land use in the Haw Creek watershed

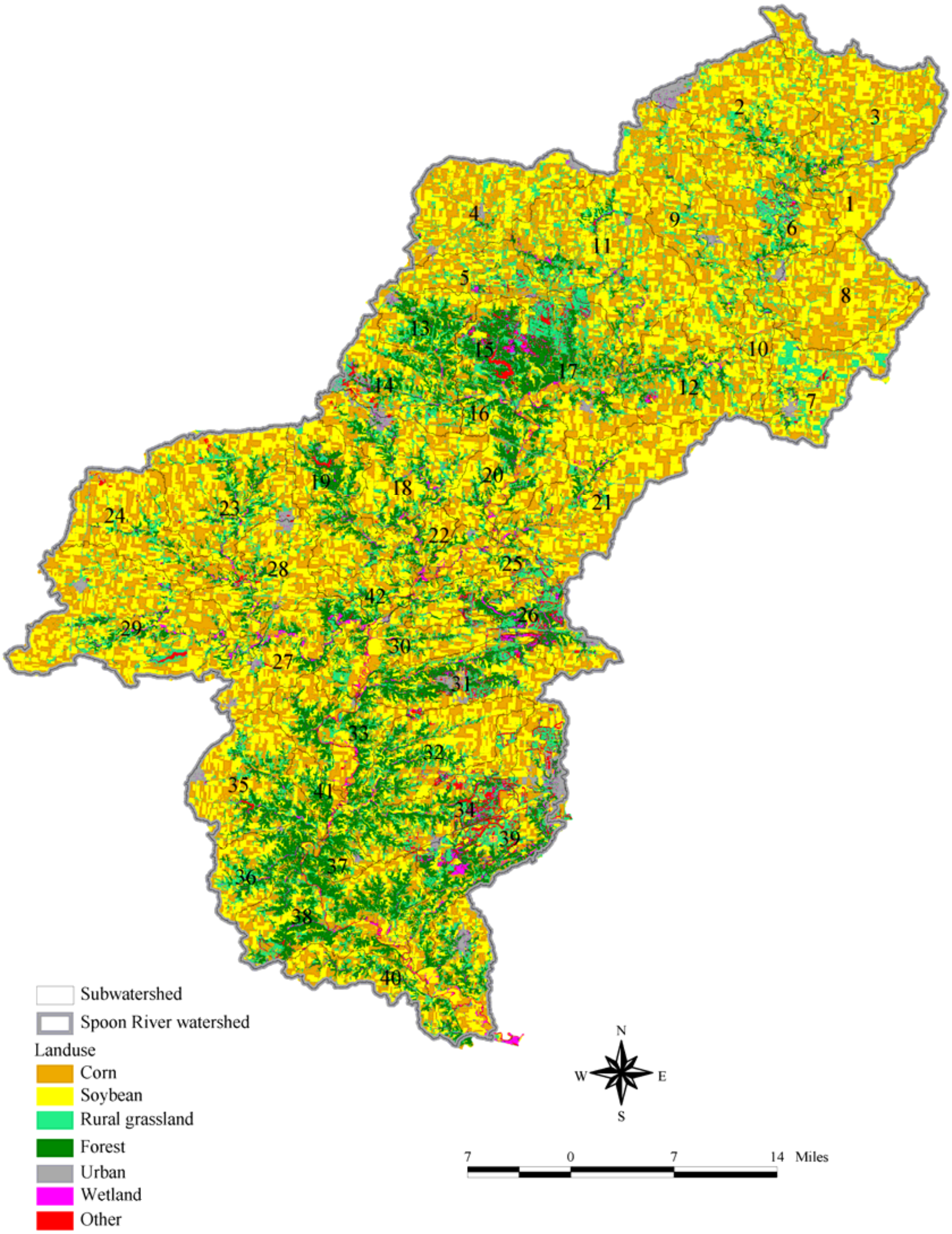


Figure 4-7. Land use in the Spoon River watershed

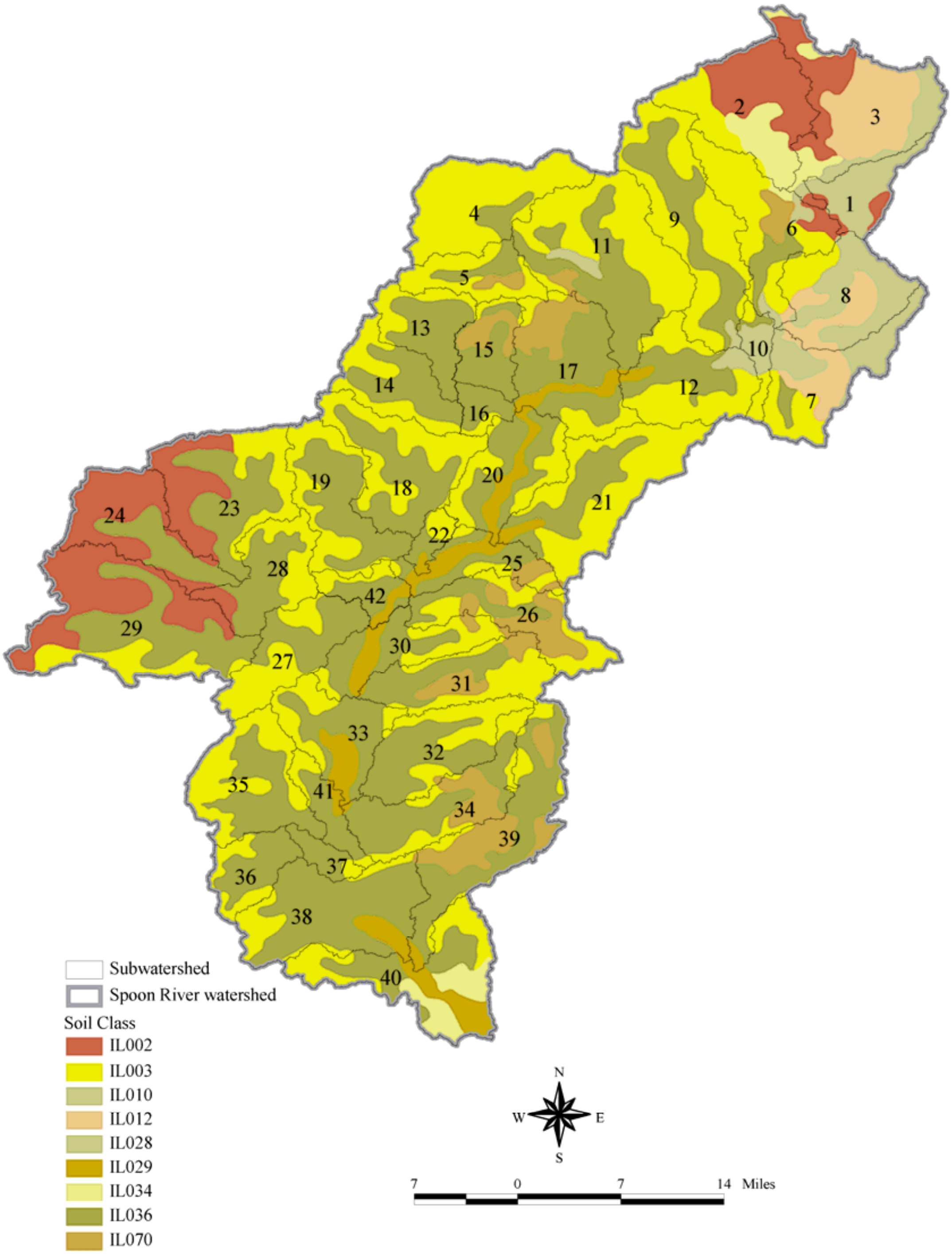


Figure 4-8. Soil types in the Spoon River watershed

Model Development

Based on the topographic and hydrographic data, the watersheds were subdelineated into smaller hydrologically-connected subwatersheds and stream reaches, and respective outlets. The Automatic Delineation procedure in BASINS with an option of 'burning in' existing streams was used. Subdelineation was done for representing spatially variable physical and other characteristics of a watershed in the HSPF model. The Court, Haw, and Spoon River watersheds were subdivided into 31, 25, and 42 subwatersheds, respectively (figures 3-2, 3-3, and 3-4). During subdelineation, outlets were specified in the models corresponding to the streamflow gaging/water quality monitoring stations on the North Creek (ISWS302), Court Creek (ISWS301), Haw Creek (ISWS303), and the USGS streamflow gaging station at Seville (USGS05570000) in the Spoon River watershed (figures 3-2, 3-3, and 3-4). The subwatersheds were further subdivided into Hydrologic Response Units (HRUs) based on land use, soil, and climate to account for the spatial variability of a basin's physical and hydrologic characteristics at a finer scale. An HRU is an area within a watershed that is expected to have a similar hydrologic response to input of precipitation and evapotranspiration. Each HRU has a set of parameter values that must be determined through the calibration process to define runoff characteristics as well as loading of various constituents from that HRU. In the Court Creek watershed HSPF model, climate data from the Court Creek and Galesburg precipitation gages were input to different subwatersheds based on the proximity. Similarly, in the Haw Creek HSPF model data from the Haw Creek and Galesburg gages were input to various subwatersheds. In case of Spoon River watershed HSPF model, data from all ten MRCC stations were specified for different subwatersheds based on their proximity to the gages.

Model of the Court Creek watershed was developed first using two years (WY2001-WY2002) streamflow and sediment concentration data from the ISWS301 streamflow gage/WQ station on the Court Creek. Calibrated model parameters from this model were then used to populate the models of the Haw Creek and Spoon River watersheds. No further calibration of these two models was performed. Haw Creek watershed model was run for the same two year period as Court Creek watershed model and the model results were compared with the observed data from the ISWS303 gage on the Haw Creek. Since long-term climate and streamflow data were available for the Spoon River watershed, this model was run for 1972-1995 period using data from the USGS05570000 at Seville.

Modeling Results

Values of a large number of HSPF model parameters can not be obtained from field data and need to be determined through model calibration exercise. The Court Creek watershed model was calibrated to assign best possible parameter values to each HRU and stream reach so that the model simulated daily streamflows and pollutant concentrations similar to the values observed at the gaging/monitoring stations. Calibration of the hydrologic component of the model was followed by the calibration of the water quality component for the sediment concentration. Model was run for hourly time step. For the two year calibration period of WY2001-WY2002, percent volume error between the model simulated and observed streamflows at gages ISWS301 on the Court Creek and ISWS302 on the North Creek were 1.2% overestimation, and 3.5%

underestimation, respectively. Comparisons of the daily streamflows simulated by the model for WY2001-WY2002 period with those observed at gages ISWS301 and ISWS302 are shown in figures 4-9a and 4-9b. The performance of this preliminary model is promising and overall the simulated streamflows follow the similar trend as the observed values. The timings and shape of the simulated streamflow hydrographs resemble the observed ones but some peak flows were underestimated by the model. In this study the model was not calibrated to match the individual stormflow events, rather it was calibrated to fit the long-term and daily data over the two year calibration period. Also, data from only two precipitation gaging stations, both near the boundary of the watershed (figure 4-2), were used to spatially represent the precipitation over the entire watershed. It is possible that rainfall measured for a particular event at one of the gages did not represent the rainfall that actually occurred in different parts of the watershed, thereby resulting in discrepancies between the observed and simulated streamflow hydrographs. Thus, more precipitation gaging stations will help improve the performance of the hydrologic model by more accurately simulating the stormflow hydrographs.

For sediment simulation by the model in the Court Creek watershed, parameters controlling soil erosion on the surface and sediment transport in the stream channel were calibrated. Comparison of sediment concentration simulated by the model and those observed at gages ISWS301 and ISWS302 are shown in figure 4-10 for the WY2001-WY2002 period. The simulated values generally followed the same trend as the observed sediment concentration values at both gages. Since most soil erosion occurs during extreme runoff events, some high sediment concentrations were underestimated by the model as a result of poor estimation of the stormflow peaks by the model during hydrologic simulations.

Streamflow and sediment concentration simulation results from the Haw Creek watershed model are compared with the observed data as shown in figures 4-11 and 4-12, respectively. Similar results from the Spoon River watershed model are shown in figures 4-13 and 4-14. In this preliminary phase, the performances of these two models were similar to the calibrated model of the Court Creek watershed. Performance of these models can be improved in the future if climate, streamflow, and water quality data are available for more stations and longer time period to improve the model calibration.

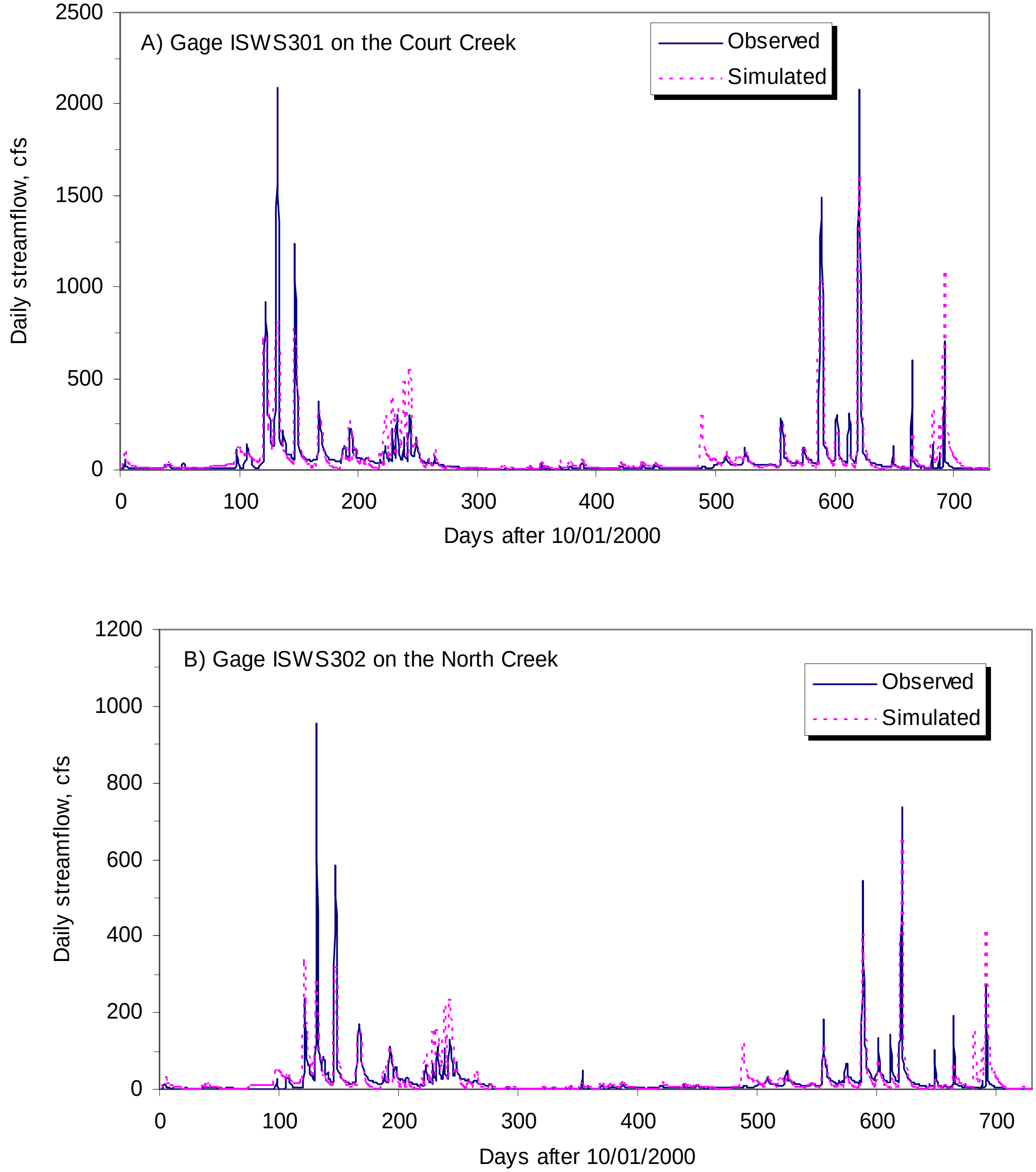
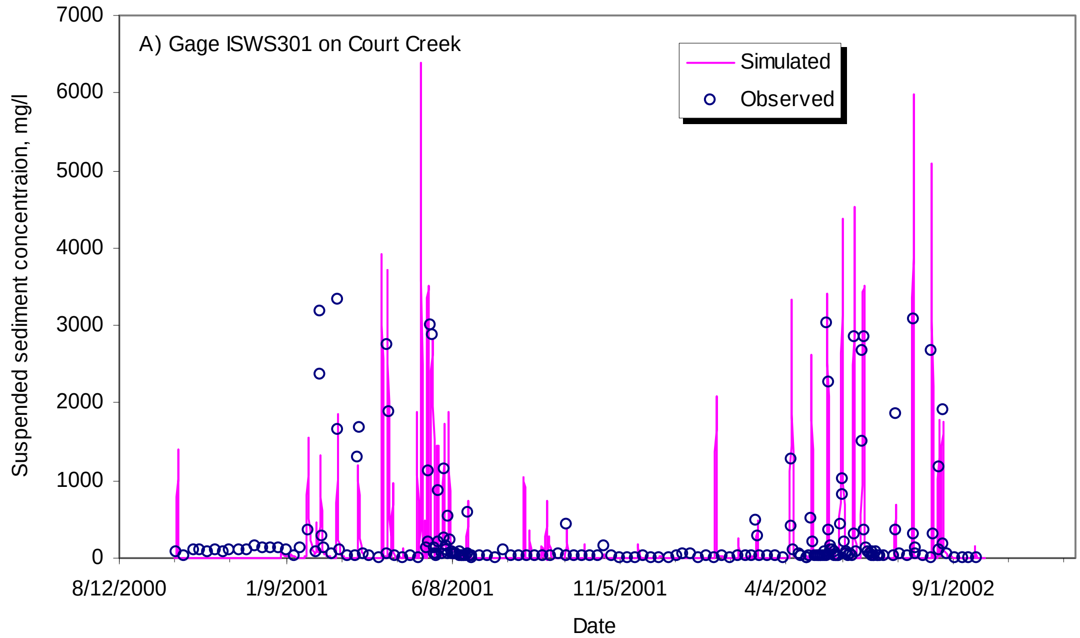


Figure 4-9. Results of model calibration for streamflow simulation for the Court Creek watershed



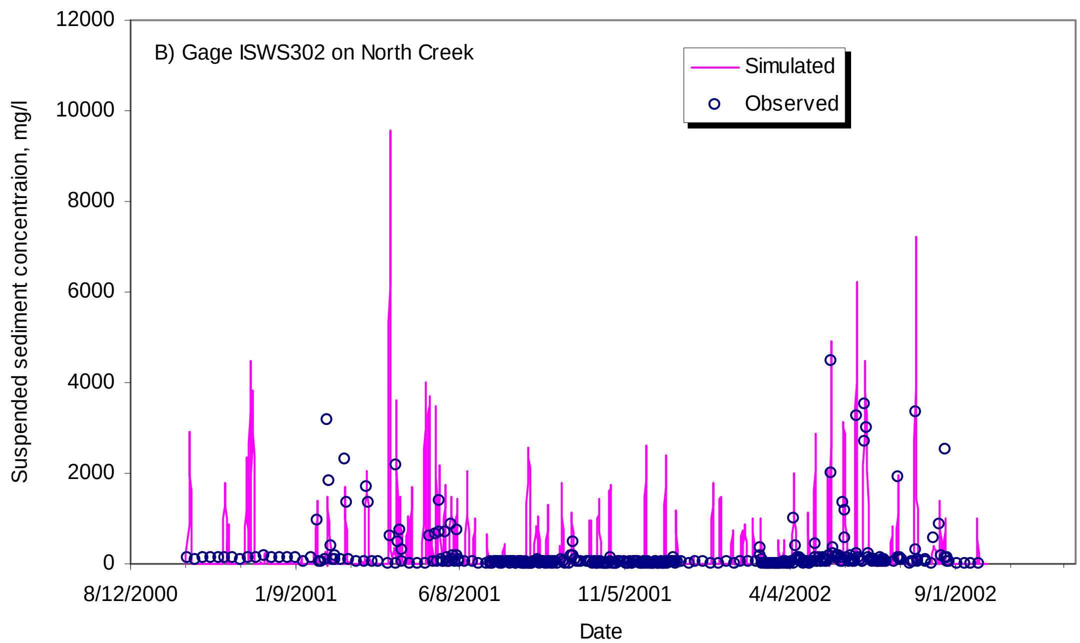


Figure 4-10. Preliminary results of model calibration for suspended sediment concentration simulation for the Court Creek watershed

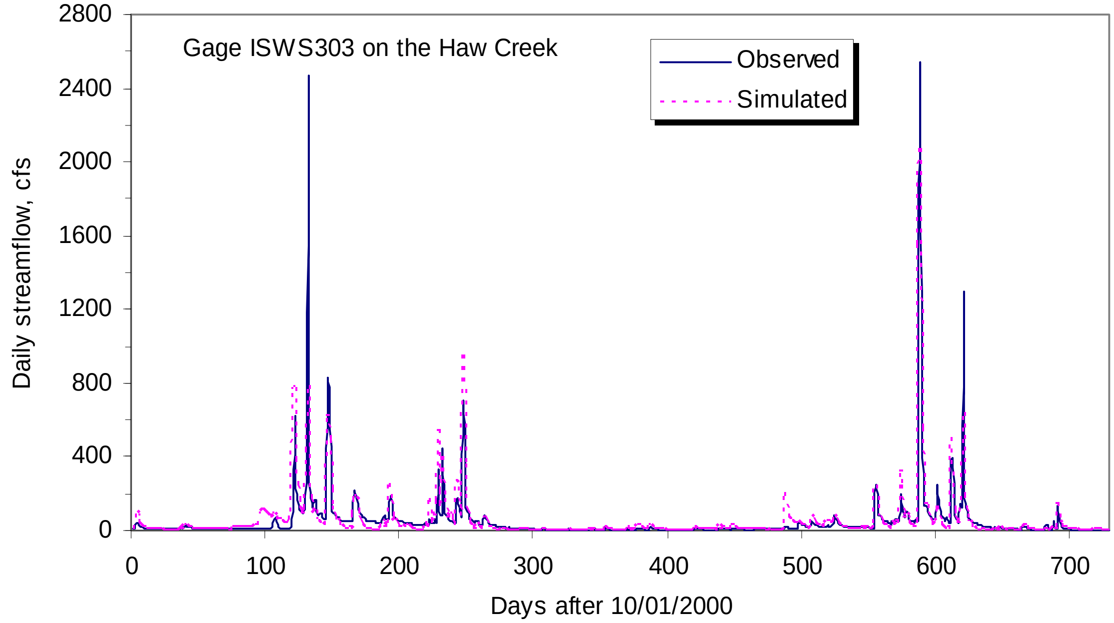


Figure 4-11. Comparison of observed and simulated streamflow by the Haw Creek watershed model developed using the calibrated parameters from the Court Creek watershed model

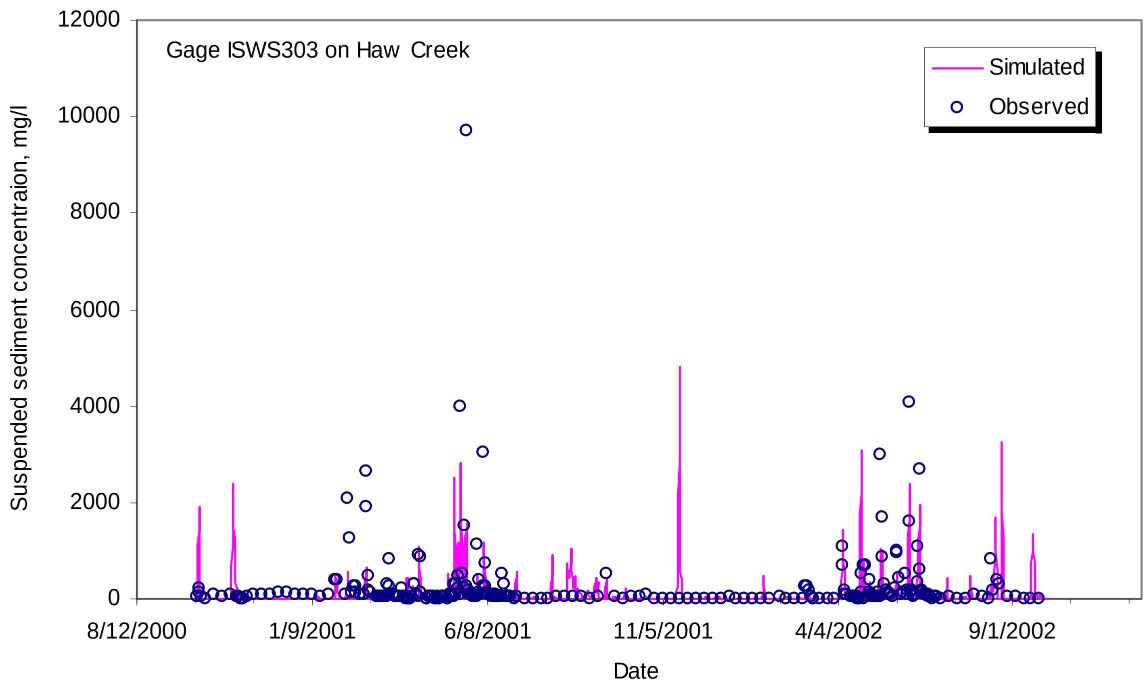


Figure 4-12. Preliminary results for suspended sediment concentration from the Haw Creek watershed model developed using the calibrated parameters from the Court Creek watershed model

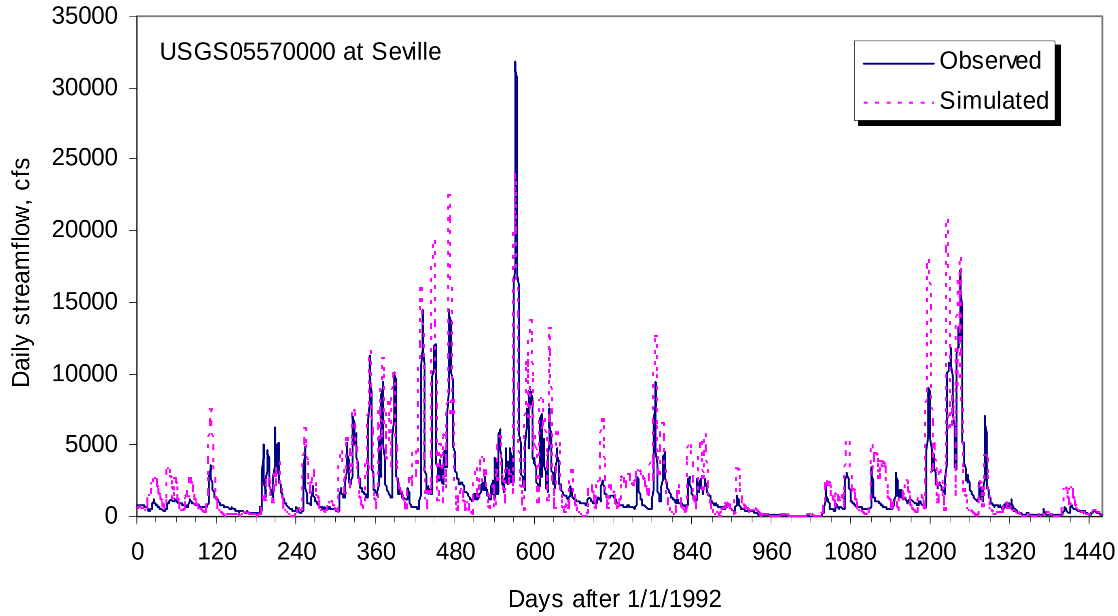


Figure 4-13. Comparison of observed and simulated streamflow simulation by the Spoon River watershed model developed using the calibrated parameters from the Court Creek watershed model

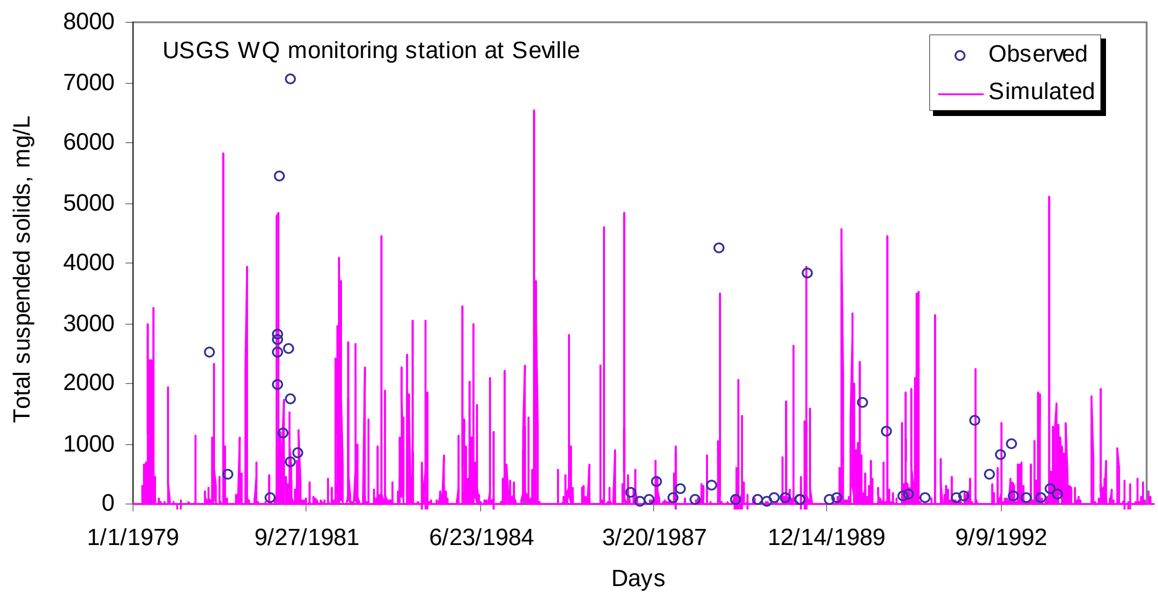


Figure 4-14. Preliminary results for suspended sediment concentration from the Spoon River watershed model developed using the calibrated parameters from the Court Creek watershed model

5. Analyses and Discussion

Sediment Loadings

Based on sediment records since 1980, the Illinois River on the average receives approximately 12 million tons of sediment annually from tributary streams (Demissie et al., 2004). About 55 percent of the sediment delivered to the river (6.7 million tons) is deposited in the river, backwater lakes, and side channels along the river. Most of this sediment is generated in the tributary watersheds to the Lower Illinois River, with the Spoon and LaMoine River watersheds as the highest per unit area generators of sediment among the major tributaries. The smaller tributaries draining directly to the river also contribute significant sediment. Controlling the erosion processes that are producing excessive sediment and reducing sediment delivery to the Illinois River will be a long-term effort, since sediment storage and mobilization along major rivers is a slow process. It will take some time to flush the sediment already in the system. In the initial phase of a restoration project, the major goal is to stabilize the system so that the erosion process is not accelerating and generating more sediment. The readjustment processes will take a number of years to reach a dynamic equilibrium condition where the natural processes of erosion and sedimentation are in balance. The long-term goal of the Illinois River restoration projects is to reach such a state where continued excessive sedimentation is eliminated.

To assess these processes, long-term monitoring is needed. The CREP program has been collecting sediment data at selected watersheds to supplement other monitoring programs. The data collection for the CREP program started in 1999 and has generated thirteen years of data. The annual sediment load data for each of the five CREP monitoring stations have been presented in chapter 2. Because of the short duration of data collection program, this data cannot yet be used to assess long-term trends. However, the short-term trends are shown in figure 5-1, where the sediment load per unit area was normalized by the runoff in inches to account for the variability of runoff from year to year. Even though the extreme wet year 2008 stands out as the year with the highest yield (for Panther and Cox Creeks), the general trend for the other stations is a gradual decrease or no trend. Again, these are short term trends and any major climatic or hydrologic variability in the coming year could change the trends, as illustrated with the influence of 2008 on Panther and Cox Creeks. As we continue the monitoring program, the trends will be more clear and reliable as the duration of the monitoring period increases.

The data were also compared with historical data collected by the USGS for small watersheds in the Illinois River basin as shown in figure 5-2. As shown in the figure, the CREP dataset is consistent with the older dataset and will be used to develop improved sediment delivery estimates for small watersheds in the Illinois River basin and improve our assessment and evaluation capability.

To assess long-term trends, data collected by the USGS and ISWS since 1980 were used to compute sediment delivery for the major tributaries to the Lower Illinois River. For the USGS data, sediment delivery from the three major tributary watersheds to the Lower Illinois River was computed for the downstream gaging stations near the outlet of the watersheds using the same methods developed by Demissie et al. (2004). The outflow of sediment from the Illinois River basin is measured at Valley City. The sediment loads and the corresponding water discharges for

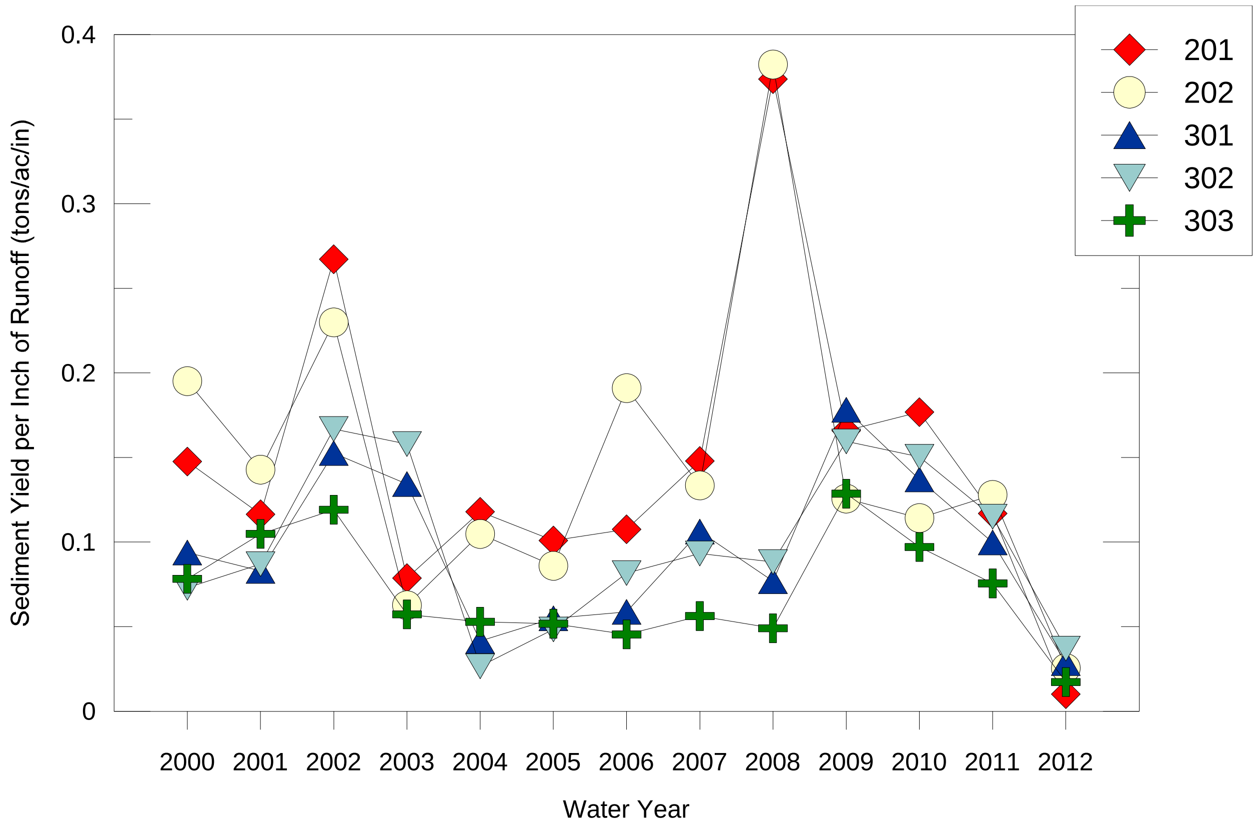


Figure 5-1. Variability of sediment yield per inch of runoff for CREP monitoring stations

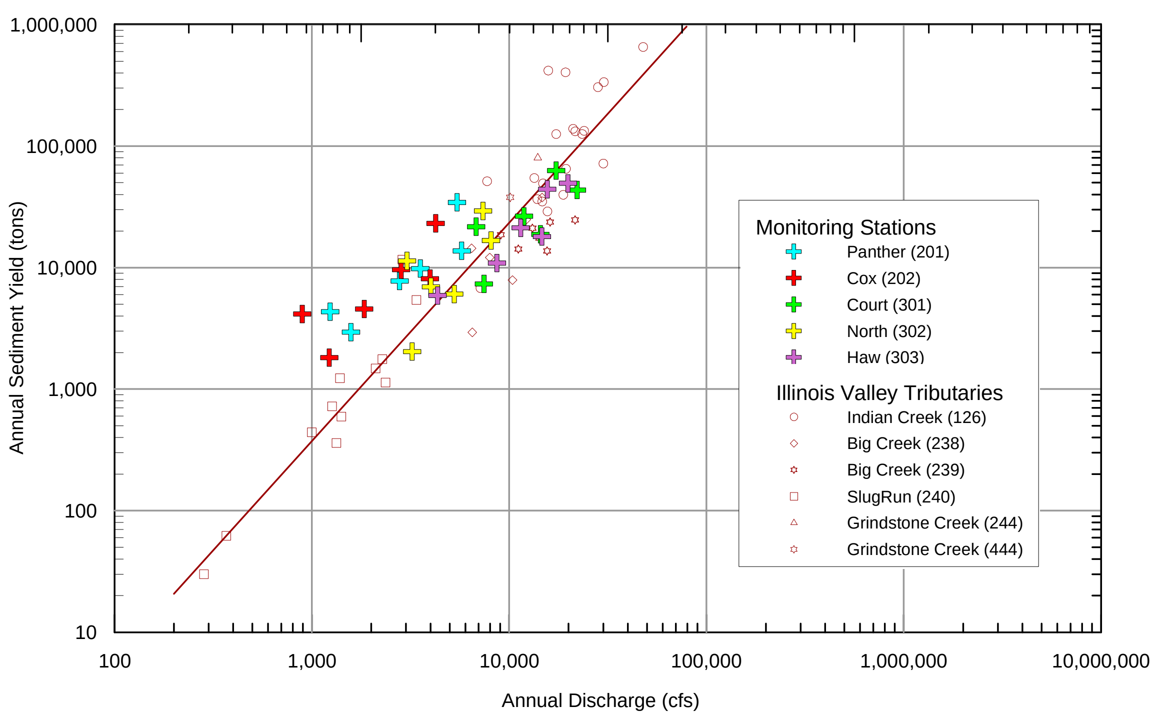


Figure 5-2. Comparison of sediment load from CREP monitoring stations with historical sediment data for small watersheds by the USGS

five-year increments since 1980 are shown in figure 5-3. The period 1991-1995 generally shows the highest sediment delivery to the Illinois River and the highest outflow from the Illinois River for the period under consideration, primarily because of the 1993 major floods. Since that period, sediment delivery from the tributaries and outflow from the Illinois River have generally been decreasing. If these trends continue into the future, there would be significant reduction in sediment delivery to the Illinois River.

Similar trends are also observed from the analyses of sediment data collected by the ISWS for the Benchmark Sediment Monitoring Program for Illinois Streams. The Benchmark Sediment Monitoring Program has been collecting weekly sediment data at selected monitoring stations throughout the state since 1980 (Allgire and Demissie, 1995). The data collected over that last 30 years have been processed and analyzed to observe trends in sediment concentrations and loads. Figures 5-4 to 5-6 show the trend in sediment load since 1980 for the Spoon River at Long Mills, LaMoine River at Ripley, and Sangamon River at Monticello, respectively. All three stations show a decreasing trend since 1980 even though the 2009 and 2010 annual loads are higher than the mean annual loads.

Nutrient Loadings

To assess long-term trends in nutrient loadings as conservation practices are implemented, the state has been collecting nutrient data at the five CREP monitoring stations where sediment data have been collected since 1999. Even though there are some low and high nutrient load years, the dataset is not long enough to assess long-term trends in nutrient loading. However, the short-term trends based on the data collected so far are shown in figures 5-7 and 5-8 for nitrate-N and total phosphorous yields per inch of runoff respectively. The nutrient yield values were divided by the inches of runoff to partly remove the effect of the variability of runoff from year to year. As shown in figure 5-7, the nitrate-N yields do not show any significant trend except for the jump in yield from 2000 to 2001 for stations 201 and 202 and a gradual decline since 2006 for all stations. Figure 5-8 shows no significant trend for total phosphorous over the whole monitoring period except for the jump in yield in 2000 and 2008 for stations 201 and 202 and a significant drop for all the stations in 2012 due to the drought.

Long-term data collected by the Illinois EPA as part of their Ambient Water Quality Monitoring Network can, however, provide a fair indication of the general long-term trend in nutrient delivery to the Illinois River. Figure 5-9 shows annual nitrate-N yields in tons per square mile from the three major tributaries of the Lower Illinois River (Spoon, Sangamon, and LaMoine Rivers). Nitrate-N represents about 70 percent of the total nitrogen load in most of Illinois' agricultural watershed, and thus is a good surrogate for total nitrogen load. As can be seen in the figure, the nitrate yields can range from almost zero during a drought year like 1989 to a high of about 11 tons per square mile during a major wet period like the 1993 flood year. Therefore, climatic factors do play a major role in nutrient transport and delivery. The most important observation that can be made for the figure is the slow decreasing trend of nitrate-N yield from the major tributary watersheds. Even though it is very difficult to measure how much impact the CREP program might have had, it is obvious that conservation practices in these watersheds, where most of the CREP lands are located, are making a difference in nitrogen delivery to the Illinois River.

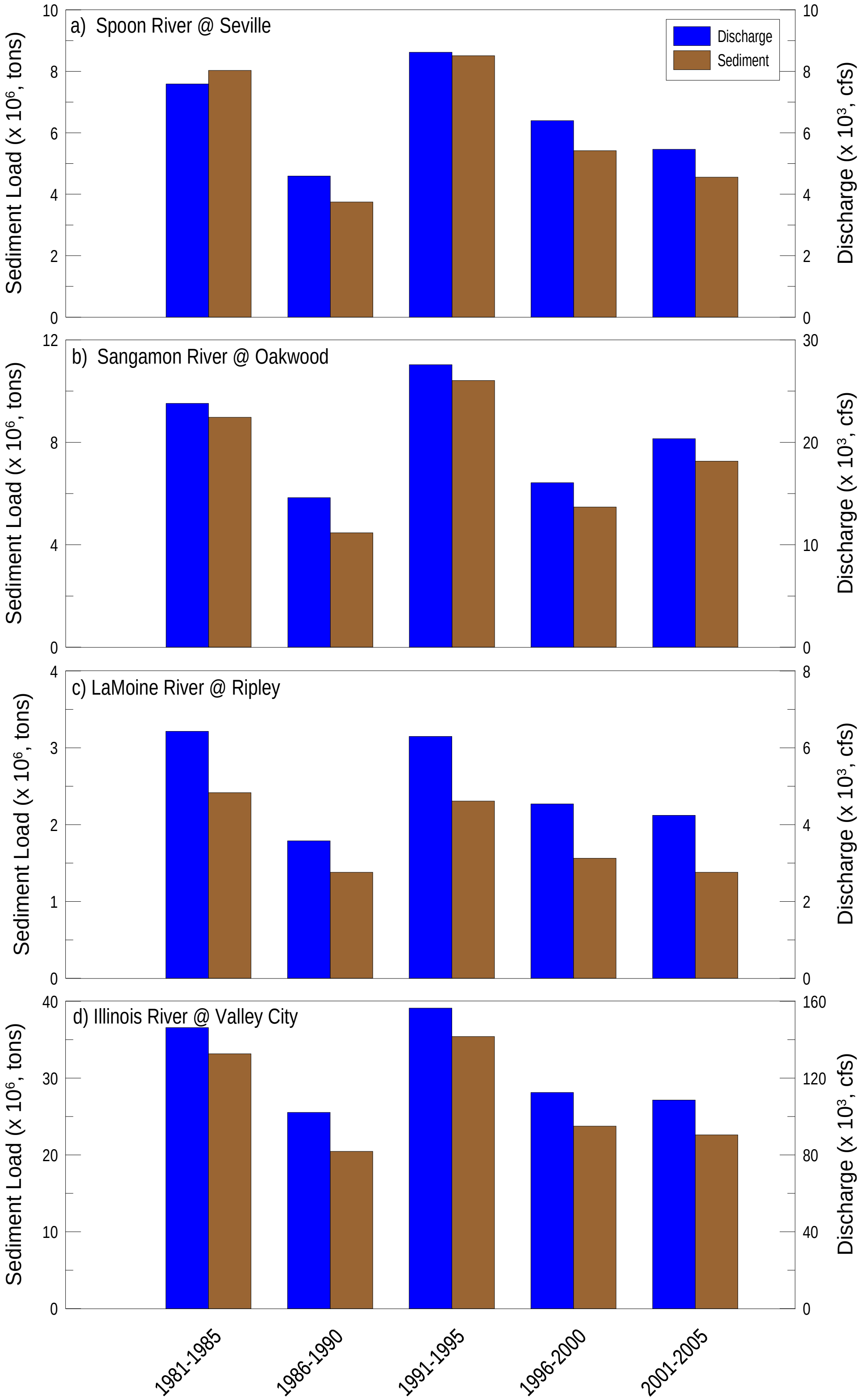


Figure 5-3. Sediment delivery from the three major tributary watersheds to the Illinois River and sediment outflow from the Illinois River at Valley City

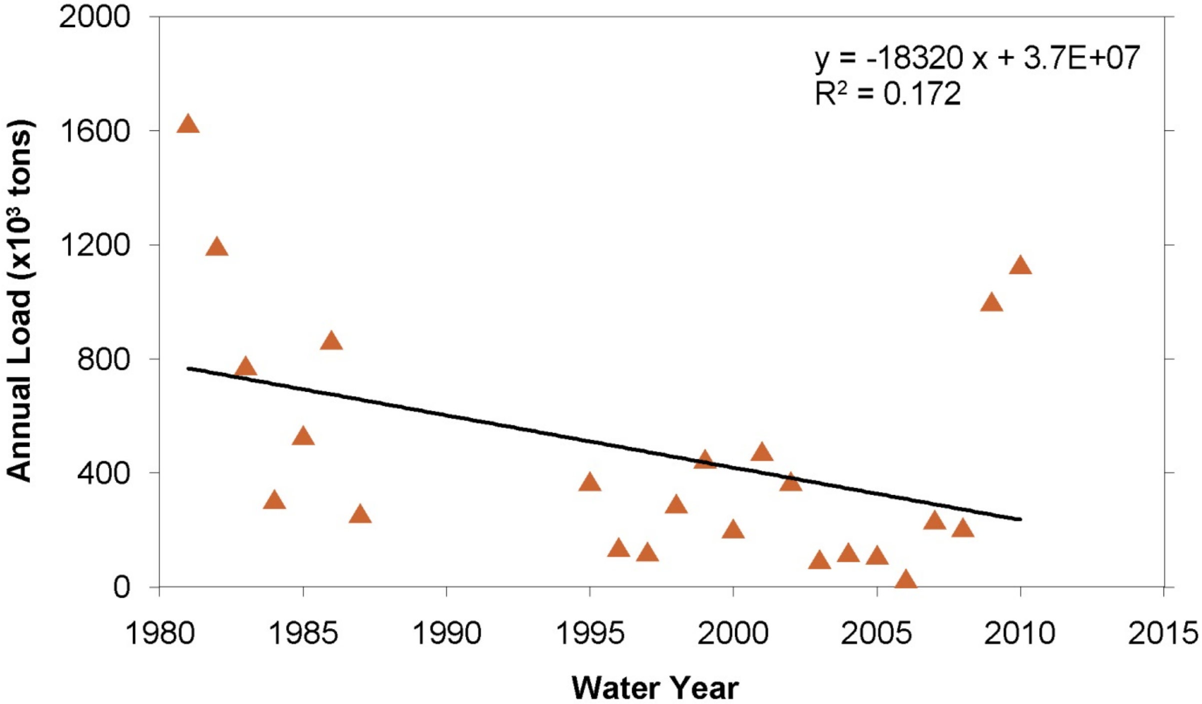


Figure 5-4. Trends in sediment load at Spoon River at London Mills (after Crowder et al., 2008)

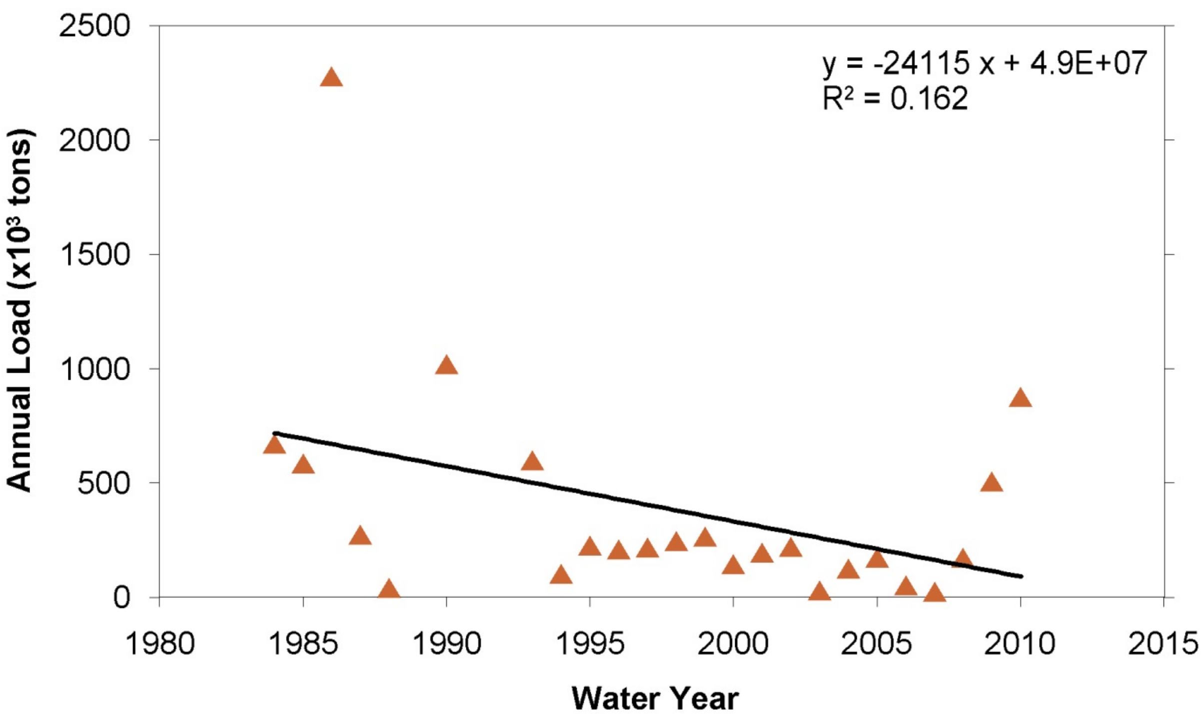


Figure 5-5. Trends in sediment load at LaMoine River at Ripley, IL (after Crowder et al., 2008)

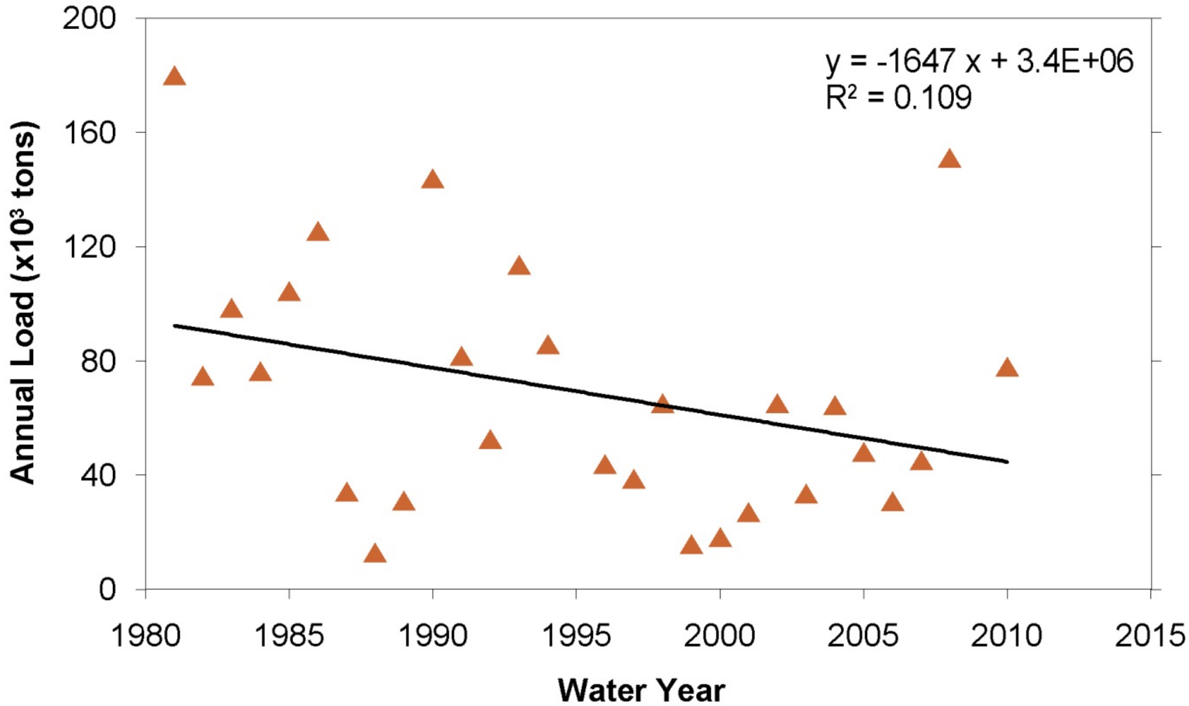


Figure 5-6. Trends in sediment load at Sangamon River at Monticello, IL (after Crowder et al., 2008)

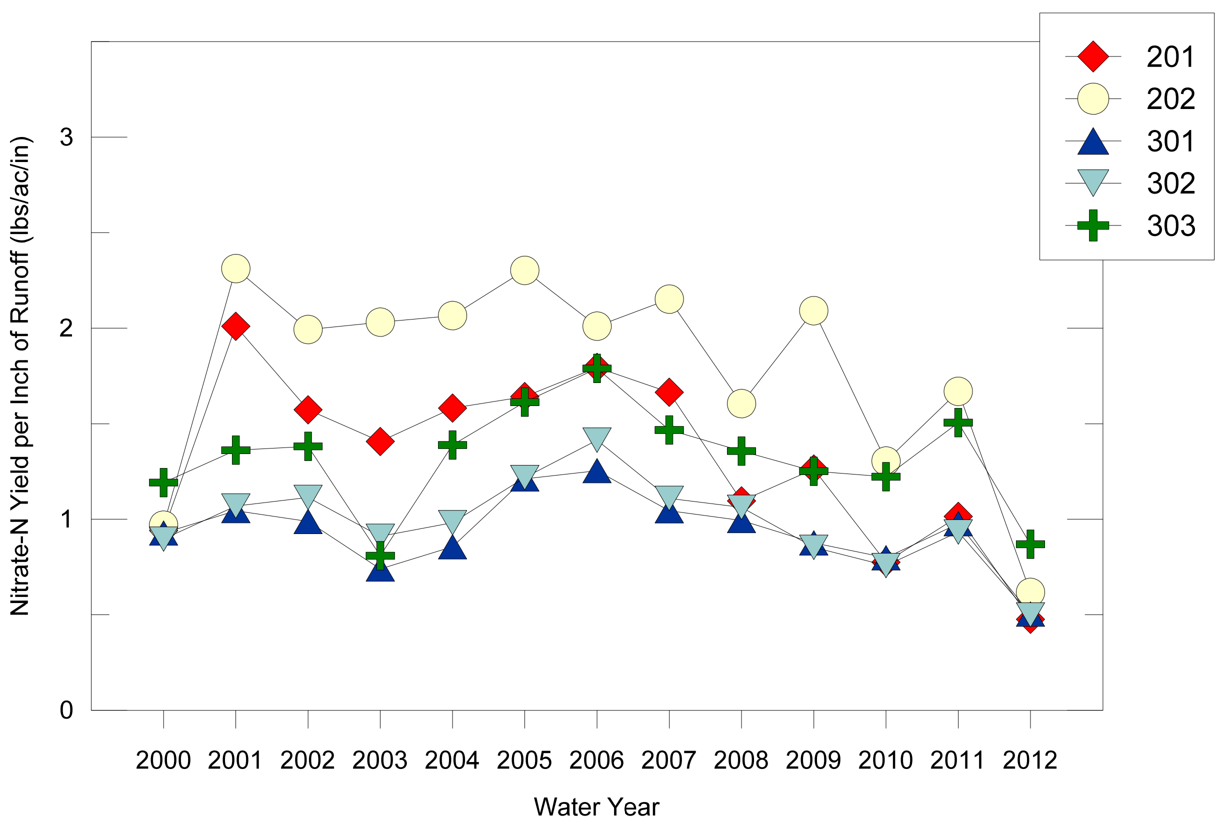


Figure 5-7. Variability of nitrate-N yield per inch of runoff for CREP monitoring stations

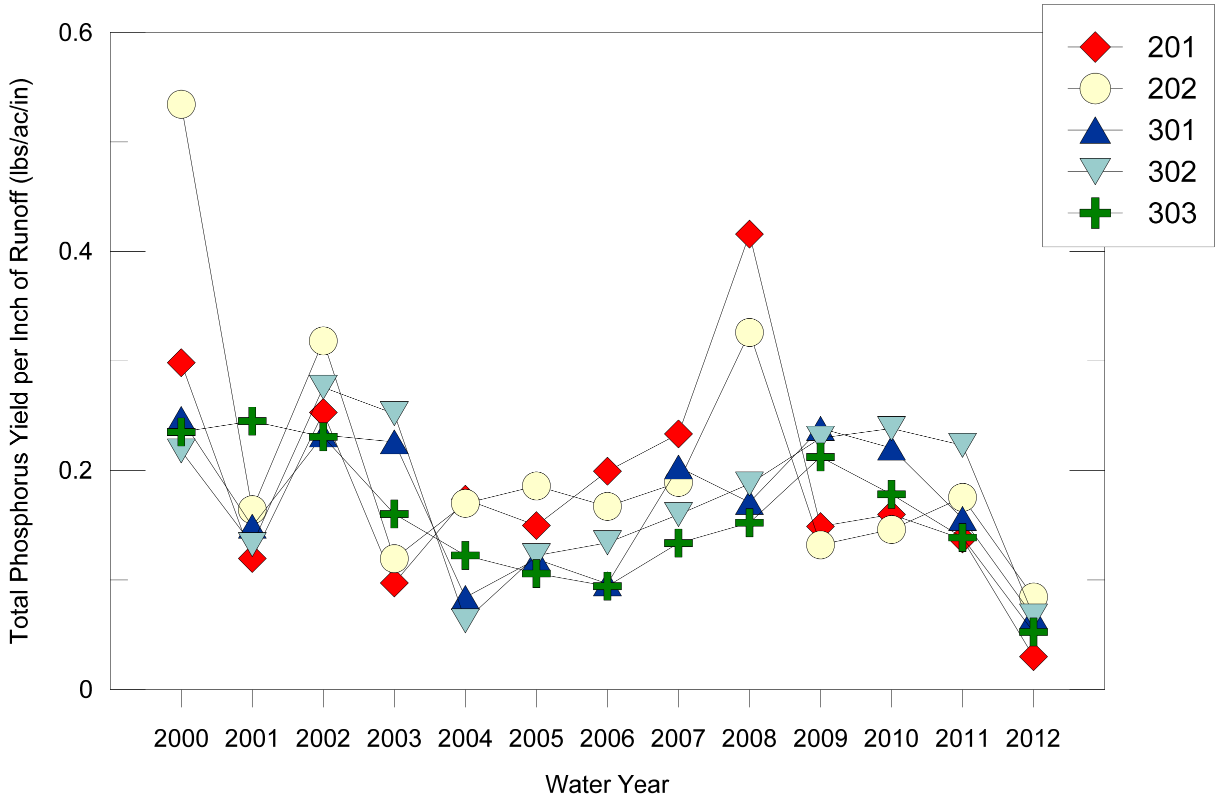


Figure 5-8. Variability of total phosphorous yield per inch of runoff for CREP monitoring stations

Figure 5-10 shows the total phosphorous yield from the same three tributary watersheds discussed in the previous figure. Annual phosphorous delivery ranges from a low of almost zero during the drought year 1989 to a high of almost one ton per square mile for the extreme wet year of 1993. The data also show how dependant phosphorous delivery is on climatic variability. Similar to the trends to the nitrate delivery, there is a slow but gradual decreasing trend in phosphorous yield from the Spoon and LaMoine Rivers, while there is a gradual increase from the Sangamon River.

The trends in nutrient loads from the major tributaries are reflected in nutrients transported by the Illinois River. Analyses of the data from the two downstream monitoring stations, Havana and Valley City, are shown in figure 5-11 for nitrate-N and total phosphorous, respectively. In general, the trend is a gradual decrease to no increase. These observations are extremely important as to nutrient delivery from Illinois streams to the Mississippi River and eventually to the Gulf of Mexico. Illinois had been identified as one of the major sources of nutrients to the Gulf of Mexico, and the fact that nutrient delivery from Illinois has not increased and is gradually decreasing is good news not only to Illinois but to the Gulf of Mexico, too.

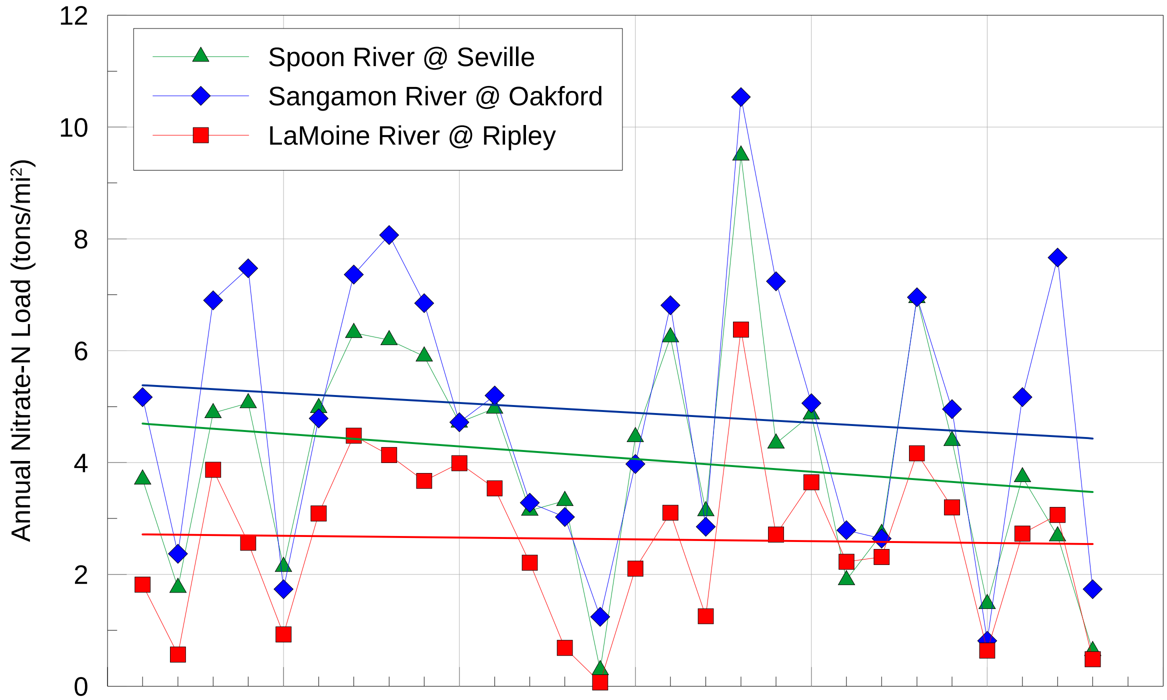


Figure 5-9. Annual nitrate-N loads for the three major tributary watersheds to the Lower Illinois River

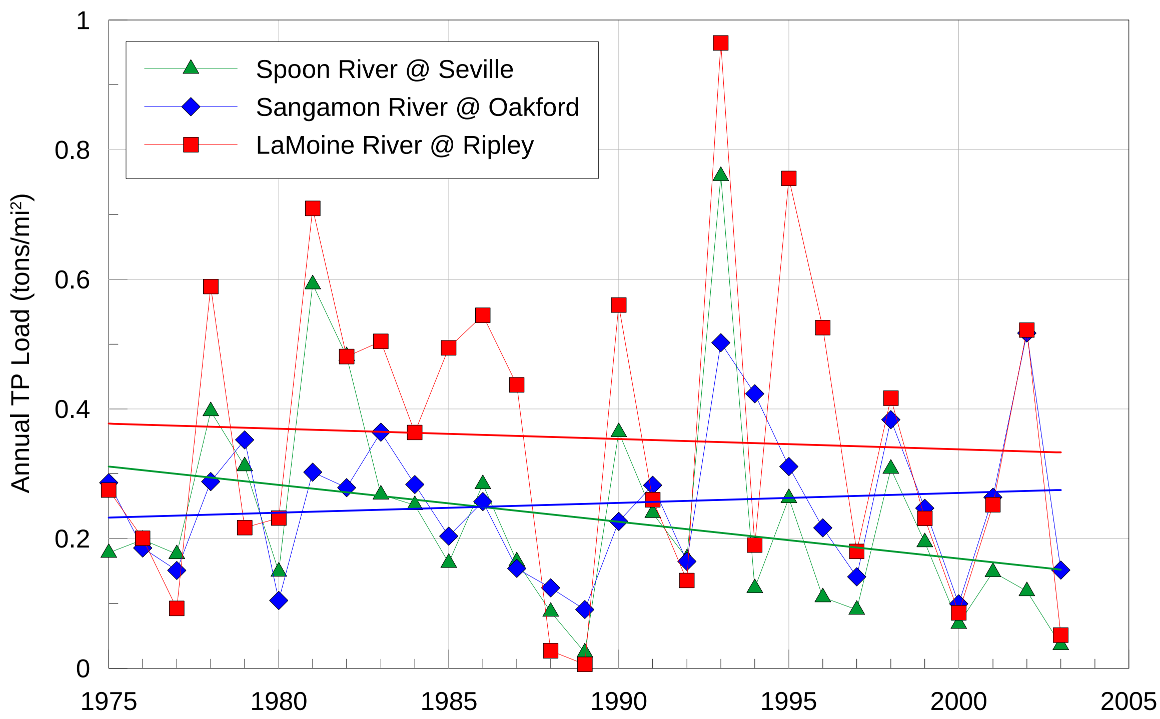


Figure 5-10. Annual total phosphorous loads for the three major tributary watersheds to the Lower Illinois River

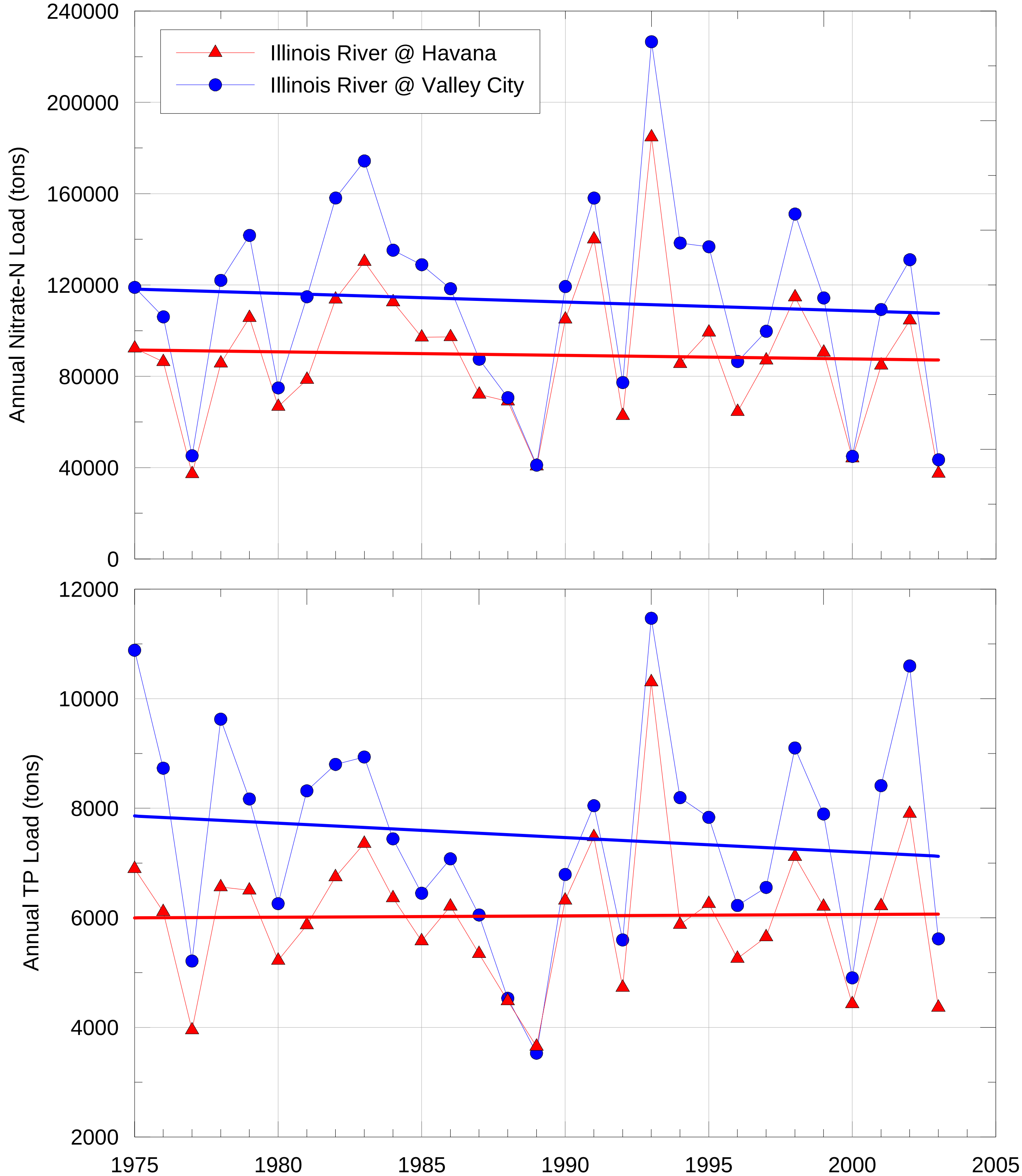


Figure 5-11. Nitrate-N and total phosphorous loads along the Lower Illinois River

6. Summary and Conclusions

As outlined in the Illinois River Basin Restoration Plan, the alternative of no-action in the Illinois River watershed will result in increased sediment delivery to the Illinois River and habitats and ecosystem would continue to degrade. However, recent data indicate that both sediment and nutrient delivery to the Illinois River have either stabilized or decreased as a result of implementation of conservation practices in the watershed. With the knowledge that reduction in sediment delivery from large watersheds takes time to move through the system, the indication of stabilized sediment delivery shows progress is being made in restoring the Illinois River watershed. If the present trends continue for the next 10 to 15 years, sediment and nutrient delivery to the Illinois River will be significantly reduced, and lead to improved ecosystem in the river and tributary watersheds in the long-term.

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