Illinois

Conservation
Reserve
Enhancement
Program

2008 Annual Report

A Partnership Between
The USDA
And
The State of Illinois

December 2008

Illinois Conservation Reserve Enhancement Program
(CREP)
Reporting Period: October 1, 2007 through September 30, 2008

The Illinois Conservation Reserve Enhancement Program (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.

Since the beginning, the program has been extremely well received by the landowners in the targeted area. The MOA was re-authorized by all the parties on December 18, 2002 increasing the eligible acreage for enrollment to 232,000 acres.

CREP is being implemented through a federal-state-local partnership in the eligible area. The Agencies that are implementing the program are USDA - Farm Service Agency (FSA), USDA - Natural Resource Conservation Service (NRCS), the Illinois Department of Agriculture (IDOA), the Illinois Environmental Protection Agency (IEPA), the Illinois Department of Natural Resources (IDNR), and the County Soil and Water Conservation Districts (SWCDs) along with the Association of Illinois Soil and Water Conservation Districts (AISWCD) in the eligible area. Other agencies and organizations provide guidance and assistance for the program through the CREP Advisory committee, which is a subcommittee of the State Technical Committee.

ENROLLMENT SUMMARY:

For the reporting period of October 1, 2007 through September 30, 2008, the Federal CREP Program enrolled 124 new contracts. Total Federal enrollment figures from the inception of the program May 1, 1998 through September 30, 2008 are as follows:

Number of contracts	-	6,607
Average acres/contract	-	19
Total acres contracted	-	126,951.4
Average rental rate/acre	-	$161.00

Total State enrollments for the same period are as follows:

Number of Contracts	-	1377
Average acres/contract	-	59.55
Total acres enrolled	-	81,995.36
Average cost/acre	-	$703.41

TECHNICAL ASSISTANCE AND PROGRAM STAFF:

Technical assistance in this program is made up of three types:

1. Assistance to the landowners during the enrollment process in determining eligibility, options, and selecting approved practices;
2. Assistance to landowners in implementing the approved CREP practice once the property is enrolled in the program; and
3. Assistance to the SWCD and landowners in the state requirements for execution of the state easement documents.

The Farm Service Agency, Natural Resource Conservation Service, Department of Natural Resources, and the County Soil and Water Conservation Districts provide primary technical assistance.

NON-FEDERAL CREP PROGRAM EXPENDITURES:

For this reporting period, the State obligated $5,260,420.39 for CREP expenditures, State cost-share expenses, monitoring costs, SWCD administrative fees and other associated enrollment and easement costs. In addition, the IDNR has provided another $305,673.20 from its operational dollars to provide for CREP Administrative Expenses, bringing the total State dollars directly expended for CREP enrollments to $5,566,093.59.

State CREP Expenses
October 1, 2007 through September 30, 2008

State Bonus Payment for State Option	$3,712,228.68
State Cost-Share Payments	$ 319,316.29
Soil and Water Conservation District (SWCD) Administrative Fees	$ 445,850.99
DNR Administrative Expenses - Contract and Data Management, Technical Assistance, Reports, Training	$ 305,673.20
Add. Admin. Fees – Legal, Survey, filing costs	$ 493,308.81
Monitoring	$ 228,715.62
TOTAL	**$ 5,566,093.59**

The Memorandum of Agreement (MOA) for the Illinois CREP, as amended on December 18, 2002, details the formula to determine the overall costs of the program and to determine if the State has fulfilled its obligation to provide 20% of the total program costs. A summary of these enrollments follows: The total federal annual rent payment for the 124 CREP contracts (935.3 acres) is $341,156. The total annual incentive payment is $85,300. The total federal annual rent plus incentive and maintenance over the life of the 15-year contracts is $5,287,348. The estimated total federal cost-share is $207,387.

To determine the overall costs of CREP, the following costs are to be used: the total land retirement costs, which will include the CRP payments made by the Commodity Credit Corporation 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 will be annual payments, an 8 percent per annum discount rate (per the MOA) is normally used to compare the CRP Payments with the State Bonus payment.

Annual CRP Payments
Discounted at 8% for 15 Years

Payment Year	Annual Payment	Payment Year	Annual Payment
Year 1	$341,156	Year 9	$175,088
Year 2	$313,864	Year 10	$161,081
Year 3	$288,754	Year 11	$148,194
Year 4	$265,654	Year 12	$136,339
Year 5	$244,402	Year 13	$125,432
Year 6	$224,850	Year 14	$115,397
Year 7	$206,862	Year 15	$106,165
Year 8	$190,313	TOTAL 15 Years	$3,043,551

Total Federal and State Expenditures
October 1, 2007 through September 30, 2008

CRP Payments (Before Discount)	$ 5,287,348	CRP Payment (Discounted 8%)	$ 3,043,551
Federal Cost-Share	$ 207,387	Federal Cost-Share	$ 207,387
State Payments for CREP Enrollments	$ 4,361,428.77	State Payments for CREP Enrollments	$ 4,361,428.77

Total Program Costs	$ 9,856,163.77	Total Program Costs	$ 7,612,366.77

The total Federal and State cost of CREP from October 1, 2007 through September 30, 2008 was $ 9,856,163.77. The State's share of costs for the reporting period was $4,361,428.77. Using the 8% per annum discount rate per the MOA, the Federal costs to be used for comparison to the state expenditures is $ 3,043,551.

Per the December 18, 2002 Agreement, the State must contribute 20% from the Program inception in May 1998. Total Program discounted costs for this period are $254,980,159. The State contributed $57,676,040, or 23% of the total program costs after using the discount rate. The State has met the requirement for incurring 20% of the total Program costs.

PROGRAM ACTIVITIES AND ACCOMPLISHMENTS

Since the beginning of the CREP program on May 1, 1998 through the end of the current reporting period (September 30, 2008), CREP has restored and/or protected 126,951.4 acres of land either in existing native vegetation or in a previous CRP sign-up (See Map 1).

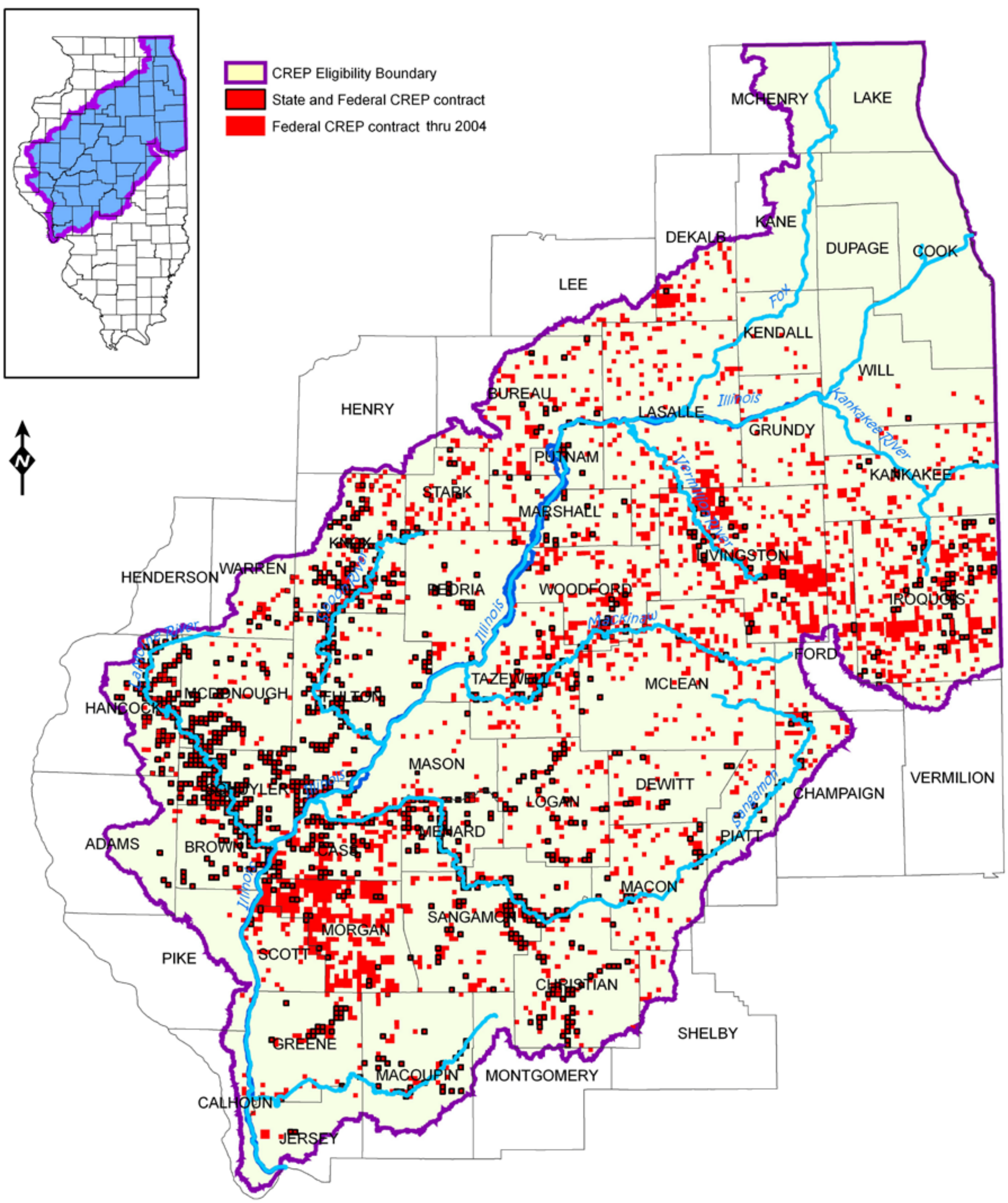
Of the 48,790.39 Federal acres enrolled in the State option, 7.65% selected the 15-year extension, 5.26% selected the 35-year extension, and 87.09% selected the permanent easement option. In Illinois, 39% of the 126,951.4 acres enrolling in the Federal CREP Program also enrolled in the State enhanced option.

The CREP program is restoring and protecting large stretches of floodplain corridors both on the main stem of the Illinois River and along the major tributaries. It is helping landowners, who have only been able to produce crops in the area once or twice in the last decade, to retire these lands from agricultural production.

Additionally, CREP activities are directly contributing to, or complimenting, the objectives of the Illinois Fish and Wildlife Action Plan and the Landowners Incentive Program of the U.S. Fish and Wildlife Agency. The ability of CREP to achieve or contribute to other program objectives make it an attractive program for continuation.

MAP 1

Location of Approved Illinois CREP Contracts from the USDA and State of Illinois All Years as of 10/2008



OTHER PROGRAMS AND PARTNERSHIPS

There are other state, federal and organizational programs that are contributing to the accomplishment of the goals of the Illinois CREP. The following highlights a few of the programs that contributed to achieving the goals the State has set for the Illinois River Basin. Any state or non-federal dollars that have been expended in these programs have not been included in the previous section that describe and list the direct state expenditures for CREP match.

STATE SUPPORTING AGENCIES

CREP AND PARTNERS FOR CONSERVATION (FORMERLY C2000): ANOTHER GREAT PARTNERSHIP

Conservation 2000 (C2000) was renamed Partners for Conservation and extended until 2021. This multi-ageny, mult-million dollar comprehensive program is 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 1996, the C2000 Program has awarded more than $14,755,000 million in C2000 grants to Ecosystem Partnerships in the Illinois River watershed basin for projects providing a variety of conservation practices. Another $14,727.000 has been leveraged as match for these projects for a total of nearly $30 million for 442 projects. Accomplishments from these projects include: 14,522 acres of habitat restoration, 160,302 feet of stream bank restoration, 1,426 sites have been or are being monitored, and more than 636,000 people have been educated on watershed protection and restoration.

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. During FY 07 and FY08, the Partners for Conservation Program, administered by IDOA, has allocated $3.2 million dollars to the 46 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. Although not all of the FY08 results are available, 521 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 more than $1 million dollars. These projects are responsible for bringing soil loss to tolerable levels on hundreds of acres of land. This translates into over 30,585 fewer tons of soil loss each year, or the equivalent of more than 1,500 semi truckloads of soil saved.

In FY 08, the Department of Agriculture provided $4.3 million to 54 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 employees’ 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 FY 07 and FY 08, 24 individual streambank stabilization projects totaling $169,933 were constructed in 15 counties within the Illinois River Watershed. In all, over 2 miles of streambank have been stabilized to protect adjacent water bodies during the past 2 fiscal years.

Another environmentally oriented Partners for Conservation Program administered by the Department of Agriculture is the Sustainable Agriculture Grant Program. Grants are made available to individuals, organizations and universities for conducting research, demonstration, or education programs or projects related to profitable and environmentally safe agriculture. In FY 07, $229,587 in funds was awarded to 15 grant recipients with programs or projects in the Illinois River Watershed in such areas as local food systems, cover crops, alternative crops, grassland management, composting, sustainable beef production and organic production.

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 also approximately 250 Intensive Basin Survey Sites in the Illinois River watershed. These sites are monitored "intensively" once every five years. The monitoring includes water chemistry, macroinvertebrates, 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, programs such as CREP.

As reported by the Illinois EPA in their 2008 Integrated Report, of the *stream miles assessed* in the Illinois River Basin for Aquatic Life Use Support attainment, 64.6% were reported as “Good,” 30.4% as “Fair,” and 5.0% as “Poor.” This compares to statewide figures of 61.1% “Good,” 34.8% “Fair,” and 4.1% “Poor.” Regarding *lake acres assessed*, 71.6% were reported as “Good” and 28.4% as “Fair” (no acres reported as “Poor”). This compares to statewide figures of 69.4% “Good” and 30.6% “Fair” (no acres reported as “Poor”).

In 2006, Illinois EPA continued to participate on the State CREP Advisory Committee and continued to provide financial assistance to local soil and water conservation district staff, so that they could assist landowners enroll in CREP. To date, more than $1,204 million of 319 grant funds have been put towards implementation of the CREP program.

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 River watershed. Some of those Illinois EPA programs include:

Section 319: Since 1990, the IEPA has implemented 237 Clean Water Act Section 319 projects within the Illinois River Watershed. 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 $48 million with another $42 million of local and state funds for total project costs over $90 million towards these projects to help improve the health of the Illinois River, its tributaries and ultimately the Mississippi River and Gulf of Mexico. Hundreds of conservation practices have been installed in the Illinois River watershed 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 reduction decreases of: 1,232,708 lbs of nitrogen, 1,502,494 pounds of phosphorus, and 79,079 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.

Pilot Construction Site Erosion Control Program: Illinois EPA has continued a program subcontracting with several soil and water conservation districts, the majority of them in the Illinois River Basin. Those partners include the DeWitt, Macon, McHenry and Winnebago County Soil and Water Conservation District Offices. 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.

Other Illinois EPA programs that complement CREP include:

Total Maximum Daily Load (TMDL): USEPA has approved 280 completed TMDL evaluations and Illinois EPA is currently developing another 220 TMDLs. 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.

Conservation 2000: A total of 35 lake monitoring (study) or protection/restoration projects have been conducted in the Illinois River Basin via the Illinois EPA's Illinois Clean Lakes Program and Priority Lake and Watershed Implementation Program. Over $7.4 million of local and state funds have been allocated for these efforts.

In conclusion, the Illinois River is a valuable resource that we are working hard to protect and restore. Illinois EPA will continue long-term monitoring of the river and its watershed 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 have made.

FEDERAL PARTNERS

NRCS CONTRIBUTIONS TO ILLINOIS RIVER WATERSHED

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 $400 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. A particular success includes Illinois NRCS' largest WRP easement, the Emiquon wetland, a 6,400 acre area located in Fulton County. The property, owned by The Nature Conservancy, will ultimately become a naturalized haven and habitat for wetland flora and fauna and enjoyed by nature and naturalists for years to come. The environmental benefits this large wetland area will offer the watershed and the state—improvements in wetland habitats, species biodiversity, water quality, and erosion reduction—will be significant.

For more information on NRCS conservation programs, please visit www.nrcs.usda.gov.

US FISH AND WILDLIFE SERVICE/PARTNERS

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 Illinois River CREP has provided opportunities on a landscape scale for restoration, enhancement, and preservation of natural habitats on private land. The net benefit of the Illinois CREP is the significant benefit for Federal Trust Resources produced by the large scale restoration and preservation of floodplain and riparian habitat in the Illinois River Watershed. The Federal Trust Resources benefited include migratory waterfowl, shorebirds and neotropical migrants that use wetland and forested floodplain habitats to feed and rest as well as the species that nest and raise their young in the restored habitats. 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 the Illinois River 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 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 River Watershed, 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.

NON-GOVERNMENTAL PARTICIPANTS

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, helps with administration of the CREP program, by providing funding to SWCDs through a 319 grant. The grant is given to certain SWCDs who express the need of additional support in their District office to complete CREP related duties. Currently there are 7 CREP Assistants in 14 Soil and water conservation districts enrolled in the CREP Assistant Funding program.
The AISWCD serves on the CREP Advisory Committee.

ILLINOIS FARM BUREAU

Illinois Farm Bureau (IFB) continues to publicize and promote the Conservation Reserve Enhancement Program (CREP). In 2008, articles in FarmWeek provided information about aspects of the program. IFB also used our 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 our county Farm Bureau mail system. An Illinois Farm Bureau statewide workshop in 2008 on voluntary programs for farmers included information about CREP and other conservation programs through various agencies.
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.

SUCCESS STORY

Lounsberry Seep/Wetland Project
Lloyd Lounsberry, owner of the Hill Prairie Winery in northern Menard County near the town of Oakford, Illinois, is also the owner and manager of many other properties in Menard County where he has been an active steward of the land. In December 2000, Lloyd enrolled part of his property into the Conservation Reserve Enhancement Program (CREP), by signing a 15-year Federal contract; and in September 2003, he signed the same property plus additional non-cropped acres, into a permanent State conservation easement. One of his main objectives in enrolling this property was to create a water element to support wildlife on his land. This

particular piece of property is unique with its hillside spring that runs year round. With many different biologists working together, a wetland restoration project was designed and accepted into the Natural Resources Conservation Service's Wildlife Habitat Incentive Program (WHIP) due to its direct benefit to the Illinois State Threatened, Illinois Chorus Frog (*Pseudacris streckeri*) and the Illinois State Threatened, Regal Fritillary Butterfly (*Speyeria idalia*). Since the project was planned on property enrolled as additional acres in the permanent State conservation easement, CREP Enhancement Funds are being utilized to provide the match necessary to complete the project.

The project site started as a hillside seep with continual water flow, covered by many successional trees, including large honey locust and Osage orange with an understory of Multiflora rose and bush honeysuckle. In implementing the project, all trees were cleared, except for the hardwoods, in order to create a small berm and shallow water area. By creating the wetland, this site will have areas of saturated soil to a maximum depth of four feet of water. This project is expected to benefit the Illinois Chorus Frog, which has been documented a ¼ mile to the west of the project in a farmed wetland.

The land above the seep will be restored to sand prairie, with violet species, to benefit the Regal Fritillary Butterfly. These butterflies host on any violet species as a caterpillar and need many nectar sources as adults, especially during the two-month period during which the female lives before laying her eggs. For the past five years, the Illinois Department of Natural Resources (IDNR) has been monitoring a population of Regal Fritillary Butterflies a half mile to the south of this location.

Construction for the wetland began during the last week of November 2008. To date, the area has been cleared and the wetland basin and berm have been created. In the spring of 2009, the sand prairie, including short grass sand prairie seeds with violet species, will be planted. A diversity of wetland plants will also be seeded around the basin. Vegetation and hydrological monitoring will be conducted, as well as, monitoring for the Illinois Chorus Frog and Regal Fritillary Butterfly.


Pre-restoration pictures of where the wetland was constructed, September 2008.


2008 CREP Habitat Monitoring Initiative

When we think about the 80,000 acres that are enrolled in long-term Conservation Reserve Enhancement Program (CREP) easements on the State side, the importance of a monitoring program is obvious. Not only is it important to monitor these easements for compliance which is already being done, but it is also important to take a look at the restoration projects to see if they are accomplishing their intended goals. It is important to assess the habitat we are protecting, to observe the species, to find out whether the water quality is improving, to collect data and then analyze it so we can understand what is happening. All of this is part of a biological monitoring program.

A monitoring program for determining success of restoration efforts is a suggested component of government programs (Mulvaney et al. 2006). Monitoring provides an evaluation process in which we can learn from our successes or correct our failures, making a monitoring program an essential component of restoration (Gayaldo 2005). Although many scholars and practitioners (e.g. Tarzwell 1934, Reeves and Roelefs 1982, Reeves et al. 1991a. cited in Roni 2005; Morrison 2002; Herrick et al. 2006) suggest monitoring is an essential component of restoration, monitoring is not a major component of current restoration projects. Monitoring is often not conducted due to limitations such as: time constraints, limited resources, and limited funding (Roni 2005; Bash and Ryan 2002). When monitoring is conducted, it is not adequately funded, designed, implemented, or reported (Roni 2005). These constraints are compounded when attempting to monitor an ecosystem restoration project, due to the dynamics of the system. For example, an instream restoration project is directly affected by what is going on upstream thus it is very difficult to draw conclusions based upon the restoration effort alone.

Despite the limitations, restoration monitoring techniques have been developed and in some cases implemented. There are different types of restoration monitoring which include: baseline, status, trend, implementation, effectiveness, and validation monitoring (MacDonald et al. 1991 cited in Roni 2005). According to Roni (2005 p. 7), "each type of monitoring is useful for answering different questions, and some combination of these are needed to fully evaluate restoration activities." Ideally, all the relative monitoring evaluations should be incorporated into a well-designed monitoring program to indicate whether restoration measures were designed and implemented properly, whether the restoration met objectives, and to provide new insights into ecosystem processes (Kershner 1997 cited in Roni 2005).

The Illinois Department of Natural Resources (IDNR) is currently involved in thousands of CREP restoration/management projects. However, no formal monitoring program is in place for monitoring the restored habitat. Thus, research is being conducted to develop and implement a CREP restoration project monitoring program. A recently implemented CREP restoration project has been utilized as a case study for: 1) selection of goals and objectives, 2) selection of hypotheses, 3) selection of performance criteria, 4) selection of a monitoring framework, 5) selection of ecological attributes to monitor, 6) implementation of Before/After sampling methods, 7) data collection and management decisions, 8) adaptive management decisions, 9) collaboration with restoration partners and practitioners, and 10) government accountability. The final design of the monitoring program was implemented at the case study site. Ultimately, the CREP staff will be able to adapt and implement the monitoring program designed in this research to all of their restoration/management projects and track the overall success of the projects.

The CREP habitat monitoring program will be used to assess the success or need for corrective action of restoration/management projects. One of the monitoring techniques utilized will be to

conduct site visits and take pictures annually to document the vegetation and condition of the project area pre-and post-project implementation (see Figs 1-2). Invasive species can be identified, as well as, documenting the return of desirable species. Other quantifiable results will be collected by conducting biological surveys such as fish, mussel, and vegetation surveys, when appropriate resources are available (see Figs 3 – 5).

A big part of this monitoring program will be the partnerships. Research is being conducted on how other state CREP programs conduct monitoring. In order to avoid "reinventing the wheel" it is necessary to find out what other states are doing or what other states would like to see done as a monitoring effort for CREP restoration projects. Also being researched is how to include various agencies, organizations, programs, and inventories into the monitoring program such as: the United States Department of Agriculture's Conservation Effects Assessment Project (CEAP), Illinois Environmental Protection Agency's Illinois Ambient Water Quality Monitoring Program, Illinois Natural History Survey's (INHS) Critical Trends Assessment Program (CTAP), and the H. John Heinz III Center for Science Economics and the Environment. For example, CREP and CTAP staff are working together on a study that compares CTAP sites and CREP sites (9 CTAP sites are within CREP sites and 103 sites are within 1 km of a CTAP site). CTAP sites are randomly selected sites which include private and public sites. CTAP staff conducts bird, aquatic and terrestrial insect, and herbaceous and woody vegetation studies. They compare their data to baseline/reference sites. They then use the data to help direct conservation initiatives, for example, they help make decisions on what type of habitat to restore. When comparing CREP sites with CTAP sites, for example, and CTAP staff find that CREP sites are not functioning as well, CREP staff can research the causes and determine how to manage the area for better biological and ecological performance.

Other than collaborating with a variety of organizations, going on site visits, and conducting biological surveys, additional tasks that are being worked on include: designing an excel spreadsheet that can be used to track CREP restoration projects and the monitoring efforts/funding; researching indicators that identify a particular habitat is not functioning properly; and researching performance criteria to be used as a template for monitoring various habitat types. As an end result the IDNR CREP staff will be provided with a monitoring protocol that can be adapted to all their restoration projects. The CREP staff will also be supplied with recommendations of what habitat/biological monitoring information could be included on an inspection report, as well as a reference sheet for landowners which includes: who to contact for management questions with indicators that illustrate a particular habitat is not functioning properly and management action needs to take place.

Figure 1. Pre restoration site visit

Figure 2. Post restoration site visit

Figure 3. Fish Survey conducted by IDNR Streams Biologists

Figure 4. Mussel Survey conducted by IDNR Staff

Figure 5. Vegetation Survey conducted by INHS Staff (http://www.inhs.uiuc.edu/inhsreports/fall-2000/ctaps.html)

The bare minimum actions that need to take place for a biological monitoring program include: conducting site visits and taking pictures annually to document the vegetation and progress of the restoration project towards pre-established goals and objectives. Aerial photography could also be used to track changes in habitat over time (decades). Invasive species should be identified, as well as, documenting the return of desirable species. All of these observations and information pertaining to the restoration project implementation and monitoring needs to be entered and stored into a database. The results should be analyzed and put into a report, which should be made available to the public. Ultimately, the results can be defended in a number of ways, and therefore, in order to be truly accountable, the CREP program needs to learn from the results and make their best efforts to improve the system they are trying to restore.

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RECOMMENDATIONS AND FUTURE PLANS OF THE CREP ADVISORY COMMITTEE

Setbacks from past reductions in CREP appropriations have had a significant impact on not only enrollment, but the loss of momentum that had been achieved with the State's successful achievement of the USDA approved acreage of 232,000 acres.

CONTINUED STRATEGIES ON PROGRAM IMPLEMENTATION

1. Maintain long-term staffing and monitoring strategies to assure adequate staff and support for the proper administration of the program and to maintain the habitat values created by the Program

2. Continue training and workshops, for all field staff and SWCD's as a means of maintaining and updating the training manual for field use.

3. Continue to expand SWCD staff to assist in the administration of the CREP program at the County level. Efforts to work with IEPA and other Partners will continue to fund staff and cost-share will continue.

4. Efforts to provide mid-management habitat assistance to achieve Wildlife Action Plan objectives while complying with CREP objectives will continue.

MONITORING AND EVALUATION OF THE ILLINOIS RIVER

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

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

by
Center for Watershed Science
Illinois State Water Survey
Illinois Department of Natural Resources

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

December 2008

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)

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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, Kip Stevenson, Mike Smith,

Josh Stevenson, and Amy Russell are responsible for the data collection and analysis. Laura Keefer was responsible for analysis of the land use data with assistance from Sandy Jones and Brad Larson. 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. David Crowder analyzed the Benchmark Sediment Monitoring data for long-term trend analysis. Becky Howard 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

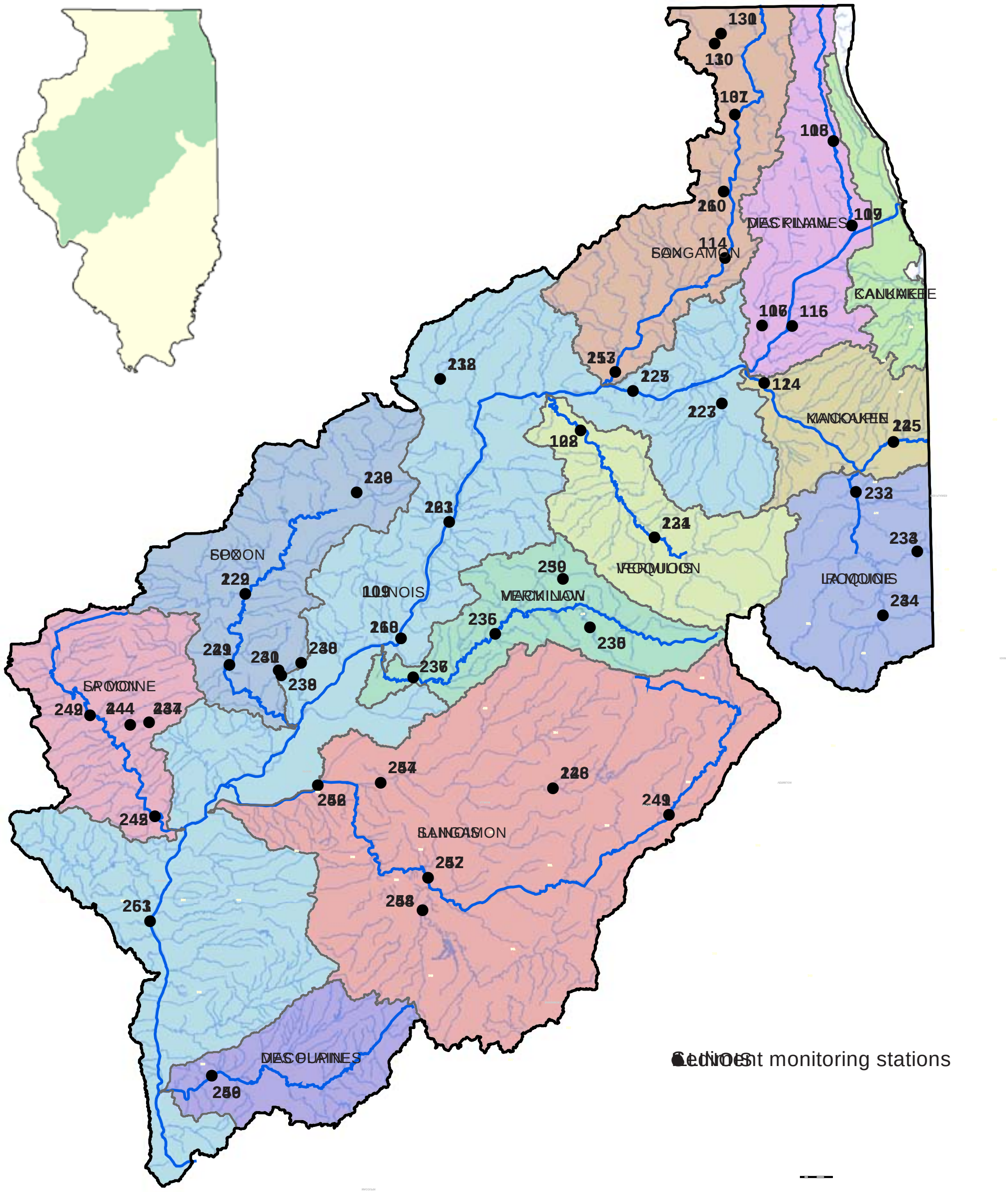


Figure 2-1. Locations of available in-stream sediment data within the Illinois River watershed, 1981-2000

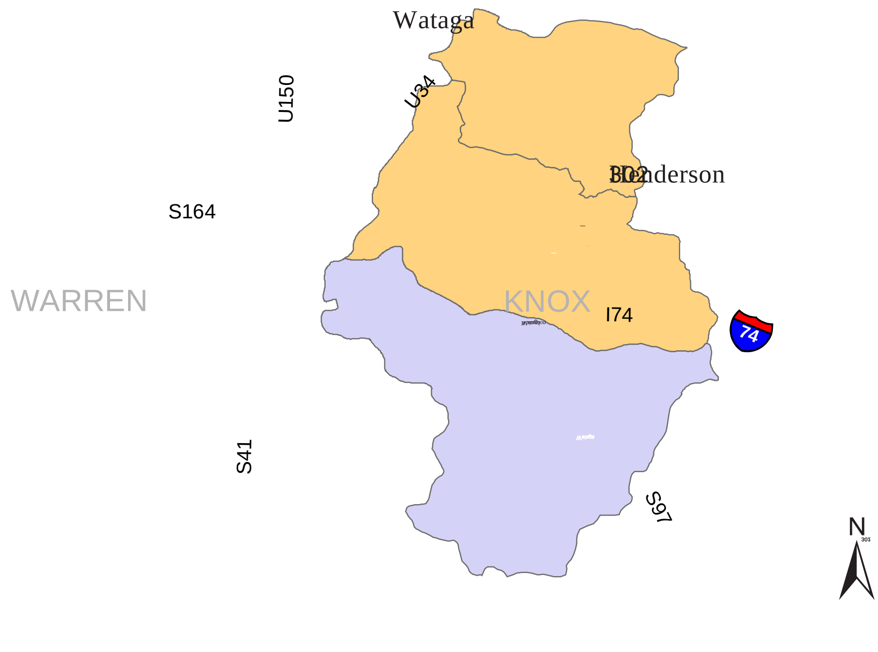


Figure 2-2. Location of monitoring stations in Court and Haw Creek watersheds

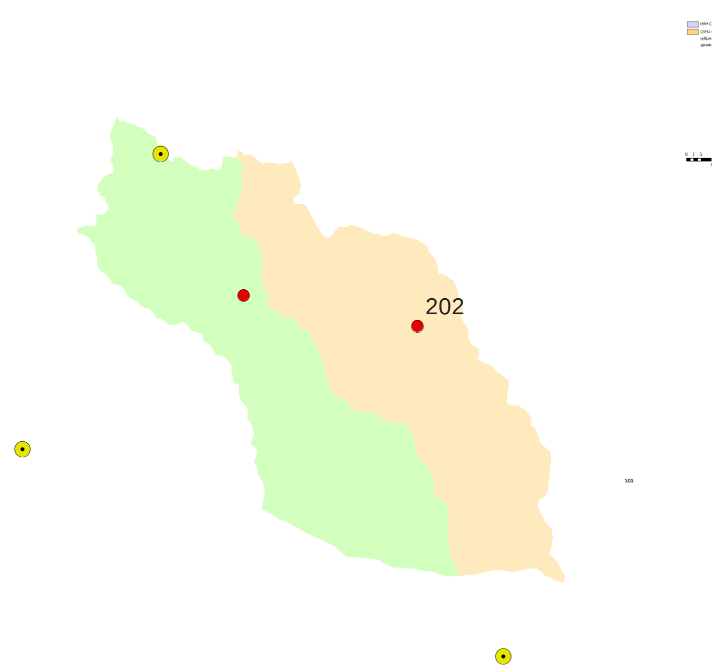


Figure 2-3. Location of monitoring stations in Panther and Cox Creek watersheds

Sediment Data

The daily streamflow and suspended sediment concentrations observed at all the five monitoring stations from Water Year 2000 to Water Year 2007 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 7,715 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 2007 at the five monitoring stations are given in Appendices D and E. The nutrient data are organized into two groups: nitrogen species and phosphourous 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 9,500 samples have been collected and analyzed for nitrate (NO_3-N), ammonium (NH_4-N) and orthophosphate (P-ortho). In addition, more than 3,820 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 sations 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.

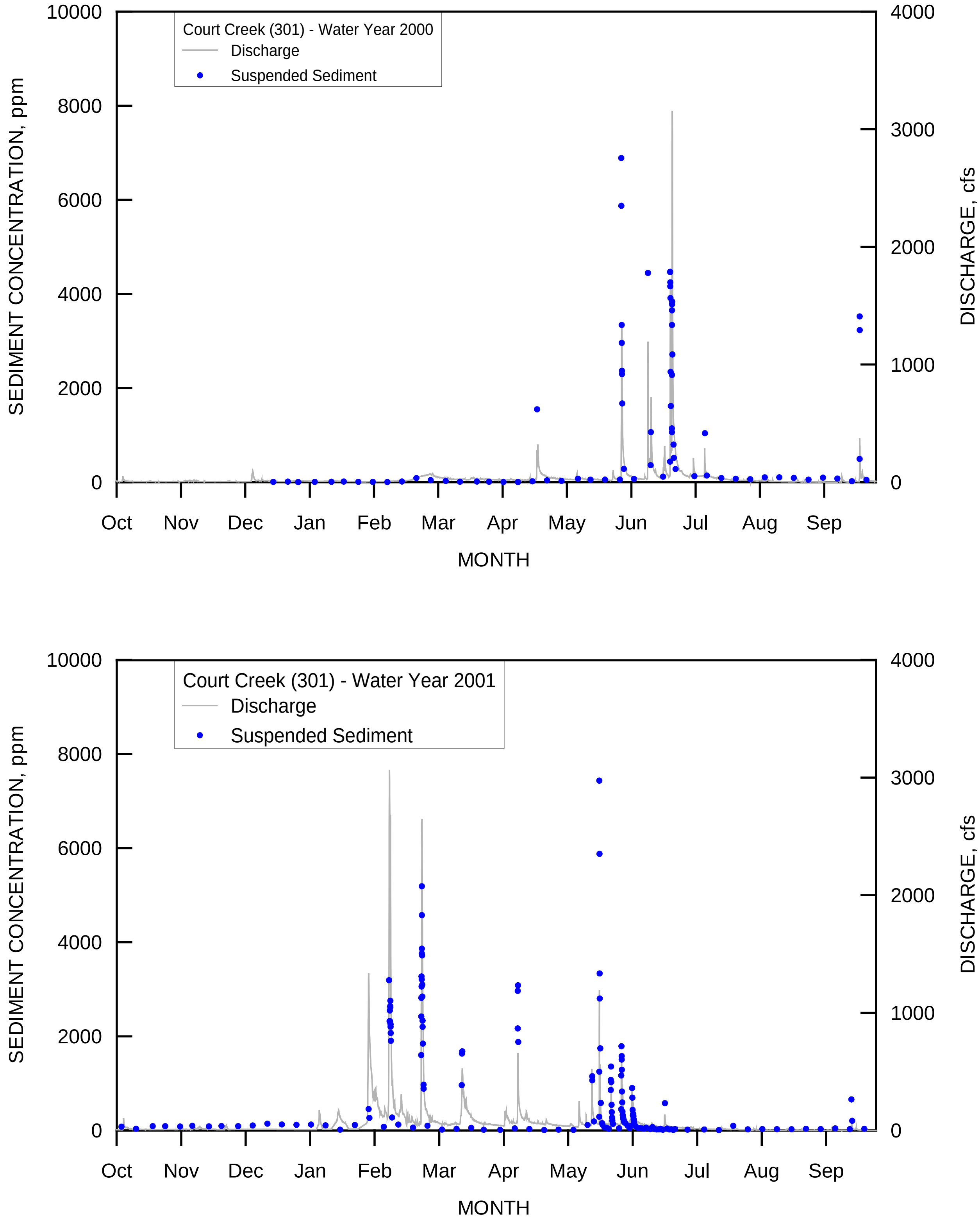
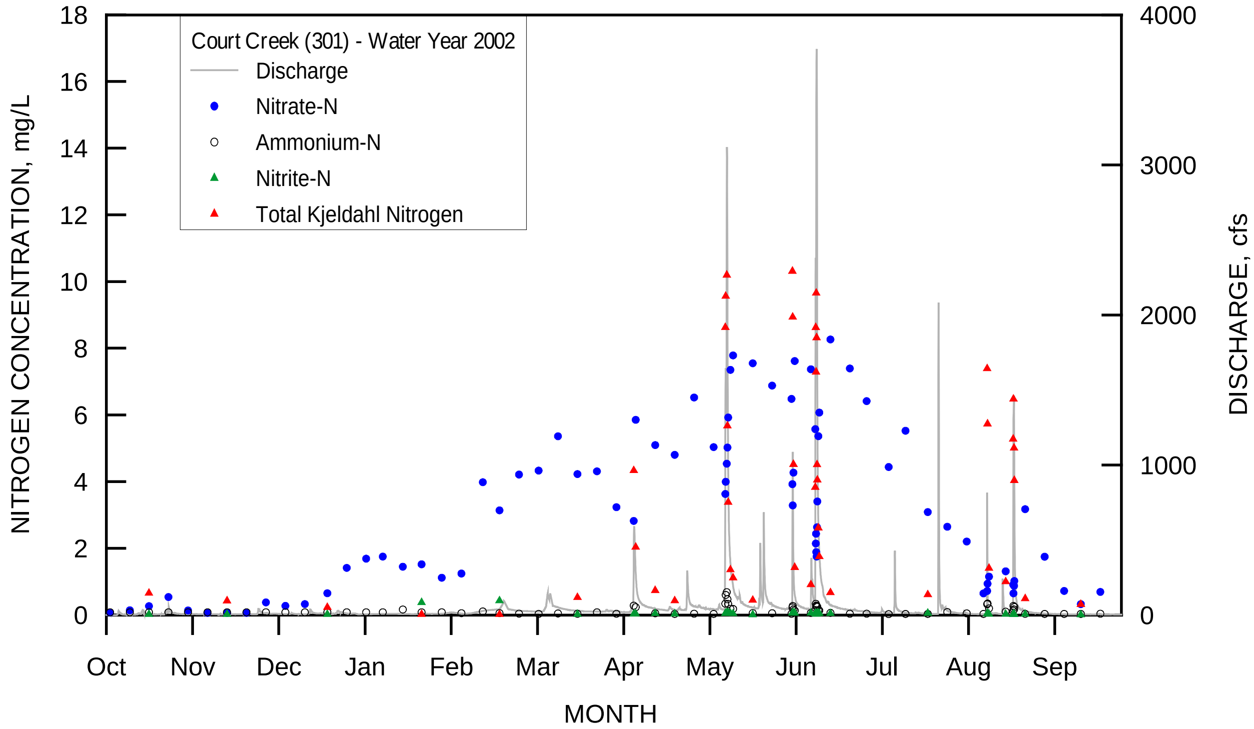


Figure 2-4. Suspended sediment concentrations and water discharge at Court Creek (301) for Water Years 2000 and 2001



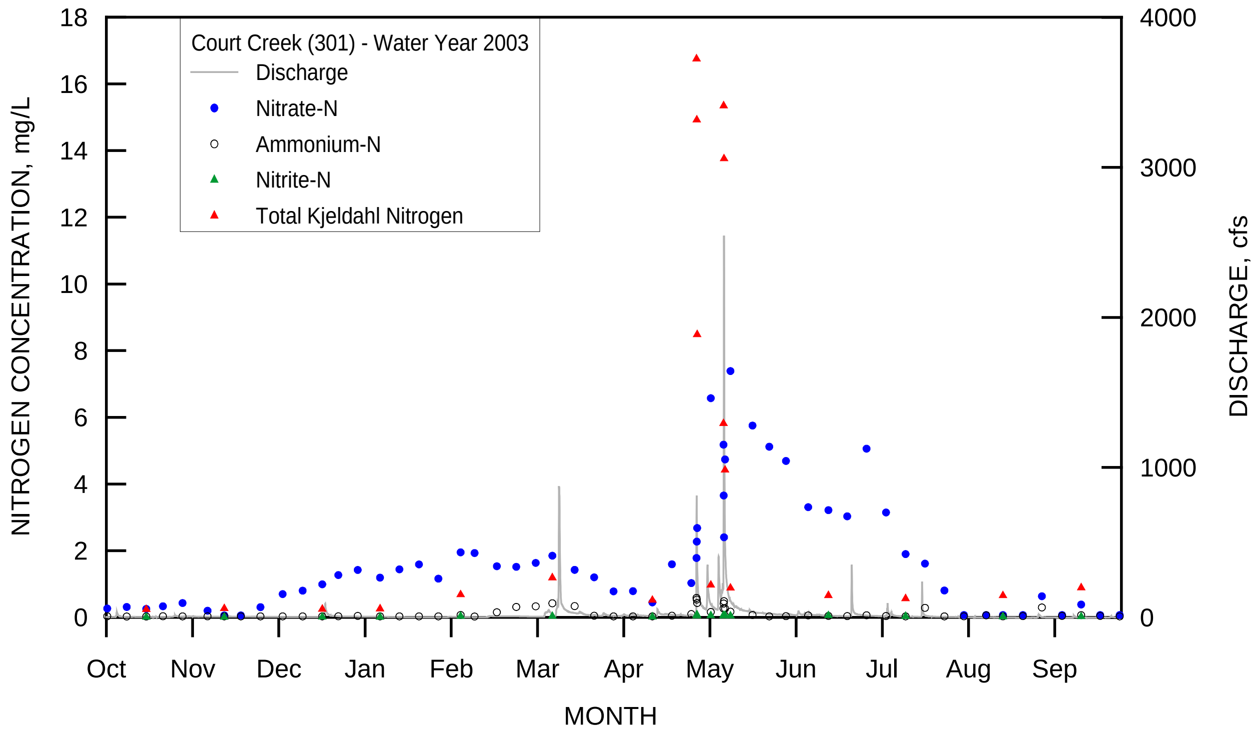
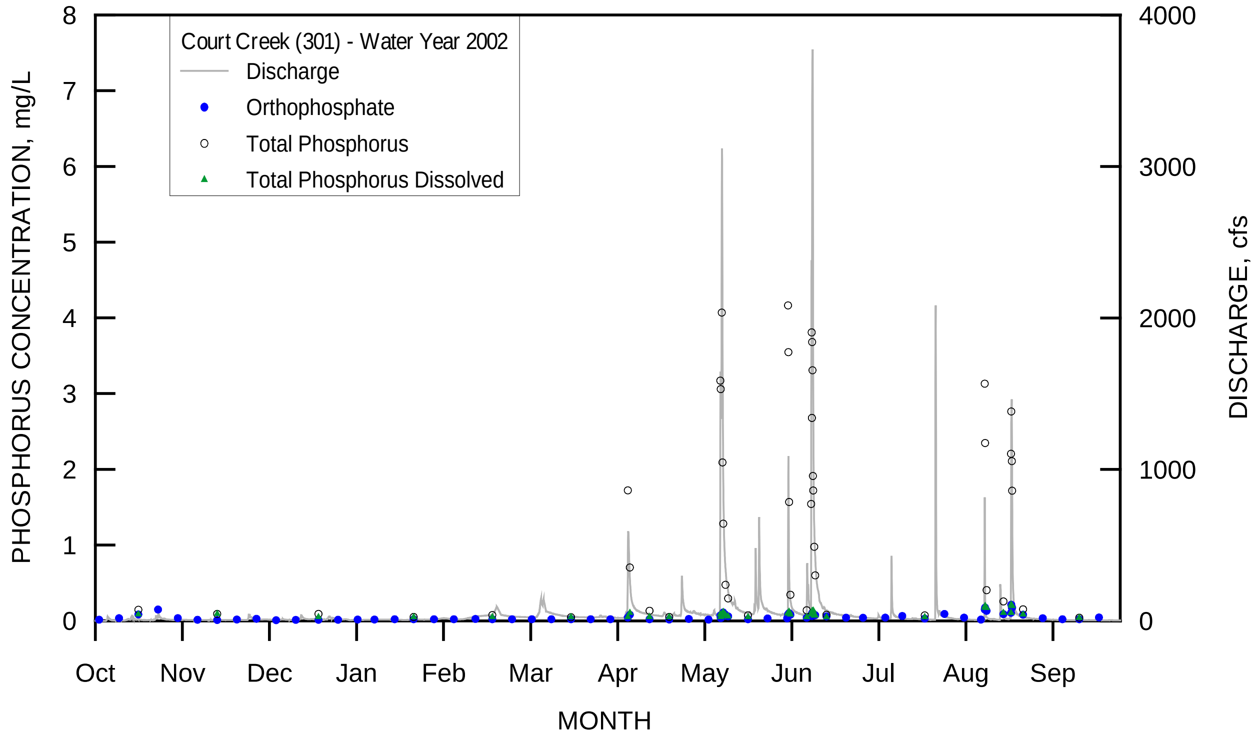


Figure 2-5. Concentrations of nitrogen species and water discharge at Court Creek (301) for Water Years 2002 and 2003

Table 2-2. Summary Statistics for Water Years 2000–2007. All concentrations in mg/L

	NO3-N	*oPO4-P*	*NH4-N*	*NO2-N*	*TKN*	*t-P*	*t-P-Dissolved*	*SSC*
Court Creek (Station 301)								
Count	524	524	524	246	246	246	246	2045
Mean	3.06	0.06	0.14	0.04	2.72	0.93	0.11	653
Median	2.75	0.04	0.07	0.03	1.28	0.32	0.09	102.40
Min	<0.06	<0.01	<0.03	<0.01	0.23	<0.03	<0.03	1.93
Max	11.37	0.48	0.90	0.13	18.69	6.58	0.49	10709
25th Percentile	0.72	0.02	<0.06	0.02	0.56	0.09	0.05	27.09
75th Percentile	4.97	0.07	0.17	0.05	3.95	1.35	0.14	561.97
North Creek (Station 302)								
Count	519	519	519	241	241	241	241	2778
Mean	3.24	0.07	0.14	0.04	2.48	0.85	0.12	415
Median	2.96	0.04	0.07	0.03	1.08	0.30	0.09	58.09
Min	<0.06	<0.01	<0.03	<0.01	0.23	<0.04	<0.03	0.36
Max	12.66	0.54	1.23	0.19	17.95	6.69	0.67	13287
25th Percentile	0.40	0.02	0.06	0.02	0.59	0.09	0.06	21.51
75th Percentile	5.45	0.08	0.15	0.05	3.00	1.05	0.15	195.83
Haw Creek (Station 303)								
Count	530	530	530	249	249	249	249	2757
Mean	4.41	0.07	0.13	0.05	2.54	0.87	0.12	546
Median	4.36	0.06	0.07	0.04	1.30	0.35	0.09	153.39
Min	<0.06	<0.01	<0.03	<0.01	0.23	0.04	<0.03	2.26
Max	11.62	0.50	1.07	0.20	16.75	5.92	0.95	9818
25th Percentile	1.37	0.03	0.06	0.03	0.61	0.12	0.07	41.85
75th Percentile	6.86	0.08	0.14	0.06	3.05	1.08	0.14	545.83
Panther Creek (Station 201)								
Count	472	472	472	187	187	187	187	2432
Mean	4.29	0.11	0.10	0.04	2.27	1.00	0.20	608
Median	3.50	0.06	0.06	0.03	0.78	0.22	0.13	69.08
Min	<0.06	<0.01	<0.03	<0.01	<0.12	<0.03	<0.03	1.47
Max	14.76	1.31	1.27	0.19	14.49	7.01	1.38	23969
25th Percentile	<0.07	<0.04	0.05	<0.02	0.47	0.12	0.08	30.04
75th Percentile	7.95	0.13	0.08	<0.05	3.17	1.29	0.24	232.09
Cox Creek (Station 202)								
Count	469	469	469	182	182	182	182	1784
Mean	5.66	0.16	0.33	0.05	2.84	1.10	0.28	664
Median	4.23	0.09	0.07	0.04	1.17	0.36	0.16	91.86
Min	<0.06	<0.01	<0.03	<0.01	<0.14	<0.04	<0.03	0.95
Max	18.14	2.70	12.83	0.23	18.25	7.90	2.95	21768
25th Percentile	0.34	0.05	0.06	0.02	0.55	0.16	0.09	44.24
75th Percentile	10.33	0.17	0.16	0.06	3.38	1.32	0.38	291.07



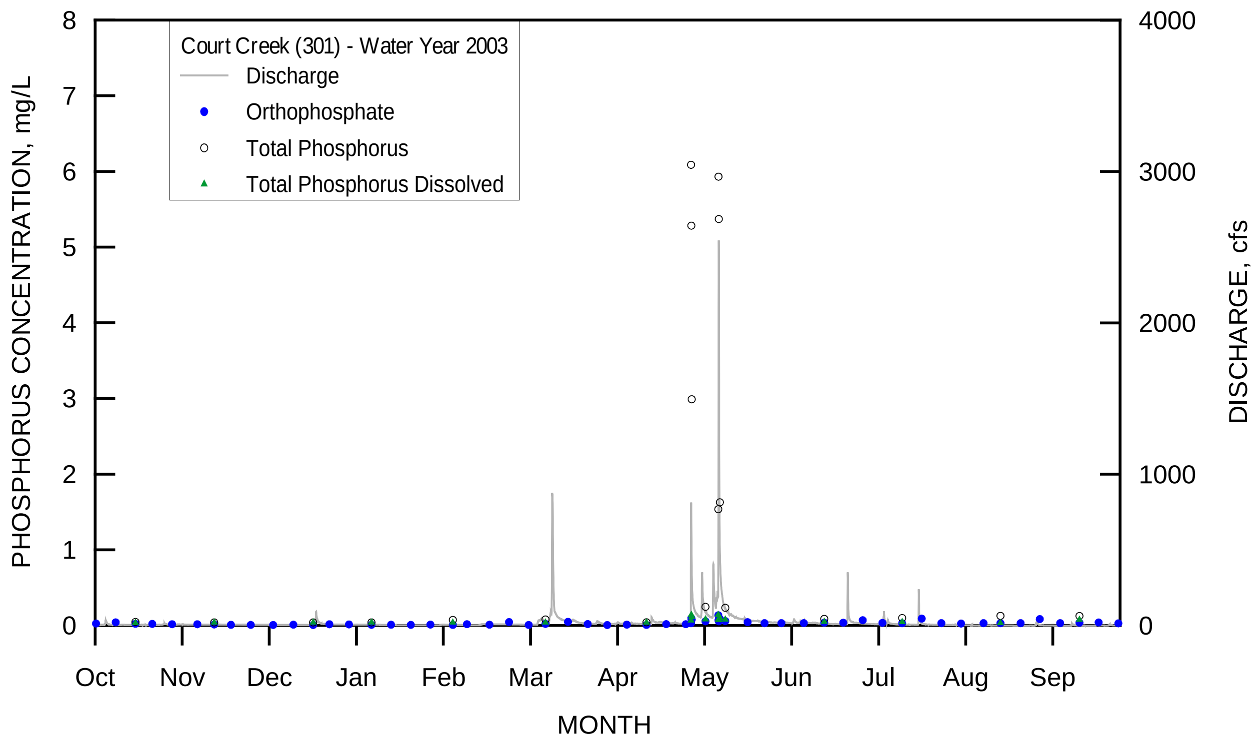


Figure 2-6. Concentrations of phosphorous species and water discharge at Court Creek (301) for Water Years 2002 and 2003

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 presented in this report to minimize report size. The annual sediment loads are highly correlated to the water discharge, and thus the wetter years, 2001, 2002, and 2007 generated more sediment at all stations as compared to drier years, 2000, 2003, and 2006. The annual sediment loads ranged from a low of 1,820 tons in 2003 at Cox Creek to a high of 62,841 tons in 2002 at Court Creek. The nitrate-N loads ranged from a low of 10.3 tons in 2000 at Cox Creek to a high of 322 tons in 2001 at Haw Creek. The total phosphorous loads ranged from a low of 1.6 tons in 2006 at Cox Creek to a high of 58 tons in 2001 at Haw Creek. For comparison purposes, the water discharges, sediment, nitrate-N, and total phosphorous loads (for the five monitoring stations) are shown in figures 2-7 to 2-14. 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	26504	131.2	35
2001	22100	43511	274.8	39.2
2002	17320	62841	203.7	47.9
2003	6805	21725	59.9	18.3
2004	7459	7347	76	7.5
2005	14400	18799	207.5	20.4
2006	5650	7886	84.3	6.5
2007	19,376	48,831	240.8	46.8

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

		Load		
Water Year	*Water discharge (cfs)*	*Sediment (tons)*	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	4009	6954	42.8	10.4
2001	8091	16718	102.9	12.7
2002	7372	29266	97.8	24.2
2003	3039	11381	32.9	9.1
2004	3224	2038	37.7	2.4
2005	5266	6061	76.3	7.7
2006	2151	4177	36.2	3.4
2007	7524	16657	99.3	14.3

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

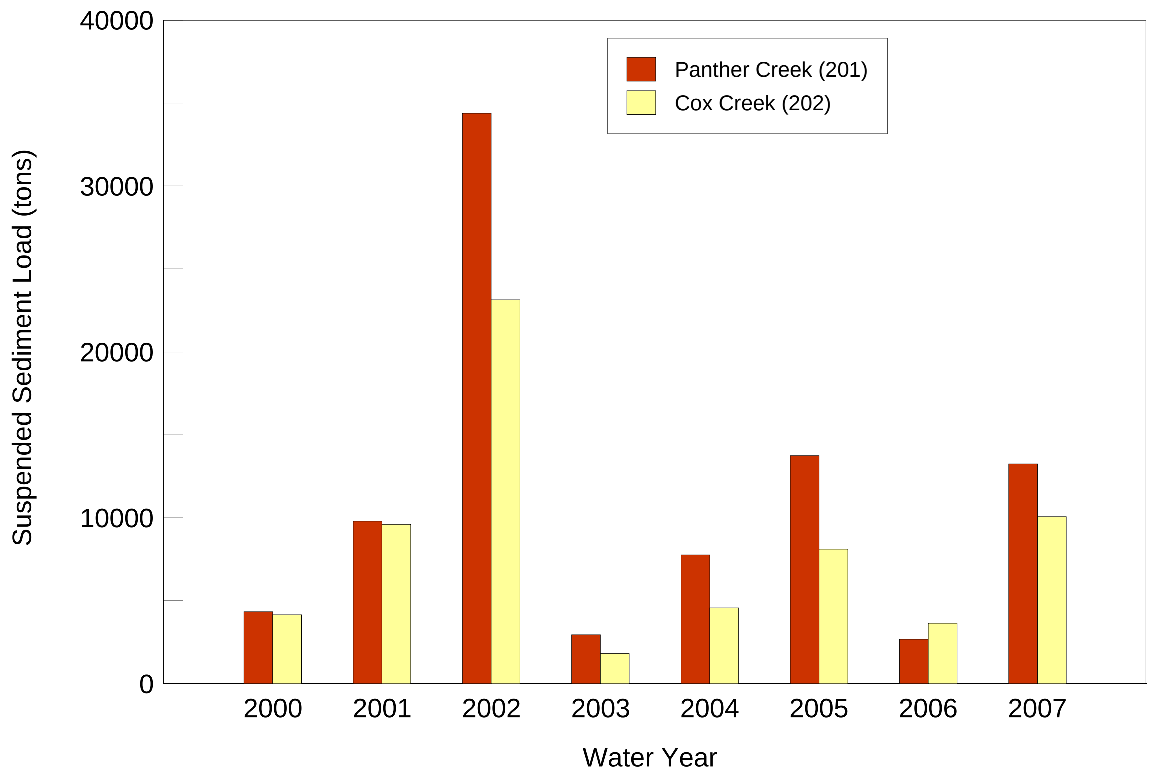
		Load		
Water Year	*Water discharge (cfs)*	*Sediment (tons)*	*Nitrate-N (tons)*	*Total phosphorus (tons)*
2000	11433	21258	162.2	32
2001	19878	49403	322	58
2002	15603	44148	256.5	42.8
2003	4337	5896	41.7	8.3
2004	8676	10894	143.4	12.6
2005	14661	18024	281.4	18.5
2006	5341	5759	113.7	6
2007	15032	20114	262.5	23.9

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	4337	13.8	4.4
2001	3550	9806	84.9	5.1
2002	5440	34384	101.8	16.4
2003	1578	2946	26.4	1.8
2004	2787	7767	52.5	5.8
2005	5743	13743	112.2	10.2
2006	1053	2682	22.5	2.5
2007	3809	13249	75.4	10.6

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	4149	10.3	5.7
2001	2833	9609	77.9	5.5
2002	4242	23143	100.6	16.1
2003	1226	1820	29.6	1.7
2004	1844	4574	45.3	3.7
2005	3976	8109	109	8.8
2006	806	3648	19.3	1.6
2007	3181	10072	81.5	7.2



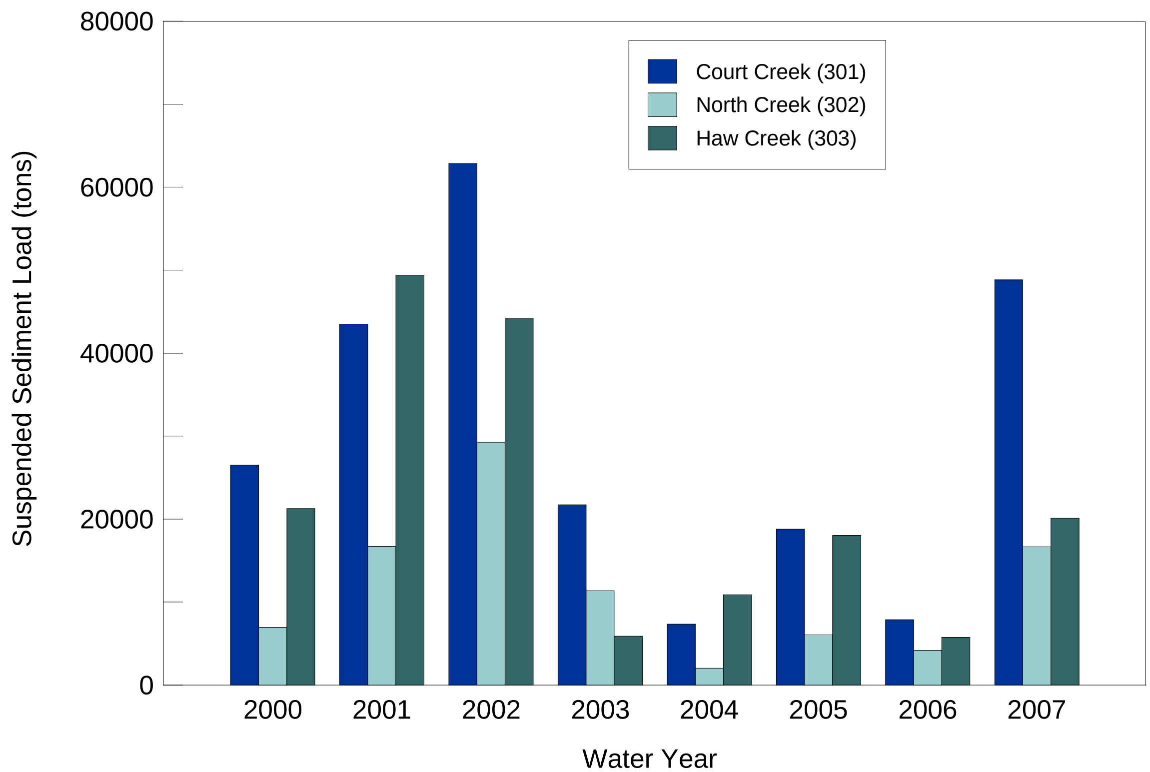
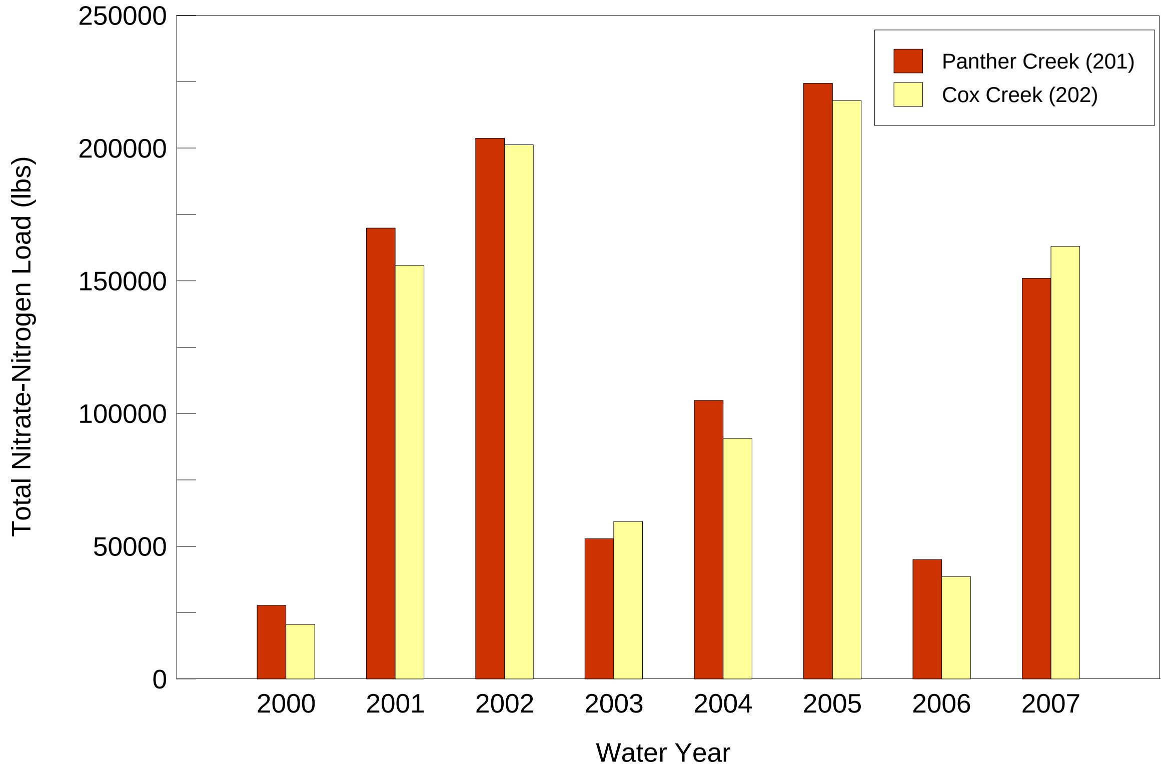


Figure 2-7. Annual suspended sediment loads at the five CREP monitoring stations



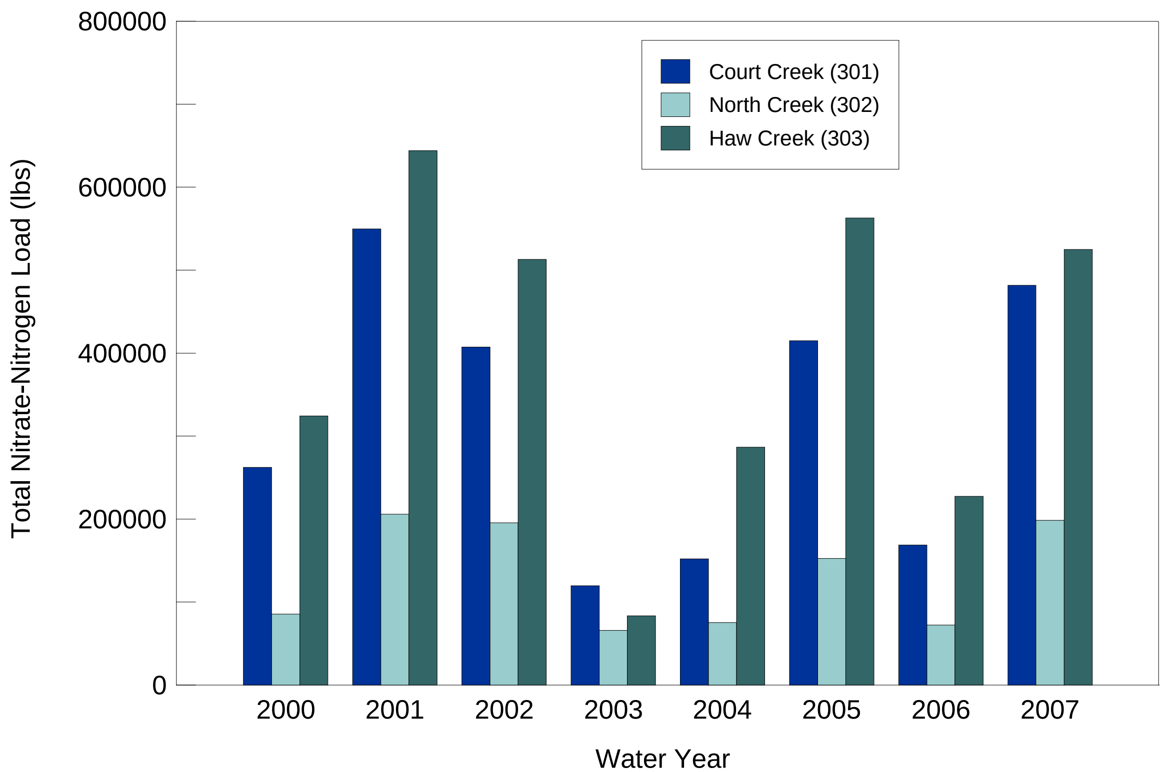
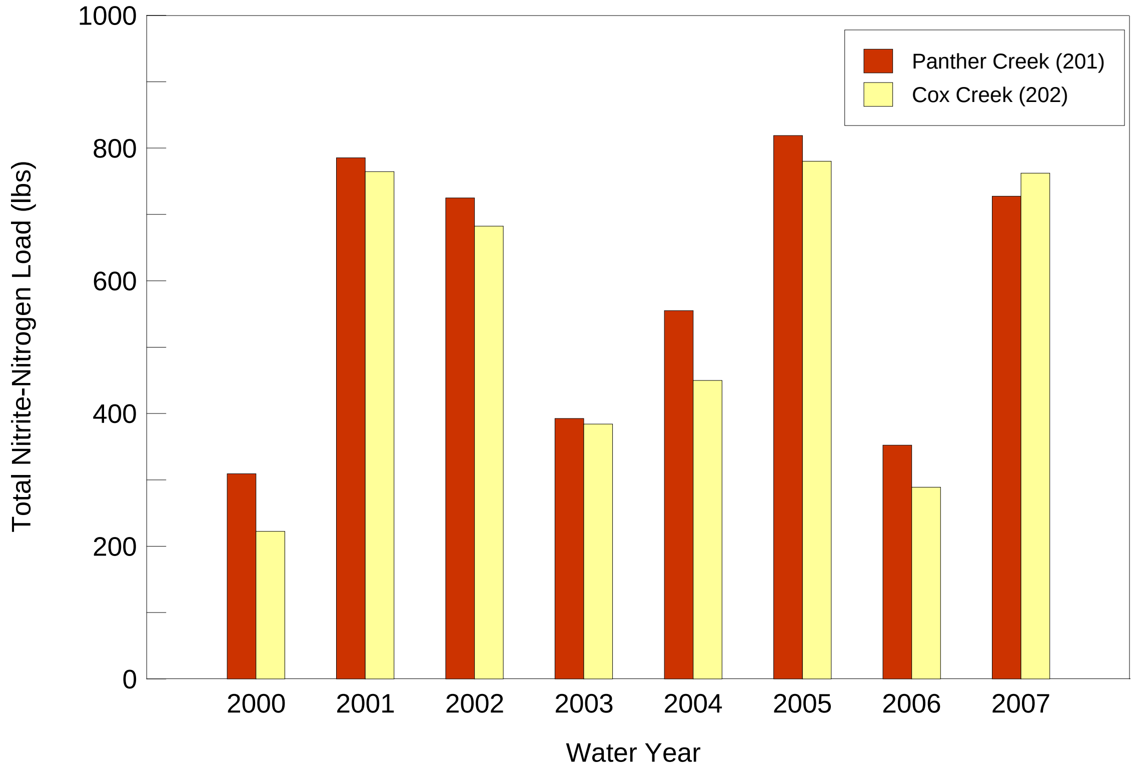


Figure 2-8. Annual nitrate-N loads at the five CREP monitoring stations



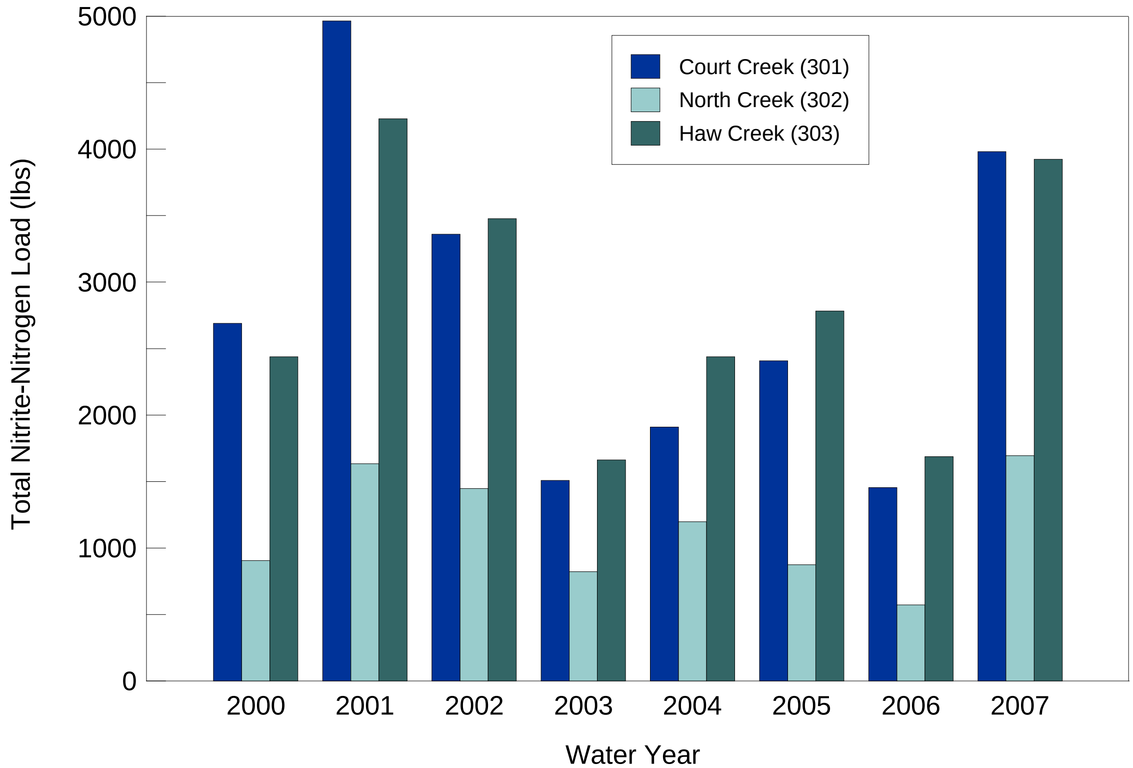


Figure 2-9. Annual nitrite-N loads at the five CREP monitoring stations

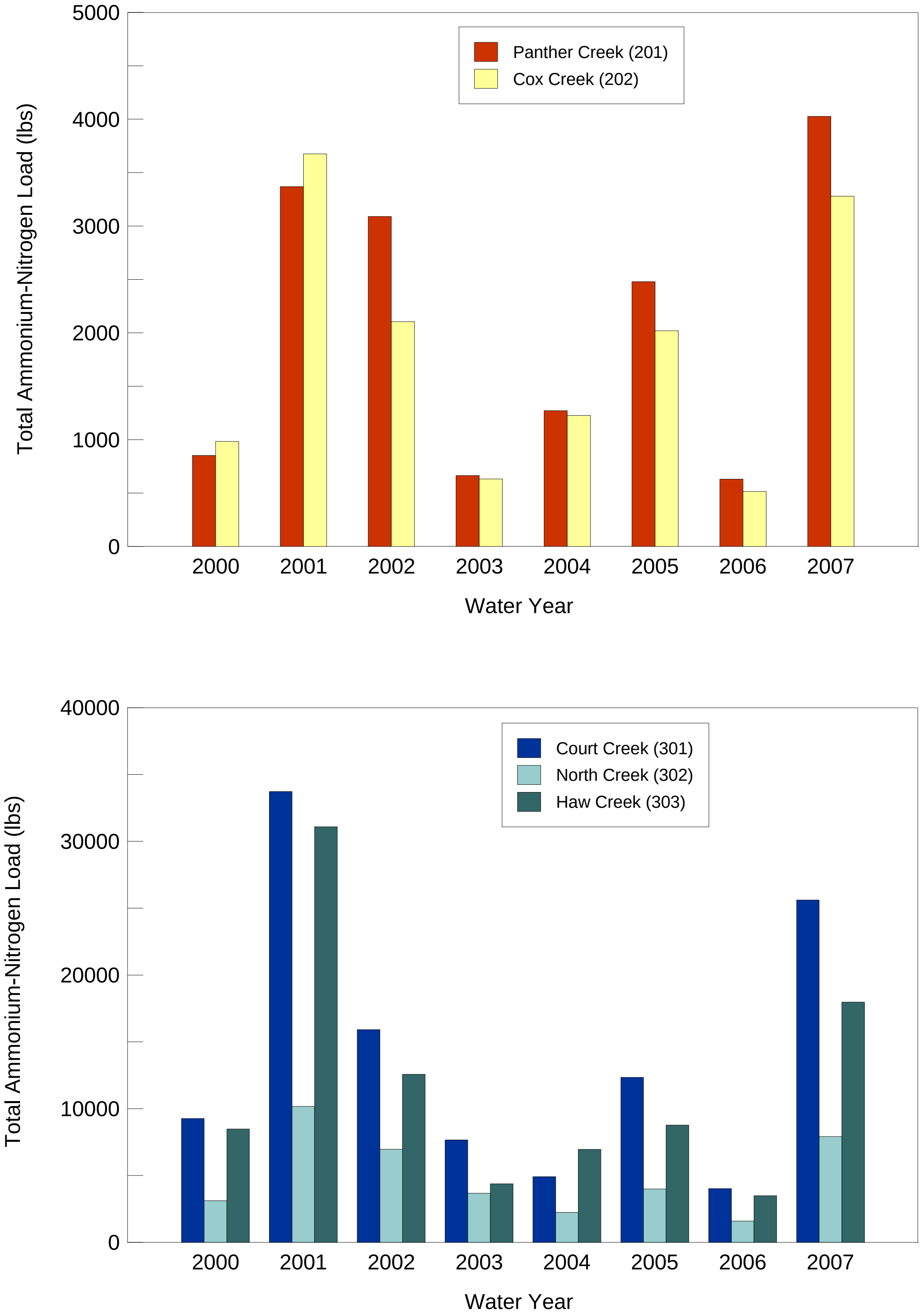
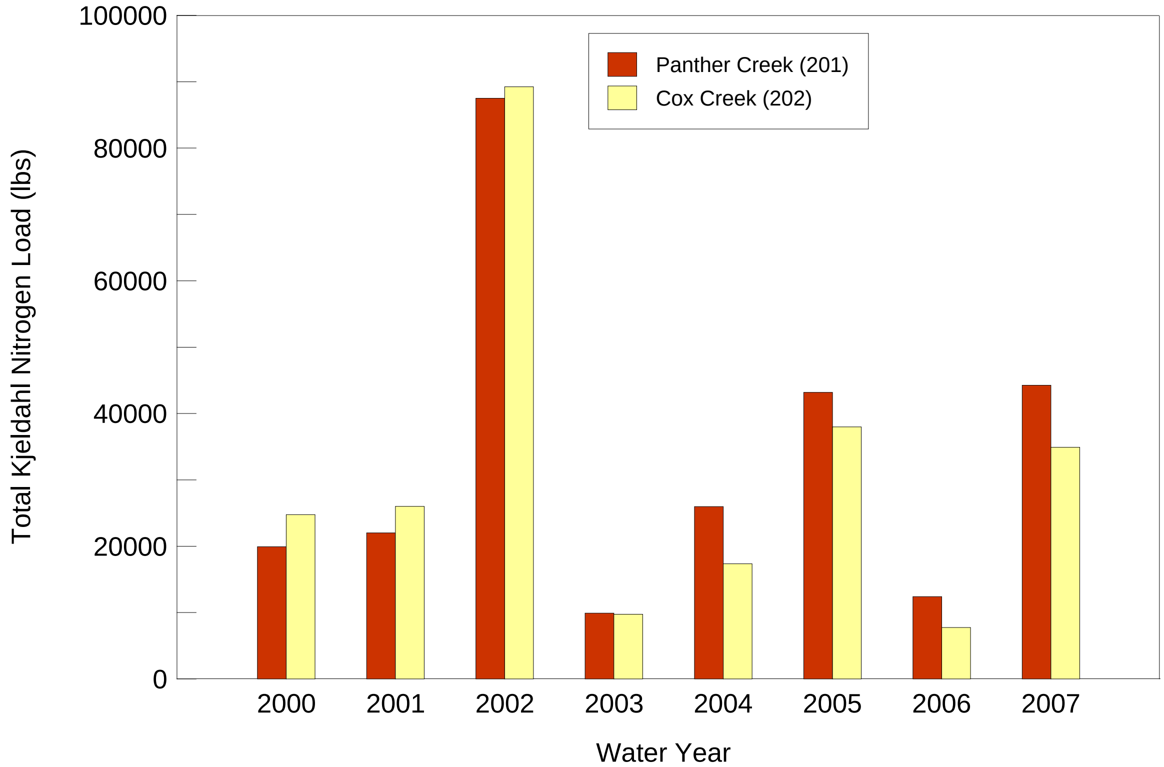


Figure 2-10. Annual ammonium-N loads at the five CREP monitoring stations



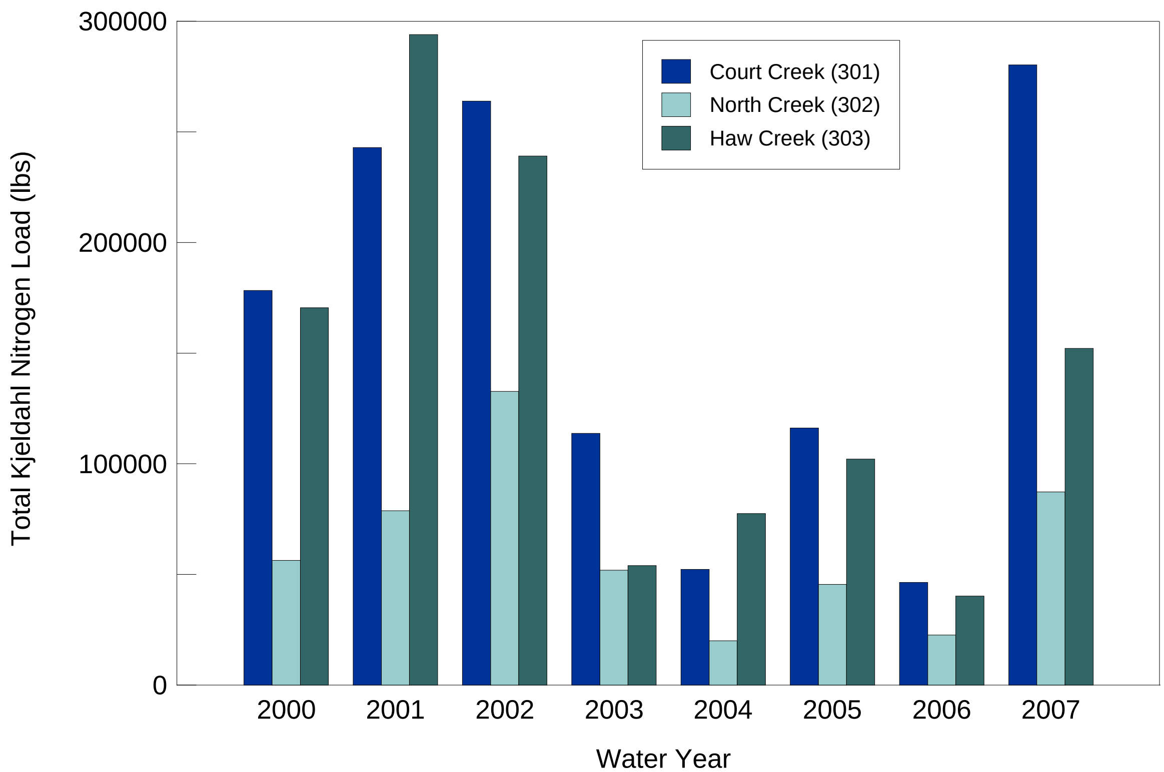


Figure 2-11. Annual Kjeldahl nitrogen loads at the five CREP monitoring stations

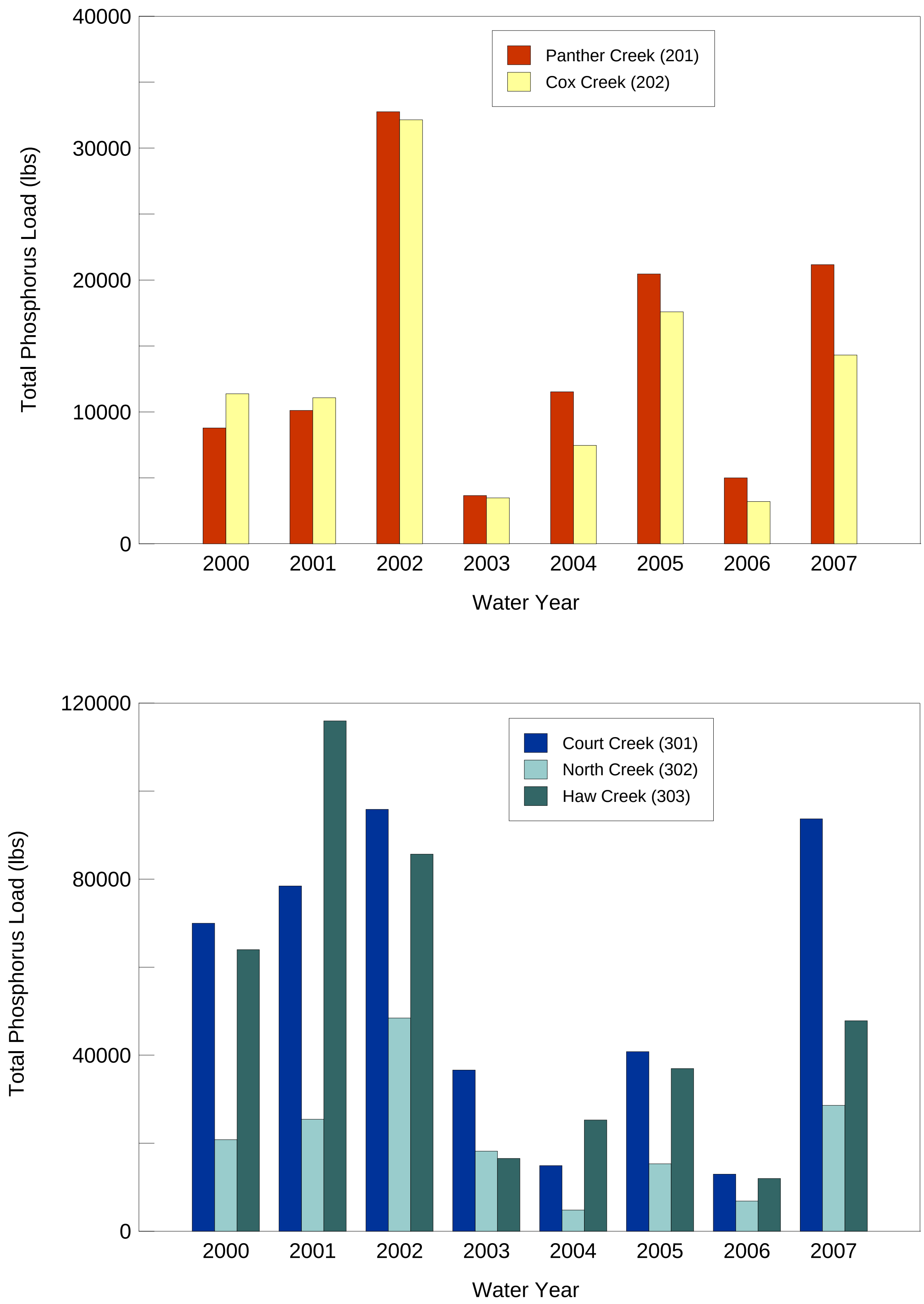
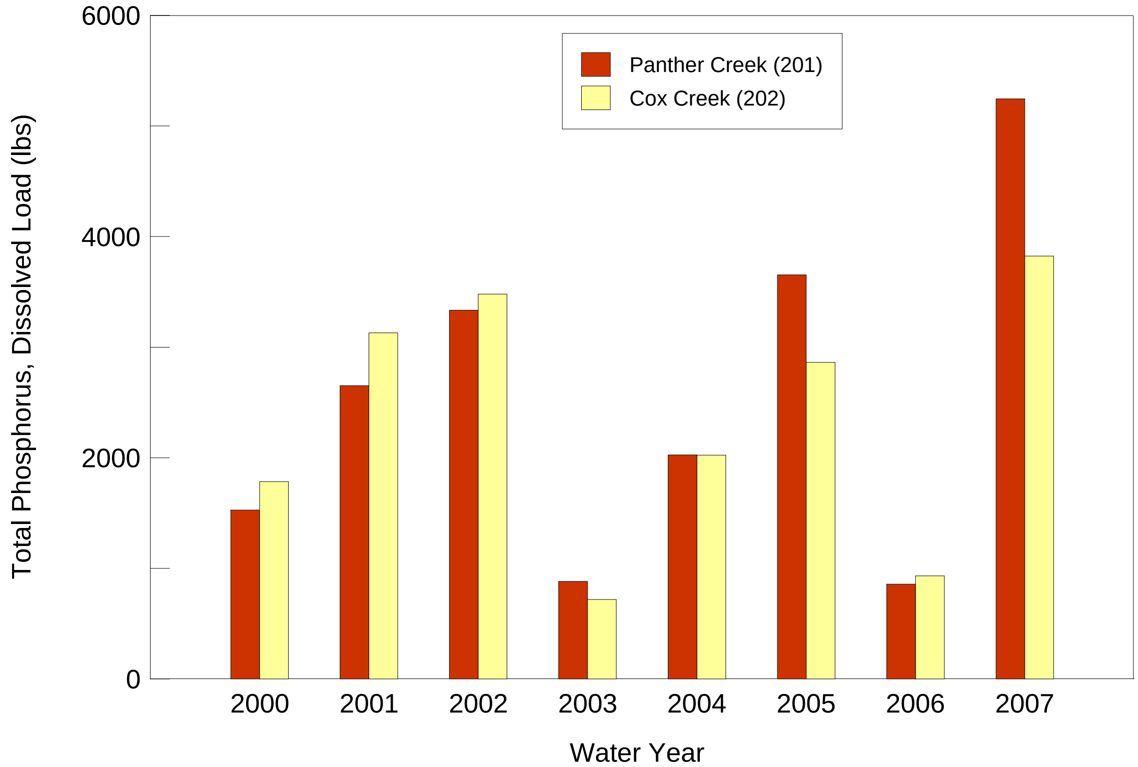


Figure 2-12. Annual phosphorous loads at the five CREP monitoring stations



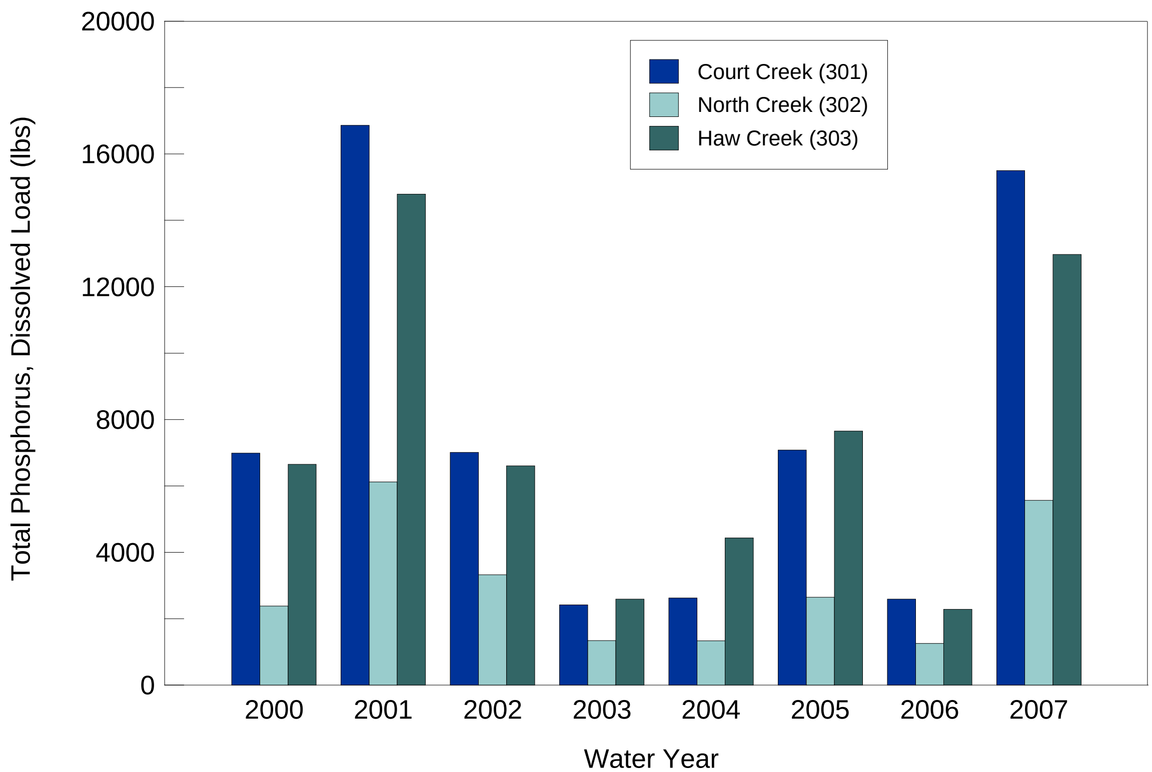
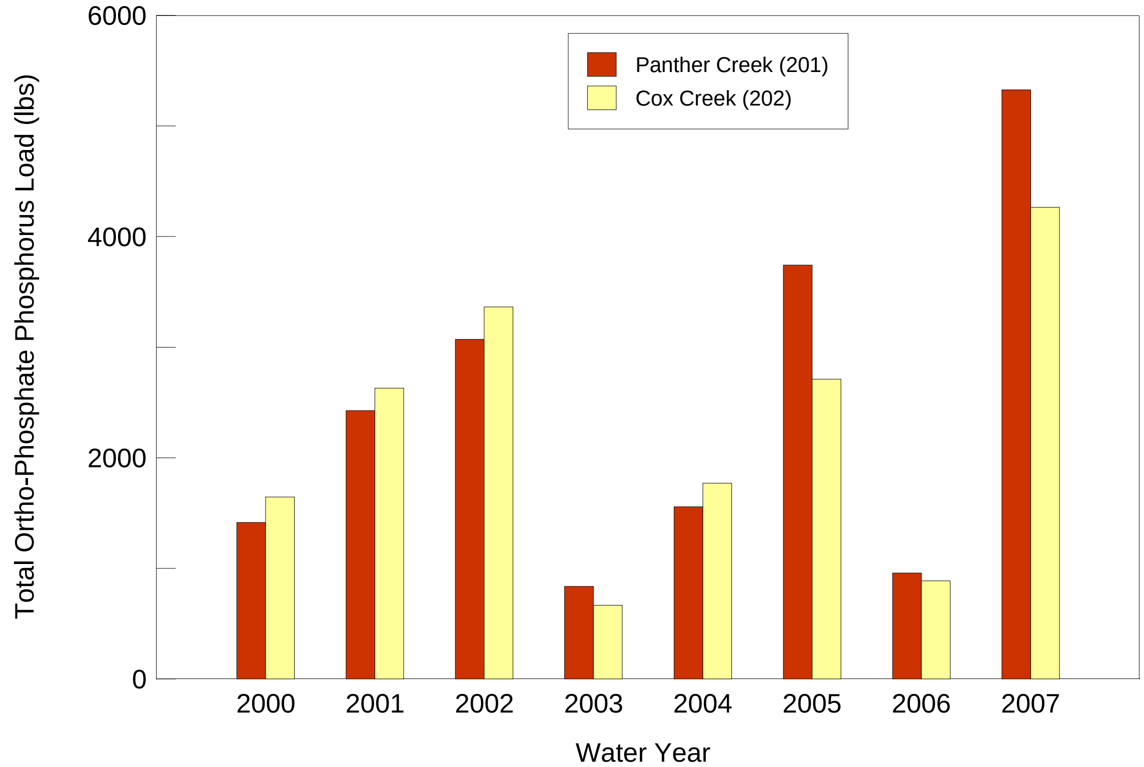


Figure 2-13. Annual dissolved phosphorous loads at the five CREP monitoring stations



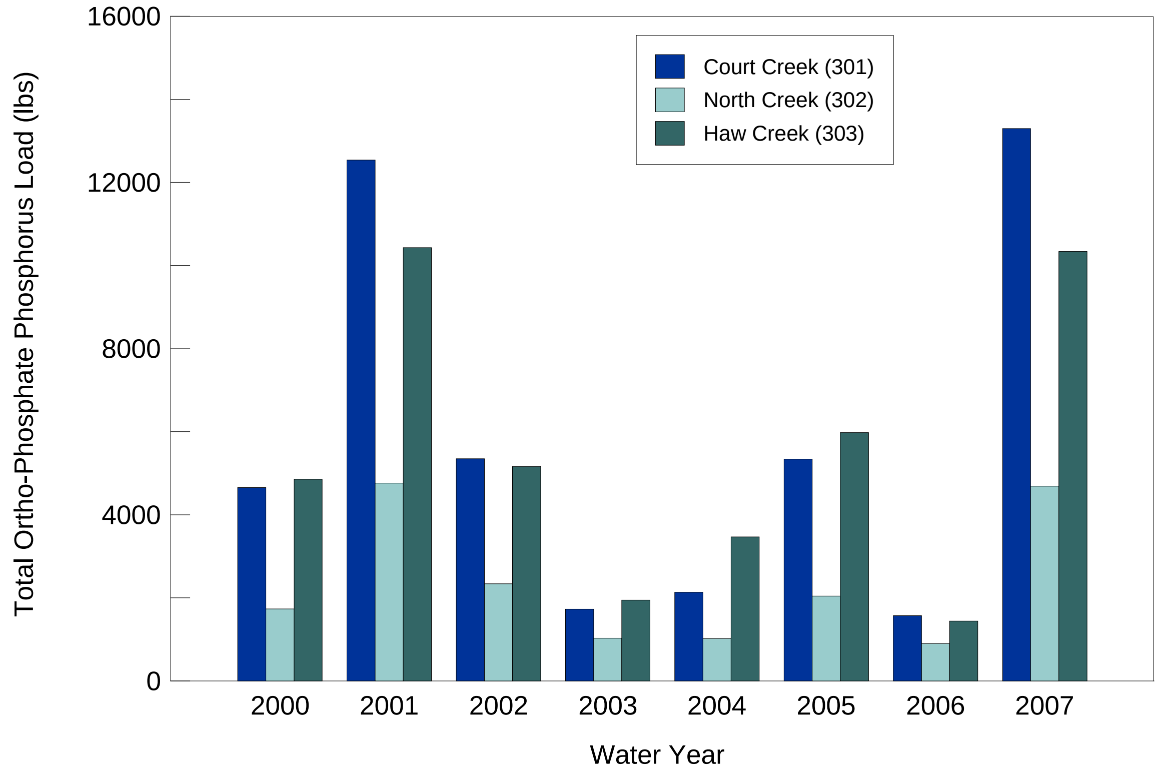


Figure 2-14. Annual ortho-phosphate phosphorous loads at the five CREP monitoring stations

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. The sediment yields rage from a low of 0.12 tons/acre for station 302 in 2004 to a high of 3.24 tons/acre for station 201 in 2002. Because of the high level of variability from year to year the average sediment yield for the eight 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 (over 1 ton/acre) than the stations with the larger areas (302, 303, 301) that yield less than 0.7 tons/acre.

Nitrate-N yields vary from a low of 2.6 lbs/acre for station 201 in 2000 to a high of 28.30 lbs/acre for station 202 in 2005. For comparison purposes the average annual nitrate-N yield for the five stations is shown in figure 2-16. 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 0.29 lbs/acre for station 302 in 2004 to a high of 4.17 lbs/acre for station 202 in 2002. For comparison purposes, the average annual total phosphorous yield for the five stations is shown in figure 2-17. 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, except for station 303 that generates more total phosphorous per unit area than stations with smaller drainage areas. In terms of nutrient yields, station 303 is generating more than what would have been expected based on its relative drainage area.

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	1.02	1.01	1.40
2002	3.24	3.01	1.48	1.76	1.25
2003	0.28	0.24	0.51	0.69	0.17
2004	0.73	0.59	0.17	0.12	0.31
2005	1.30	1.05	0.44	0.37	0.51
2006	0.25	0.47	0.19	0.25	0.16
2007	1.25	1.31	1.15	1.00	0.57

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

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

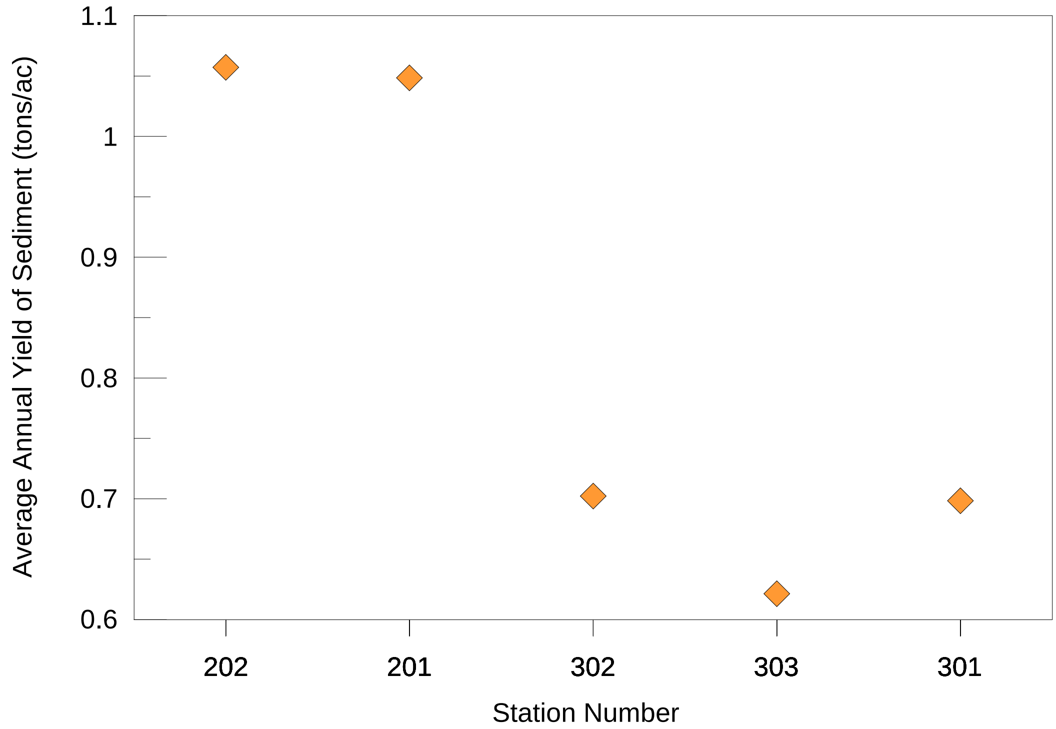


Figure 2-15. Average annual sediment yield in tons/acre for the CREP monitoring stations

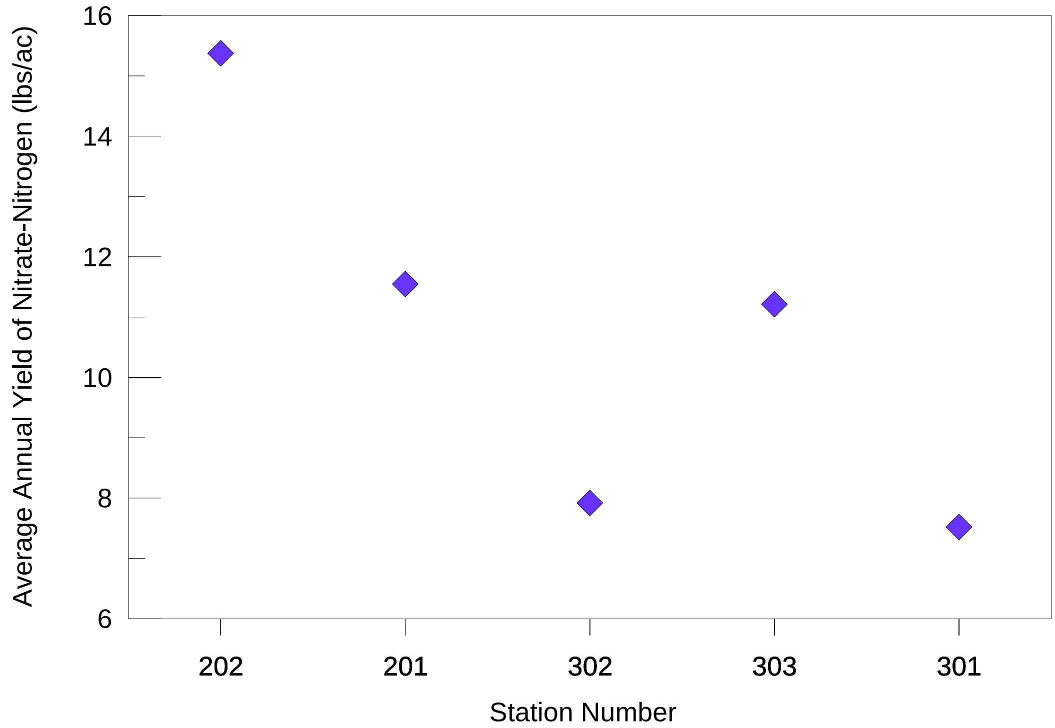


Figure 2-16. Average annual nitrate-N yield in lbs/acre for the CREP monitoring stations

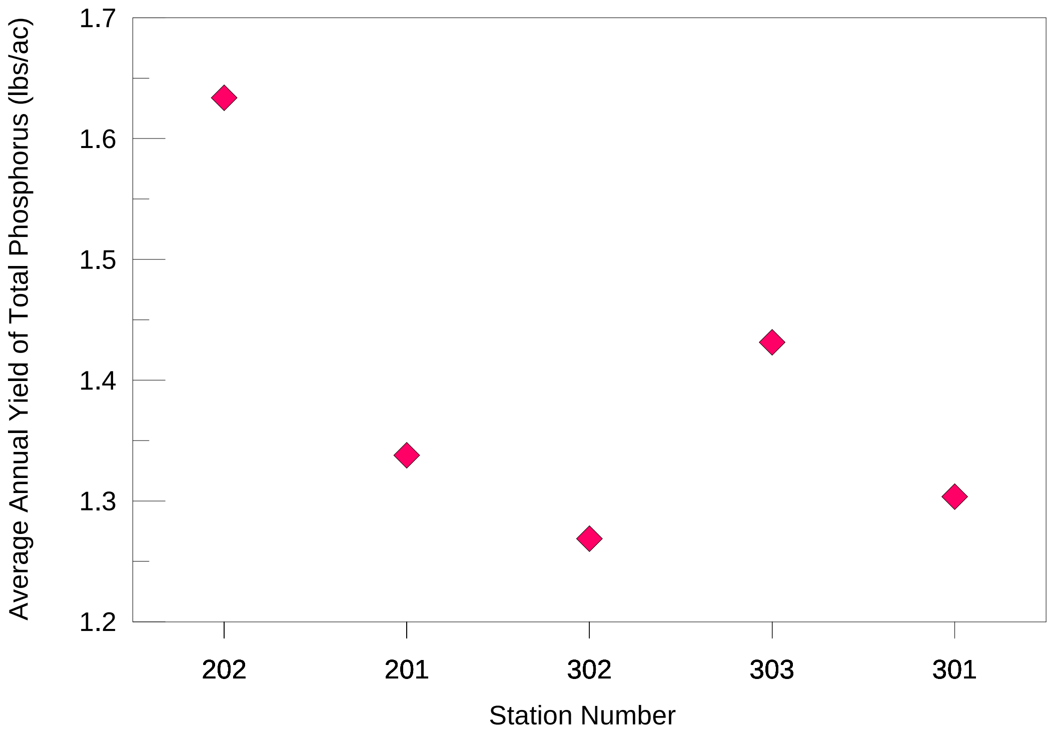


Figure 2-17. Average annual total phosphorous yield in lbs/acre for the CREP monitoring stations

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, 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

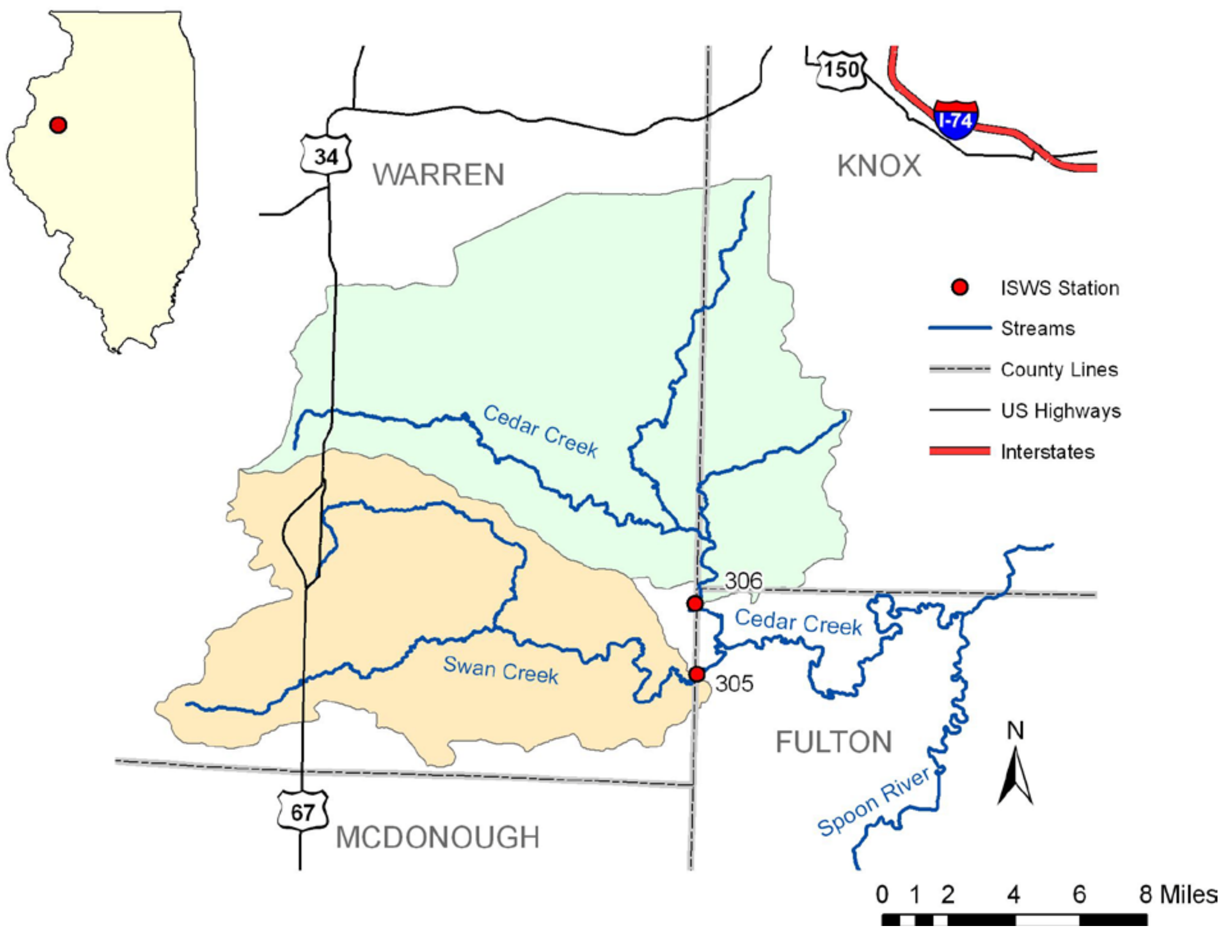


Figure 2-18. Locations of monitoring stations in the Cedar and Swan watersheds

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 Water Year 2006 (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 1/1/08 227 samples have been collected at London Mills while 231 samples have been collected at Seville. Summary statistics for suspended sediment concentration data collected through Water Year 2007 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)	559	586
Mean	287.6	298.8
Max	4315.7	4230.8
Min	2.1	3.5
Median	80.1	62.9
25th Percentile	26.6	26.2
75th Percentile	311.6	227.8

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

	London Mills (05569500)	*Seville (05570000)*
Count (samples)	216	221
Mean	185.9	256.6
Max	2268.8	3223.7
Min	1.9	3.9
Median	60.7	88.8
25th Percentile	34.8	42.3
75th Percentile	174.0	234.5

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)

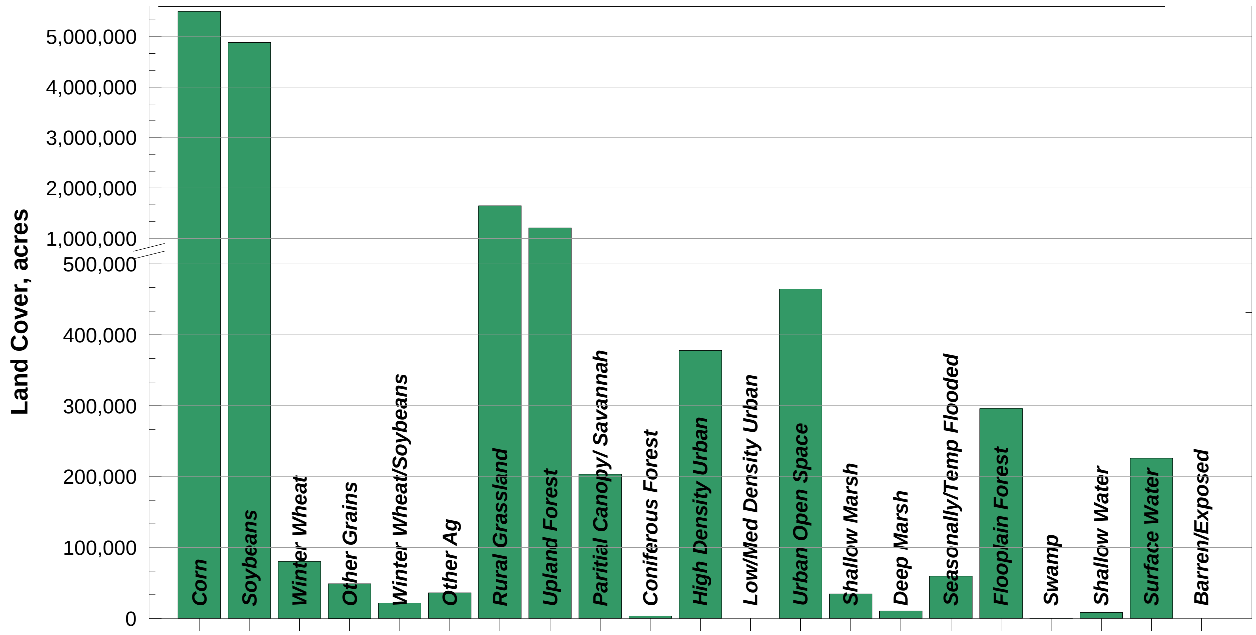


Figure 3-2. Land cover acreages in the Illinois River basin

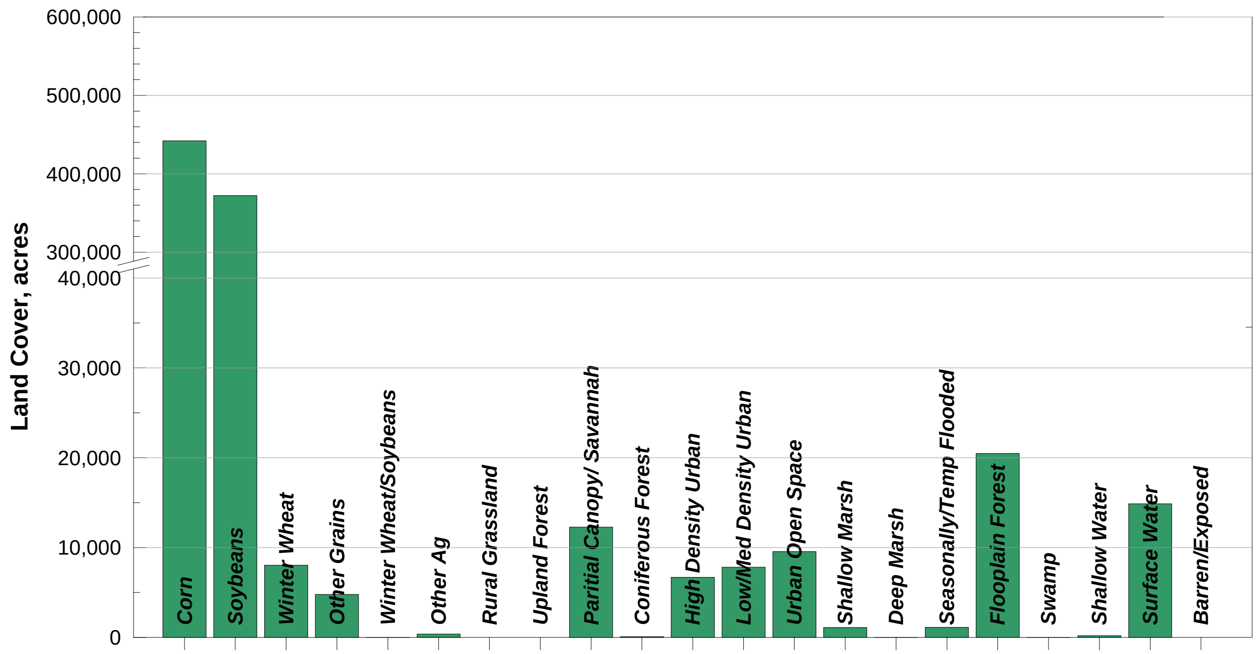


Figure 3-3. Land cover acreages in the Spoon River watershed

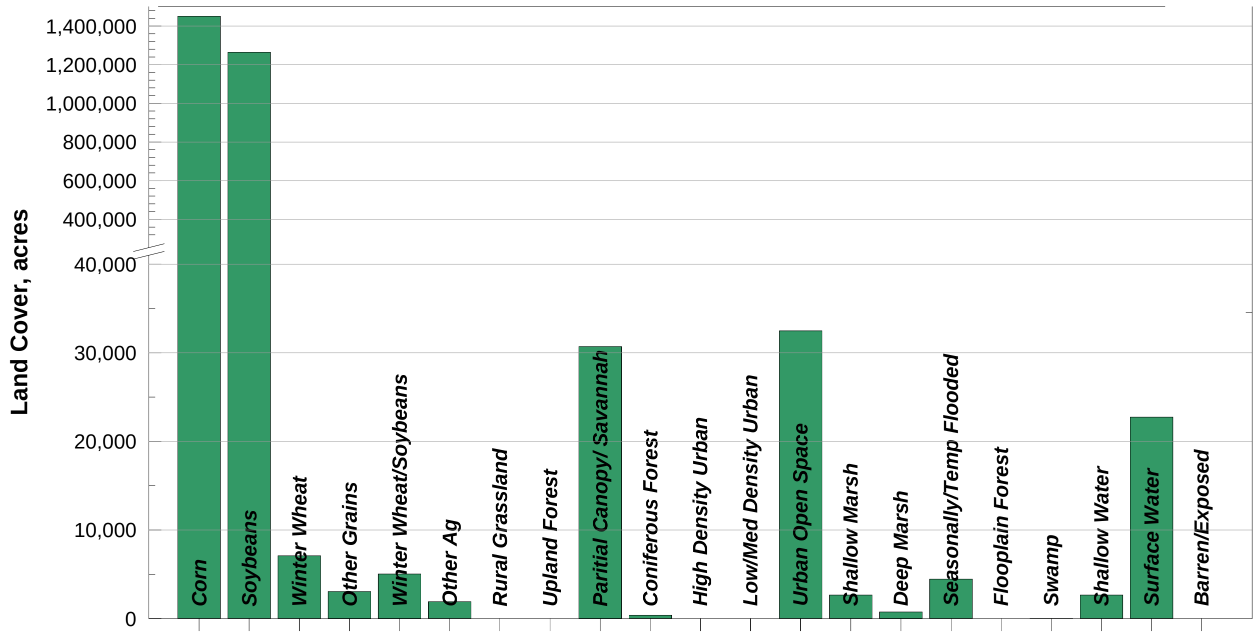


Figure 3-4. Land cover acreages in the Sangamon River watershed

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)

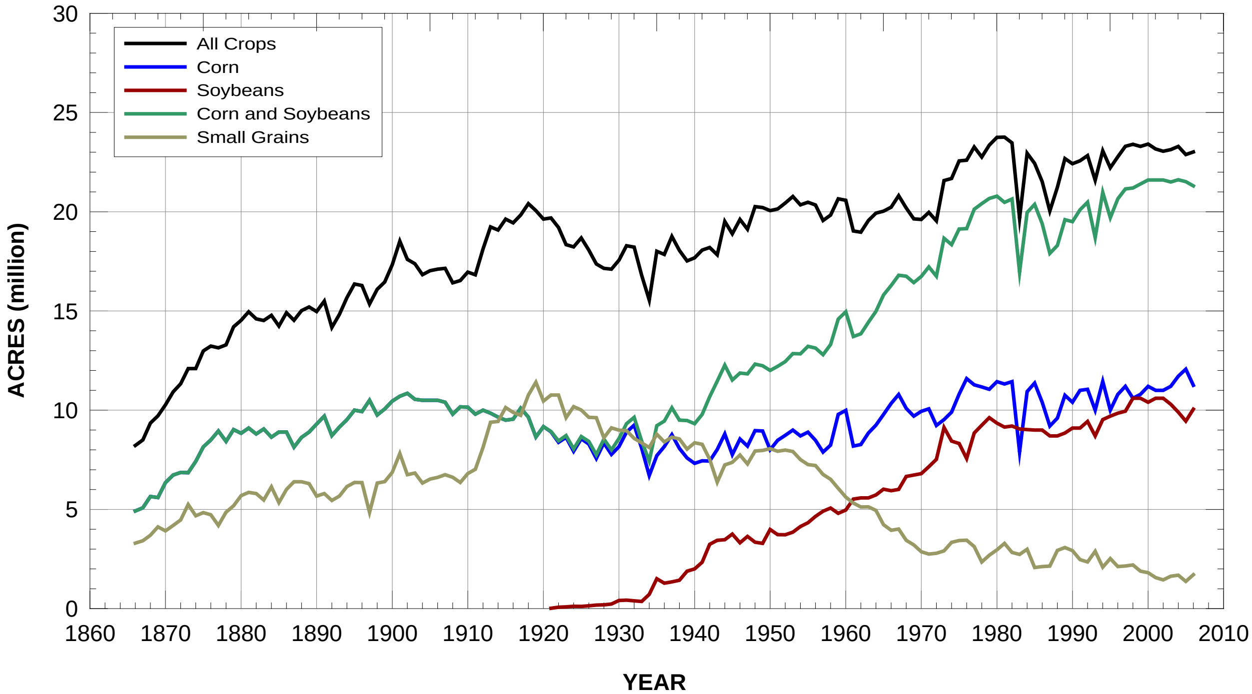


Figure 3-5. Acreage of agricultural land uses in State of Illinois (1866-2006)

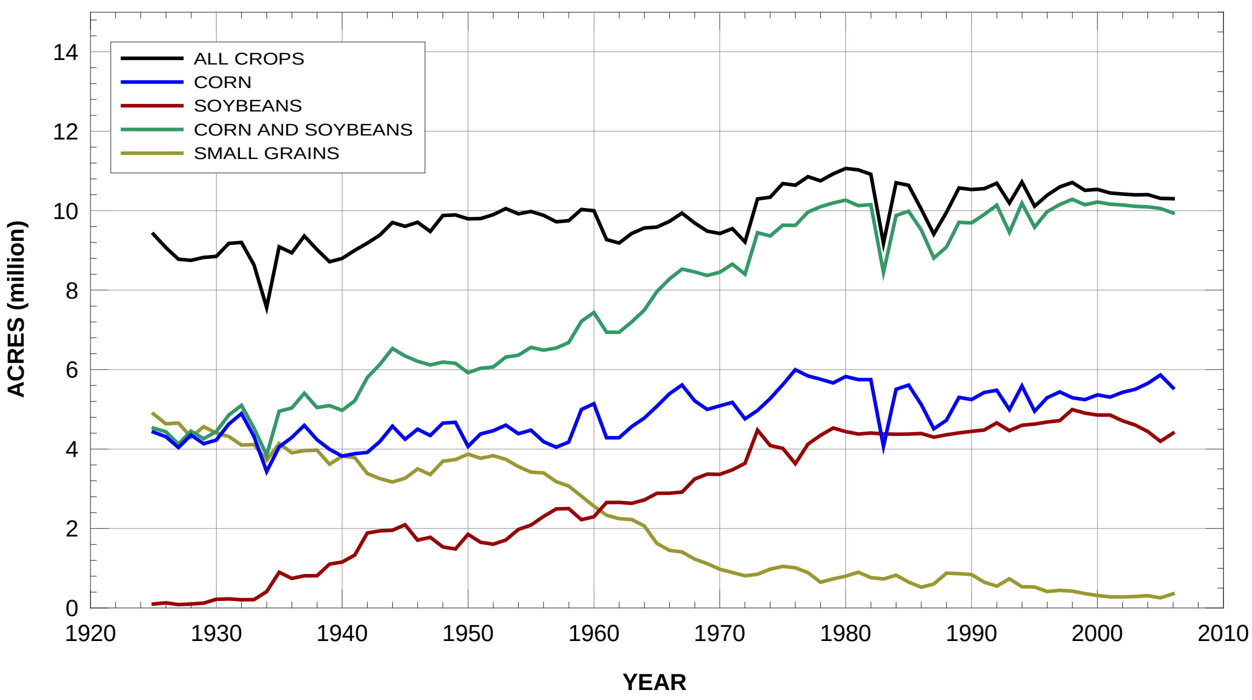


Figure 3-6. Acreage of agricultural land uses in Illinois River basin (1925-2006)

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.

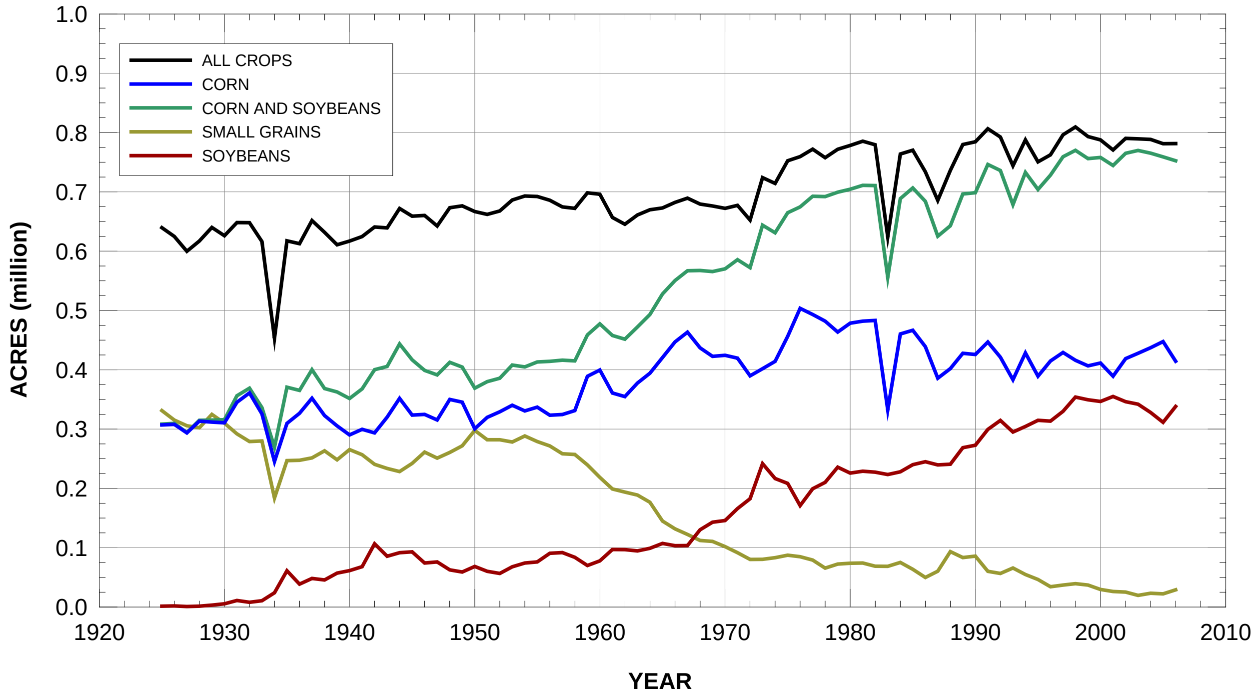


Figure 3-7. Acreage of agricultural land uses in Spoon River watershed (1925-2006)

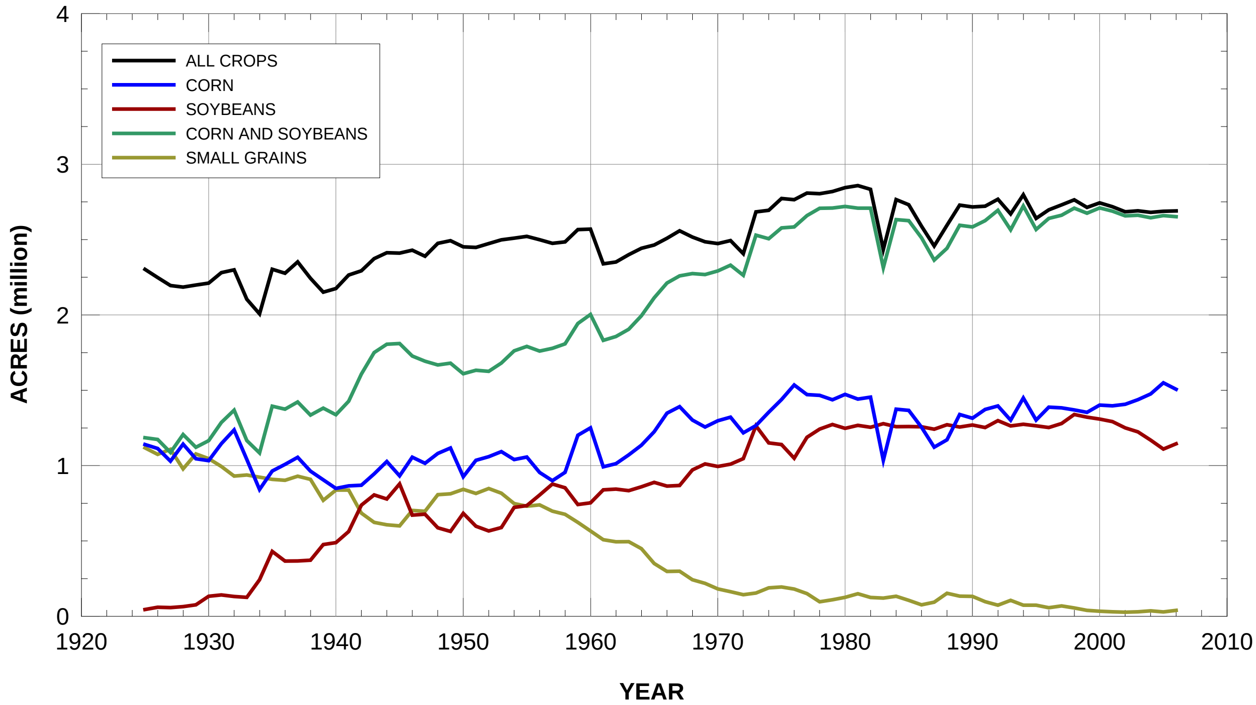


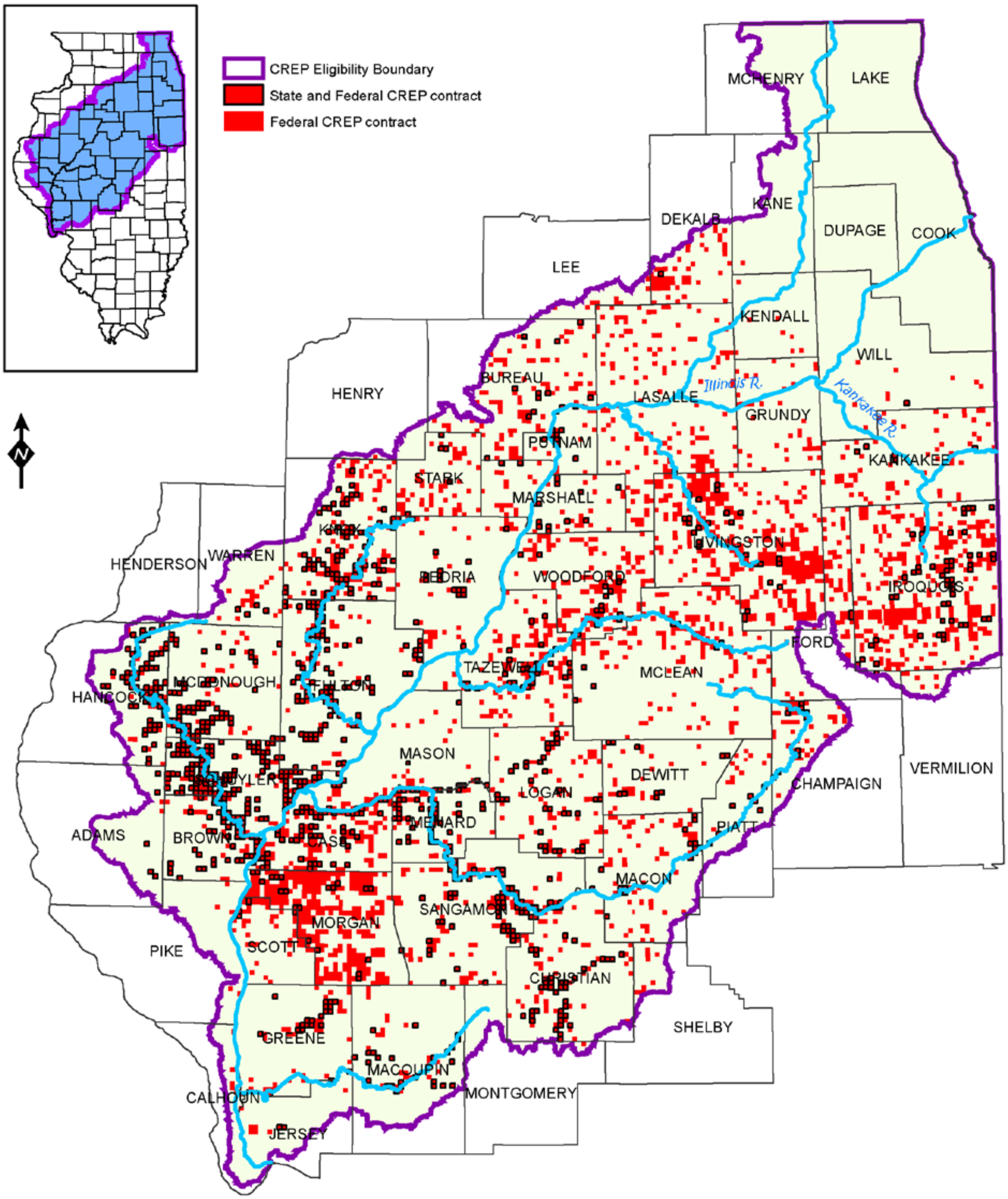
Figure 3-8. Acreage of agricultural land uses in Sangamon River watershed (1925-2006)

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.

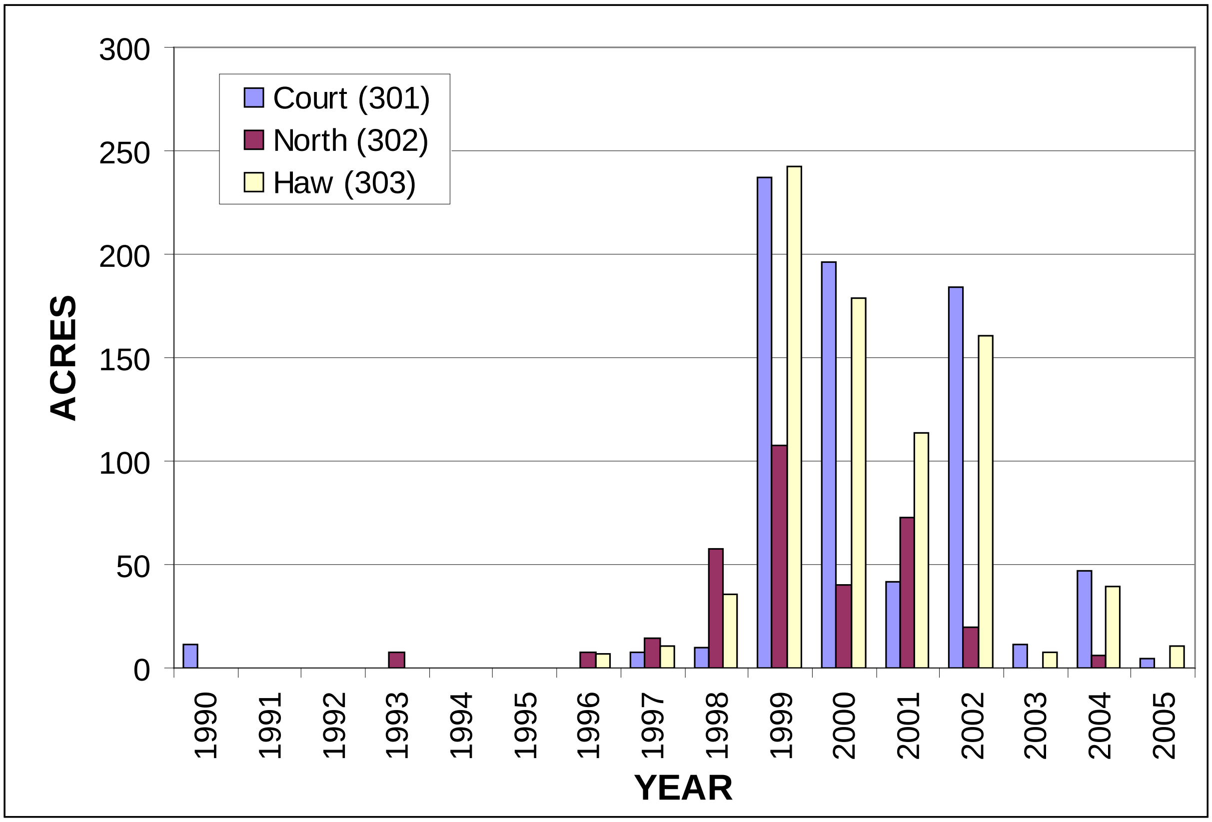


Figure 3-10. Acres of conservation practices installed in Court and Haw Creek watersheds over time

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

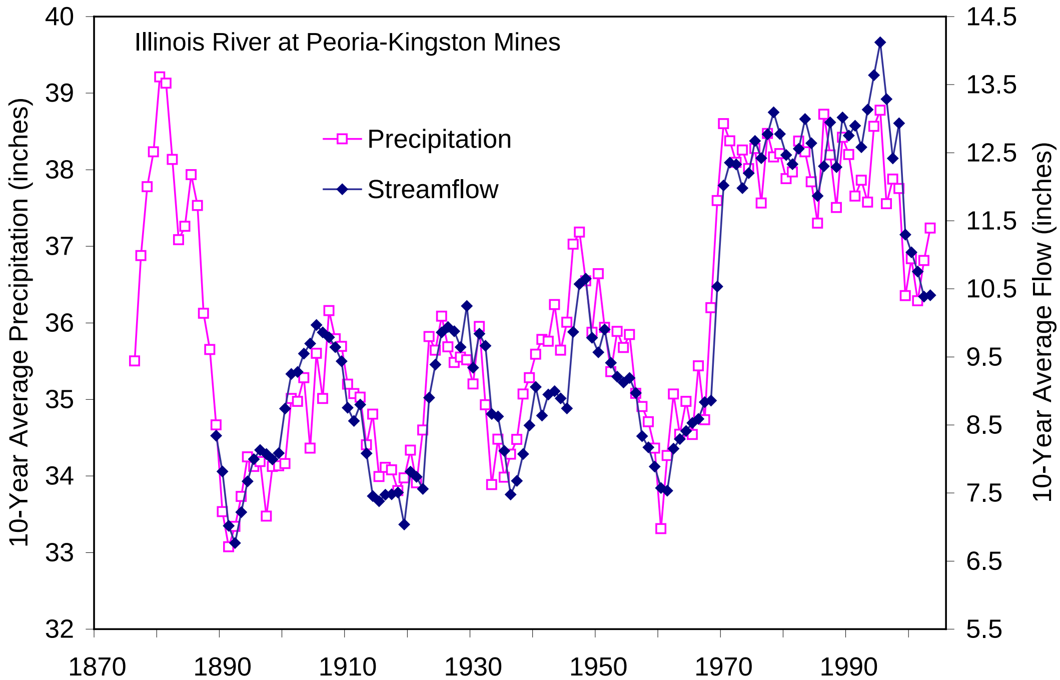


Figure 3-12. Ten-year average precipitation and streamflow,
Illinois River at Peoria-Kingston Mines

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.

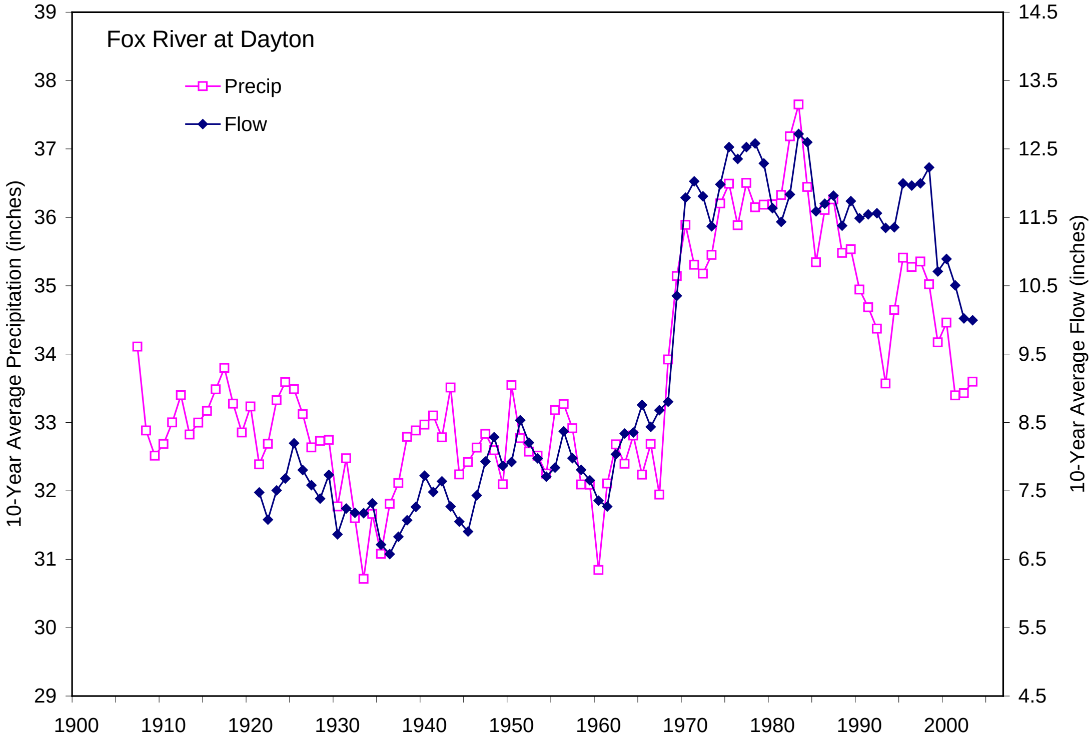


Figure 3-13. Ten-year average precipitation and streamflow, Fox River at Dayton

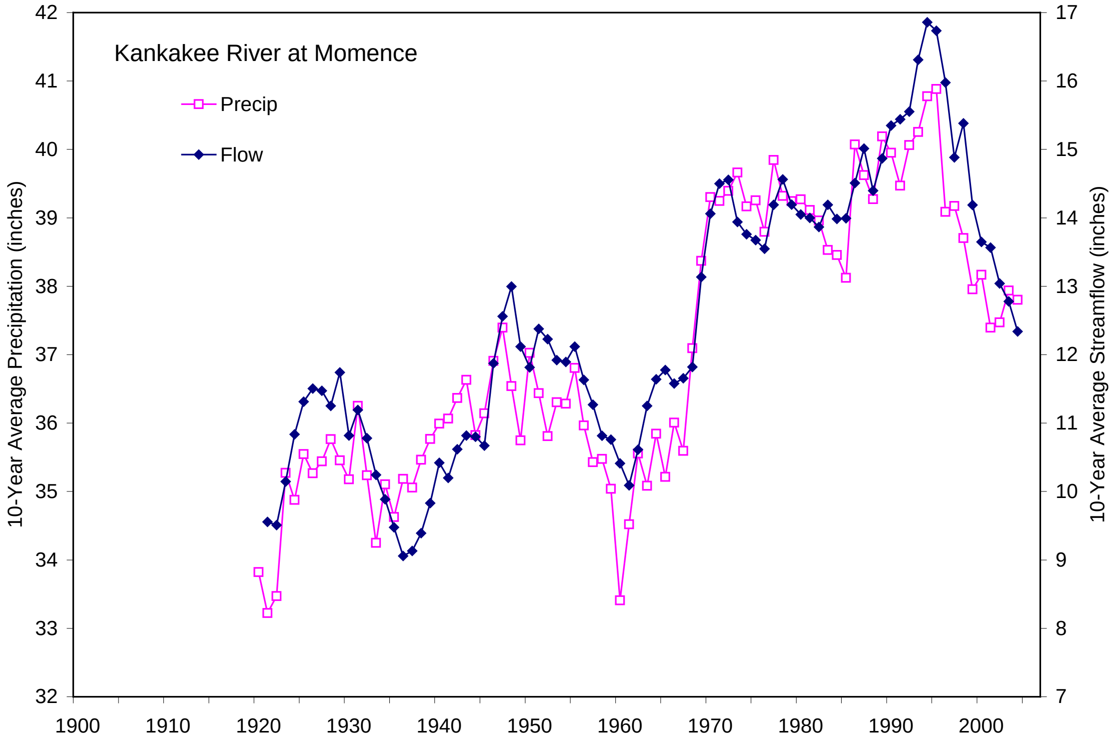


Figure 3-14. Ten-year average precipitation and streamflow, Kankakee River at Momence

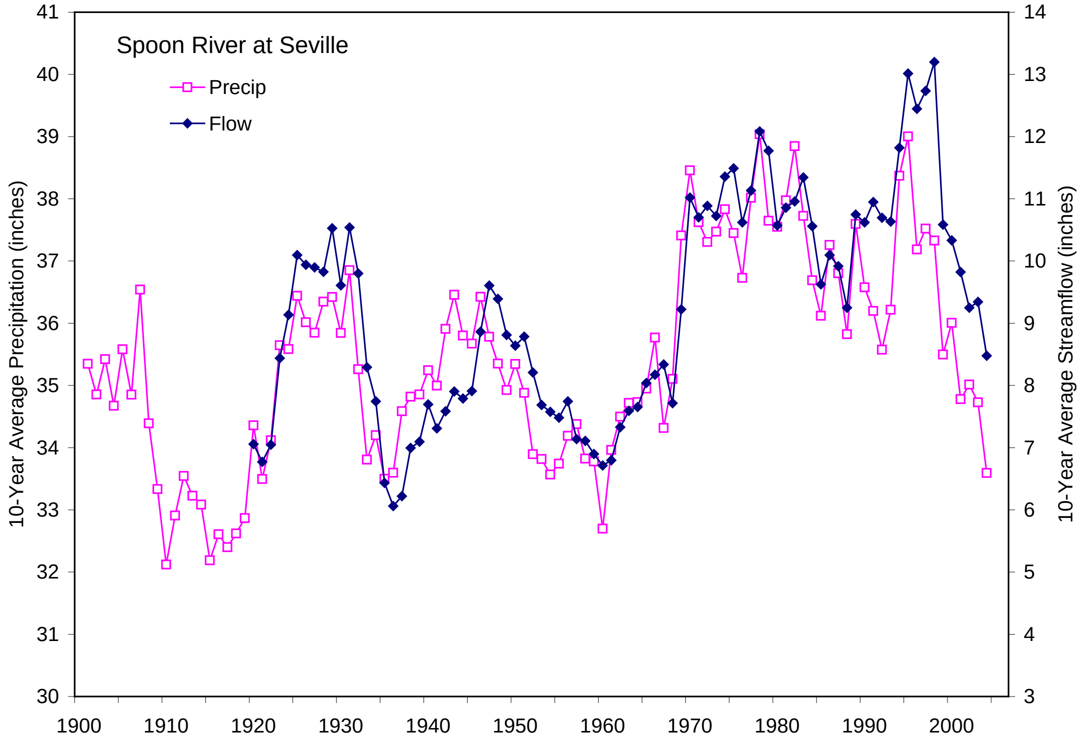


Figure 3-15. Ten-year average precipitation and streamflow, Spoon River at Seville

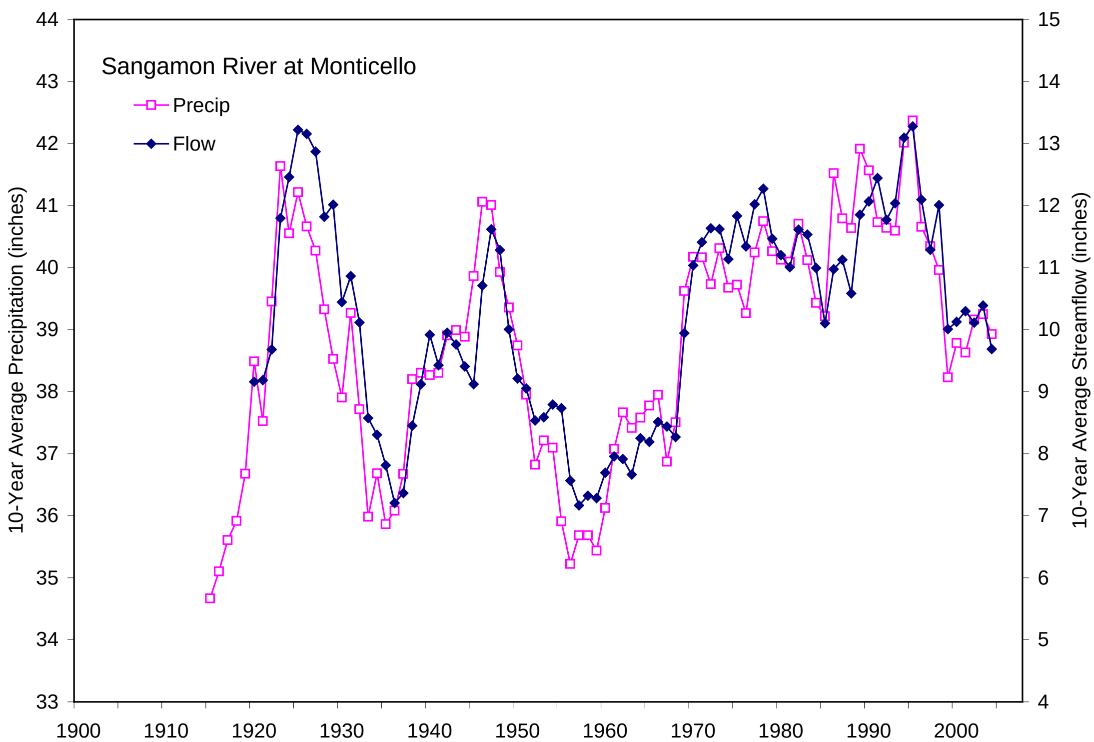


Figure 3-16. Ten-year average precipitation and streamflow, Sangamon River at Monticello

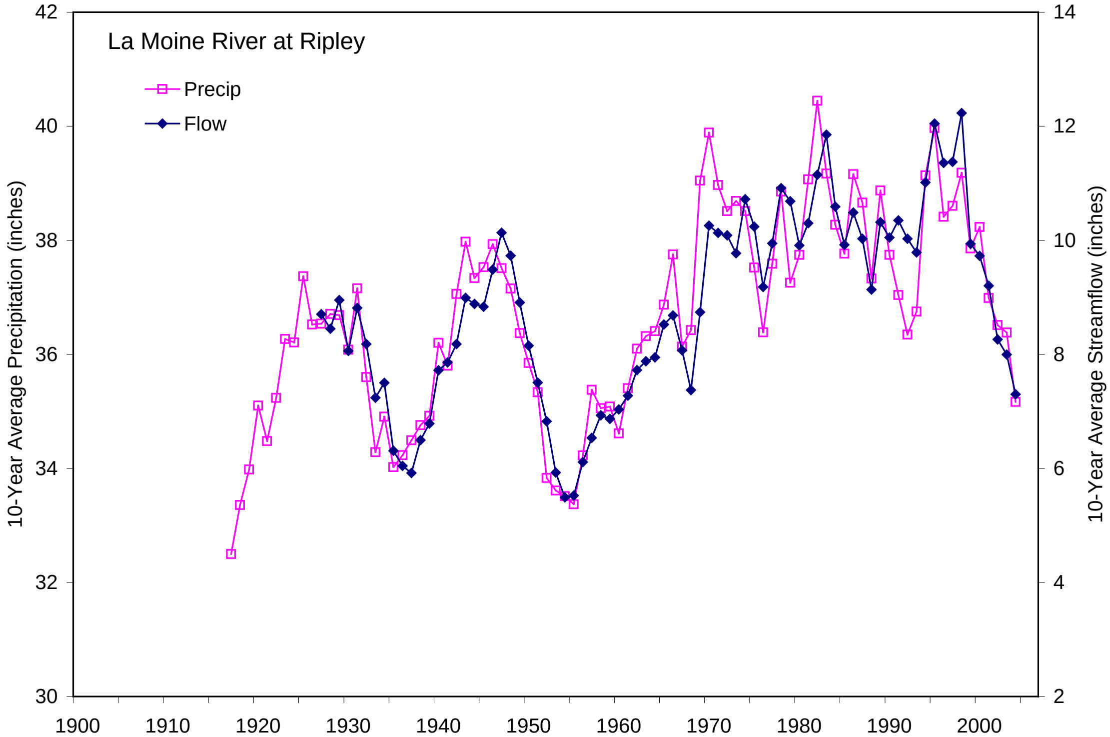


Figure 3-17. Ten-year average precipitation and streamflow, LaMoine River at Ripley

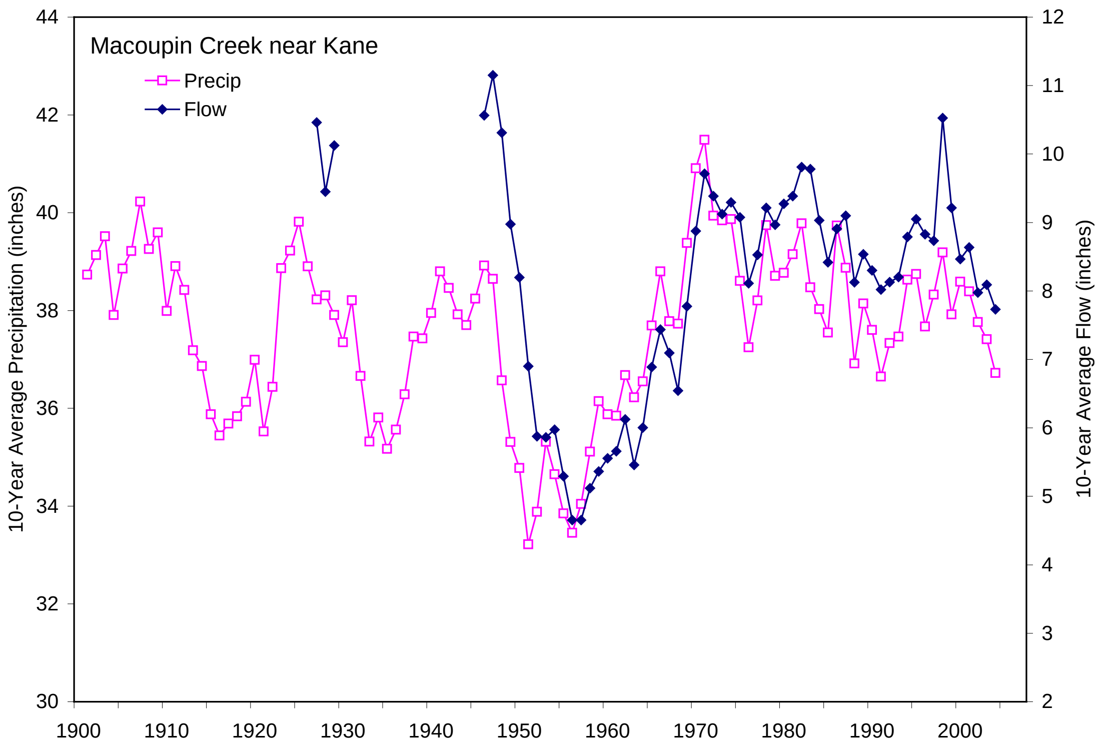


Figure 3-18. Ten-year average precipitation and streamflow, Macoupin Creek near Kane

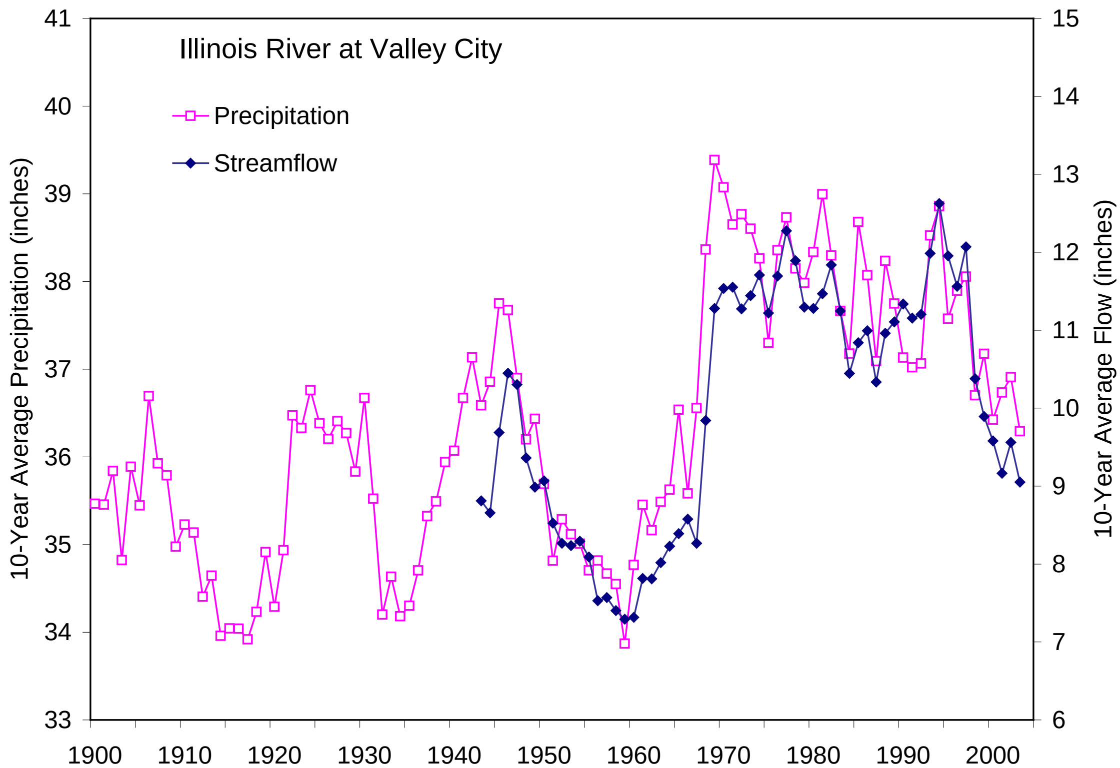


Figure 3-19. Ten-year average precipitation and streamflow, Illinois River at Valley City

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

Upper Fox
Des Plaines
Chicago/Calumet
Lower Fox
Kankakee
Upper Illinois
Spoon
Mackinaw
Vermilion
Iroquois
La Moine
Salt Fork Sangamon
Lower Sangamon
Upper Sangamon
Lower Illinois
South Fork Sangamon
Macoupin
Major Rivers
Spoon Watershed
Watershed Boundaries
Illinois River Basin
State of Illinois

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.

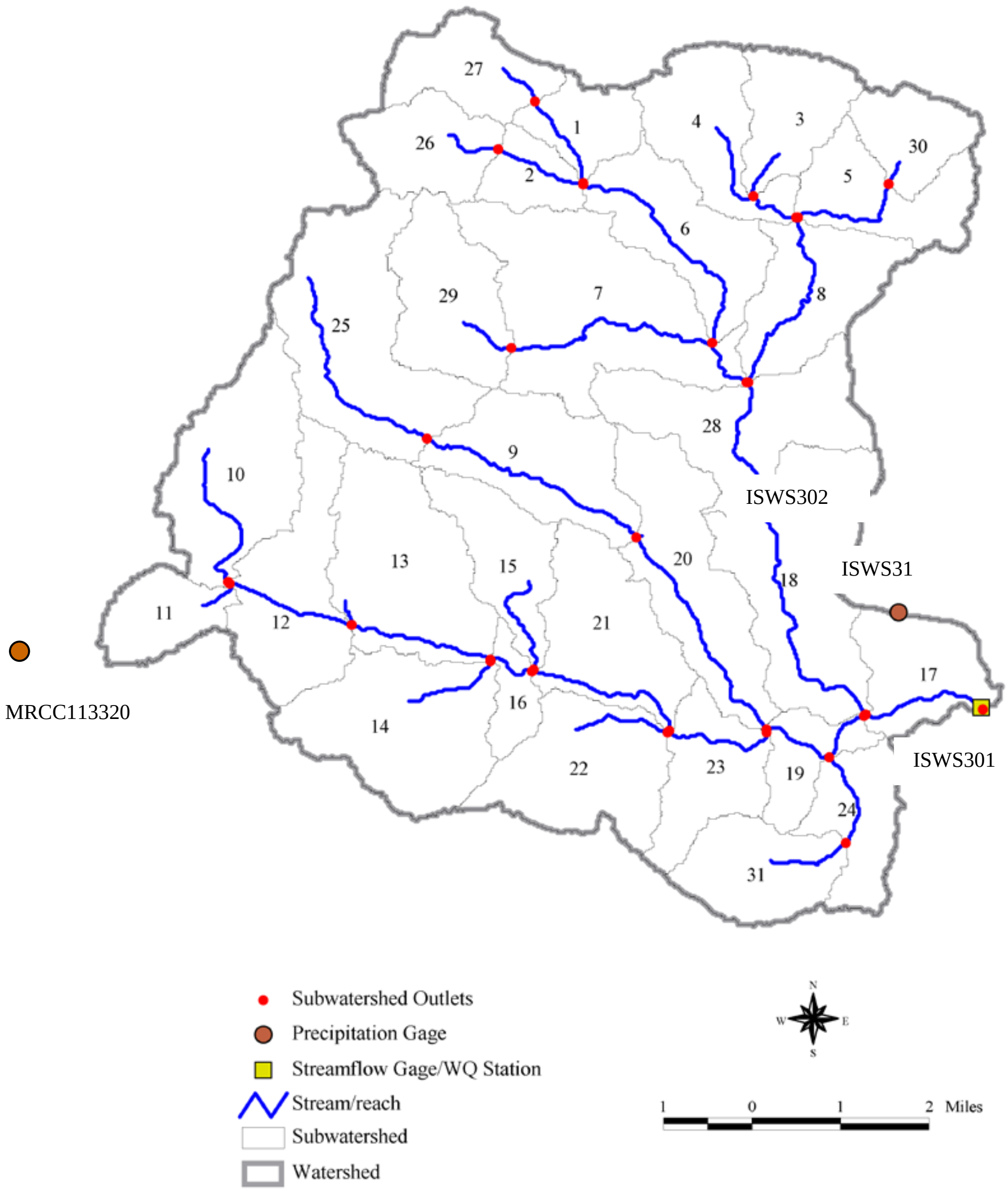


Figure 4-2. Schematic of the subwatershed and stream delineation, and precipitation gages used for the Haw Creek model

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

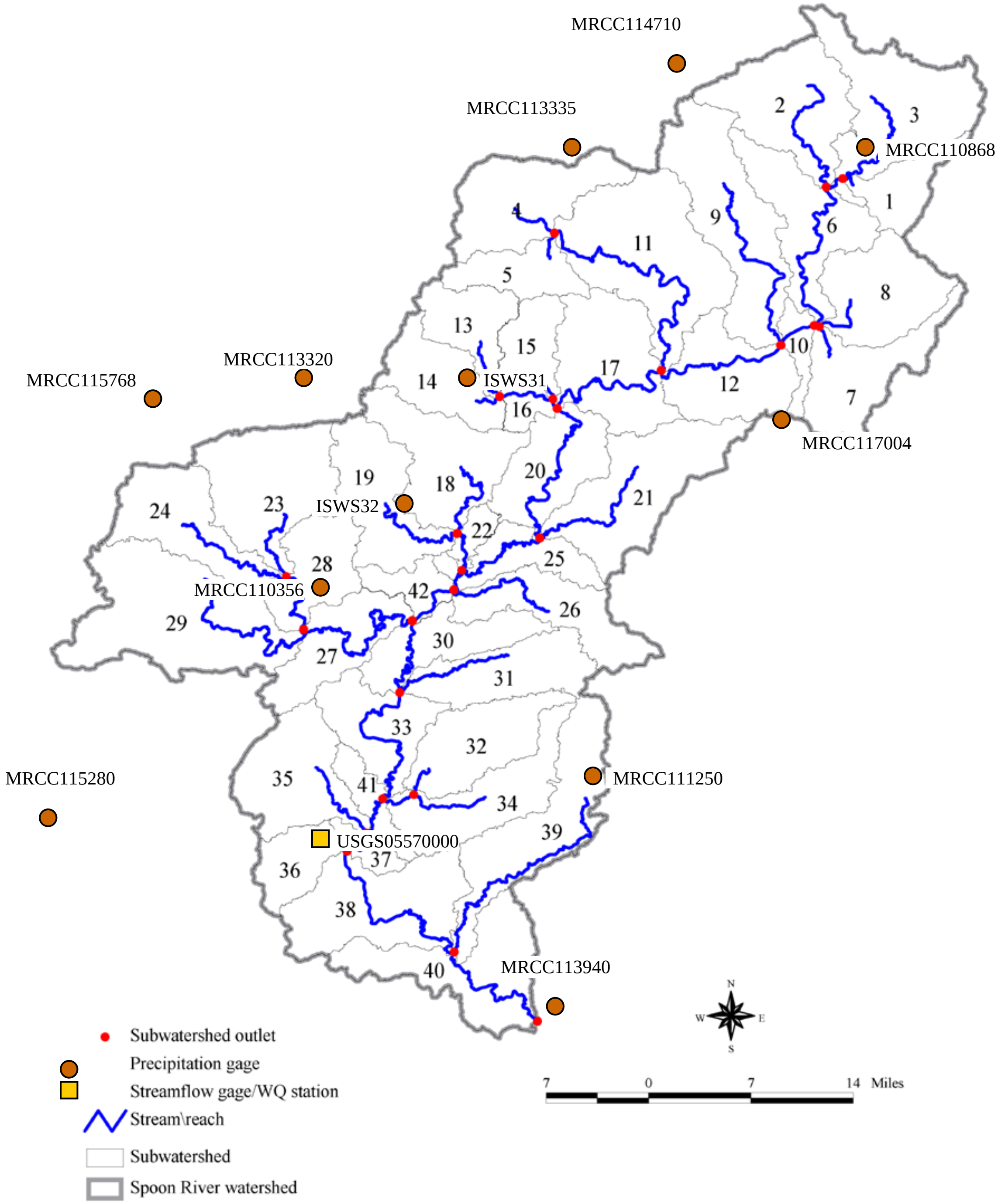


Figure 4-4. Schematic of the subwatershed and stream delineation, and precipitation gages used for the Spoon River watershed model

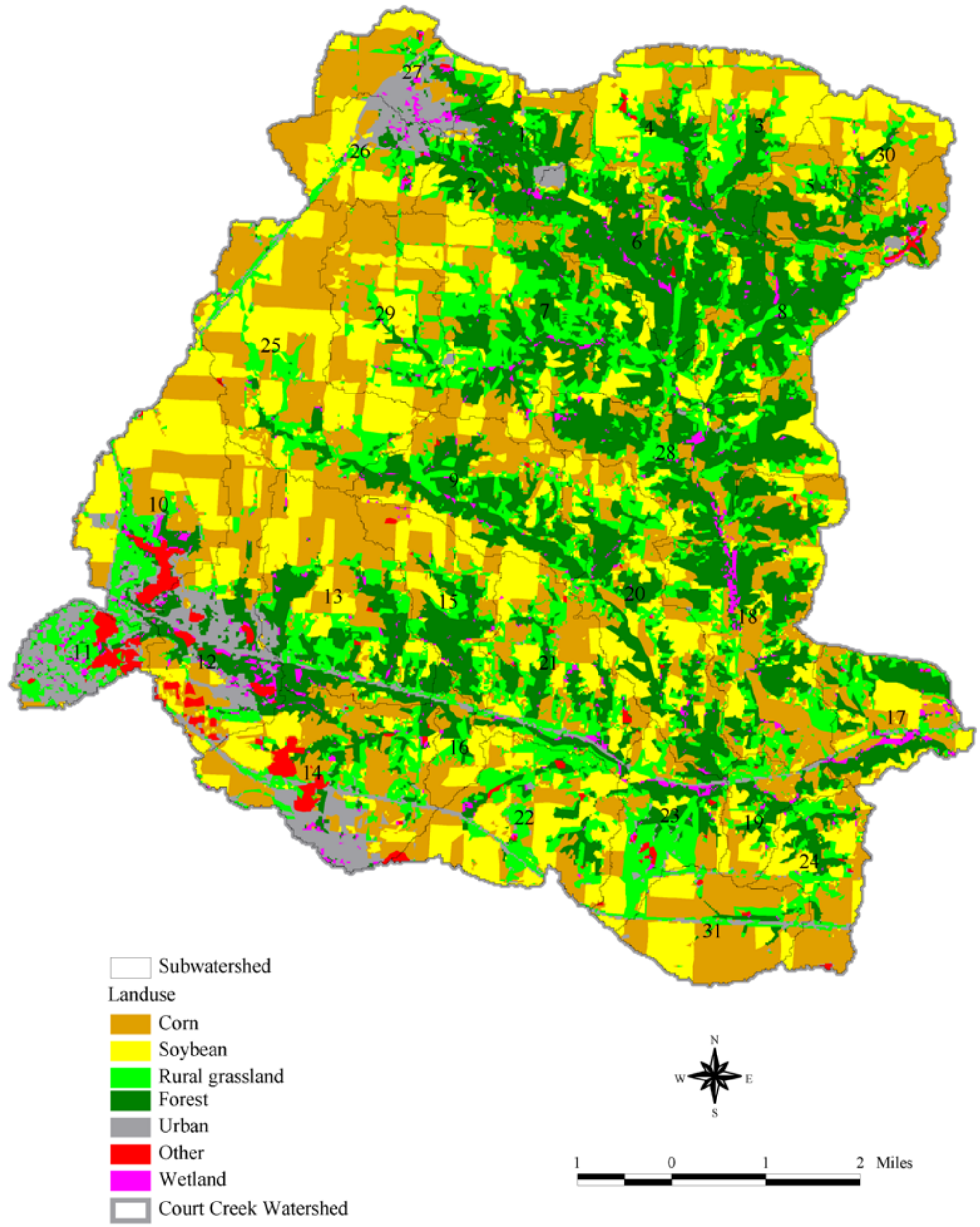


Figure 4-5. Land use in the Court Creek watershed

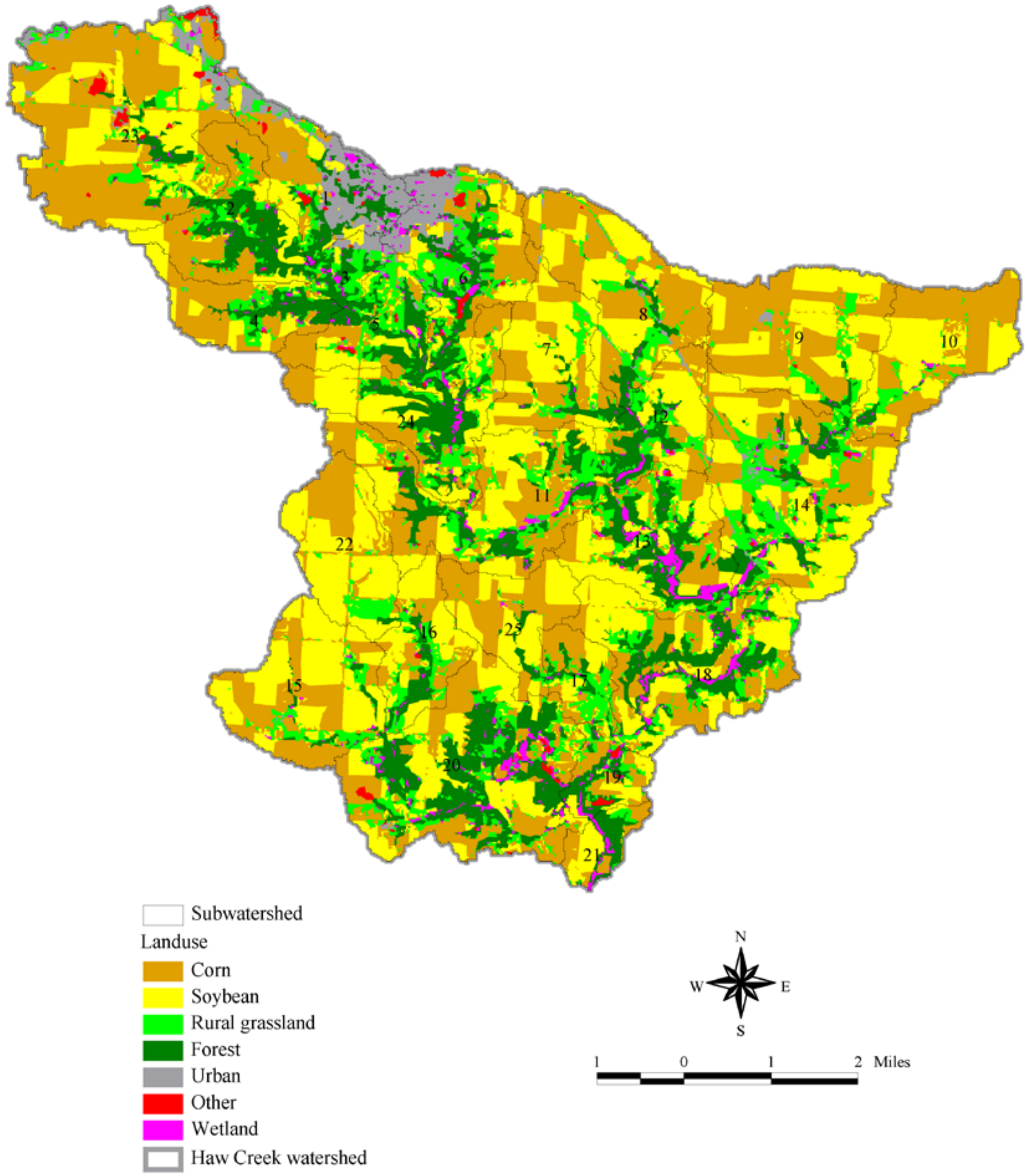


Figure 4-6. Land use in the Haw Creek watershed

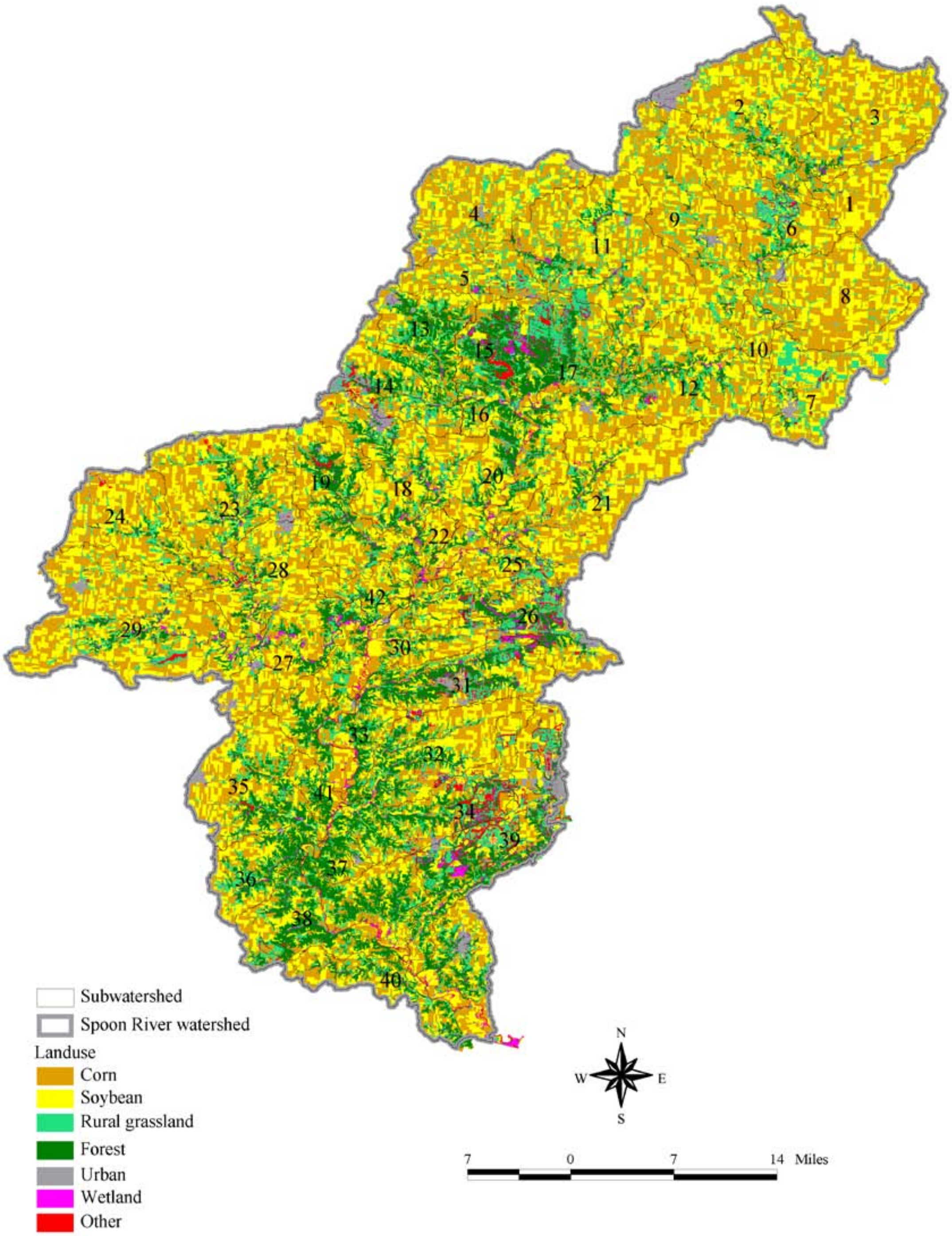


Figure 4-7. Land use in the Spoon River watershed

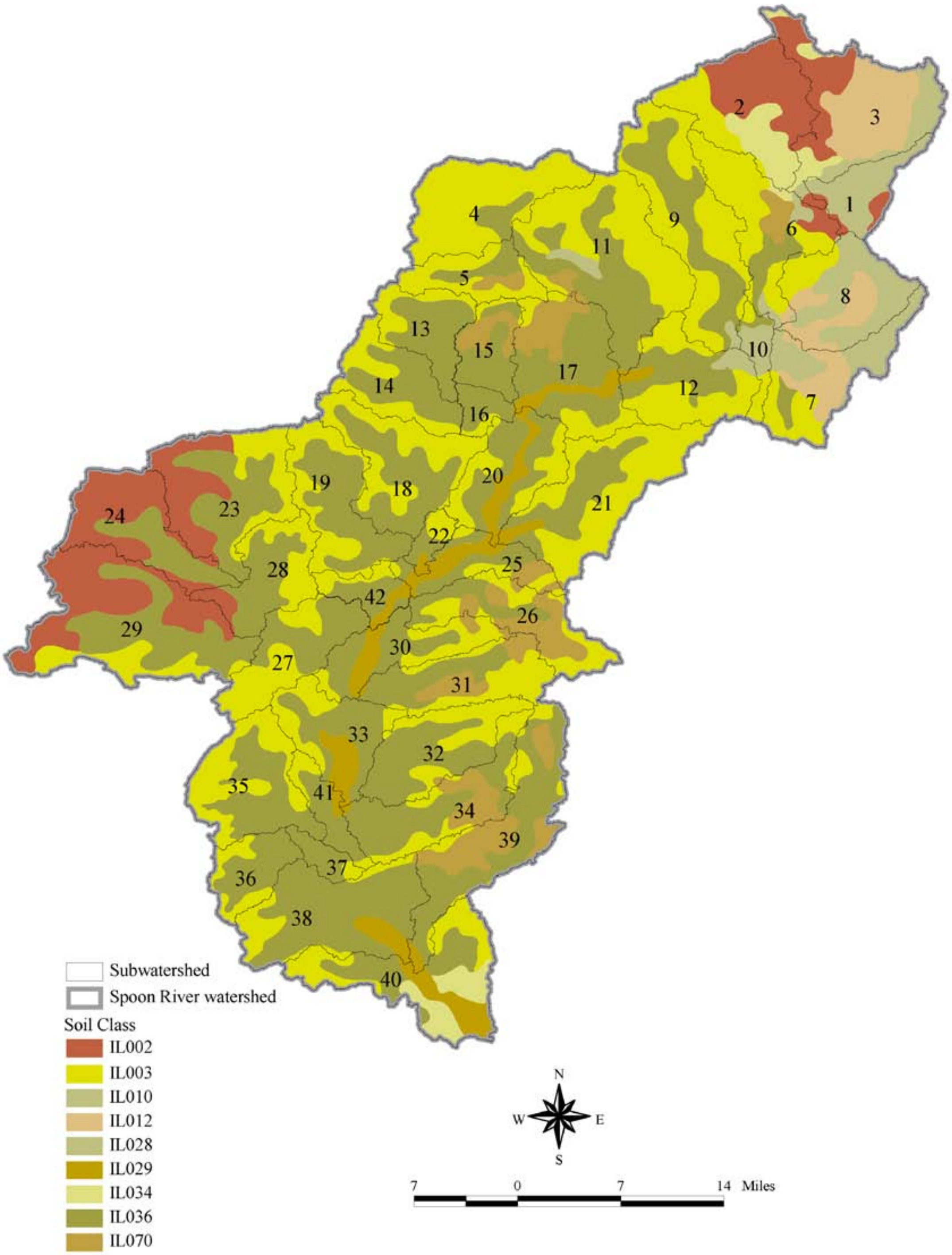


Figure 4-8. Soil types in the Spoon River watershed

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.

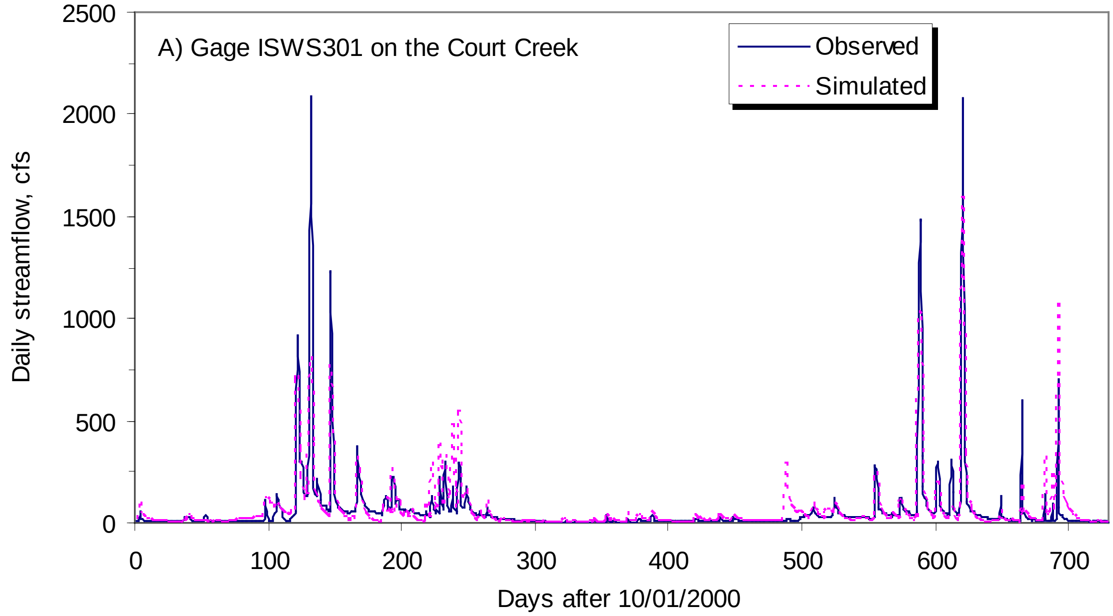
Modeling Results

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.



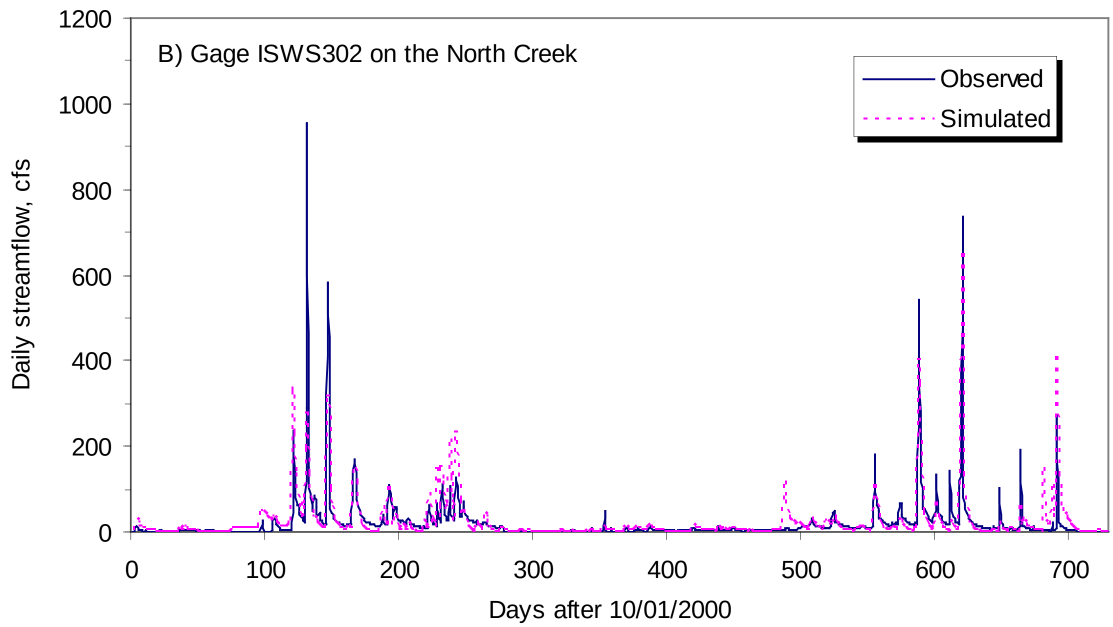
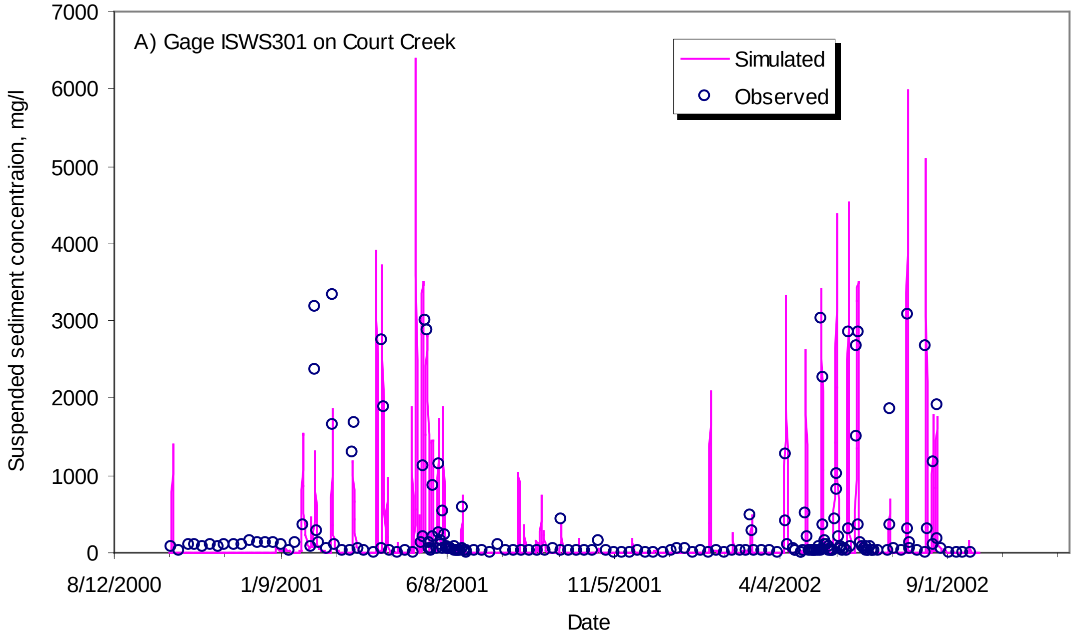


Figure 4-9. Results of model calibration for streamflow simulation for the Court Creek watershed



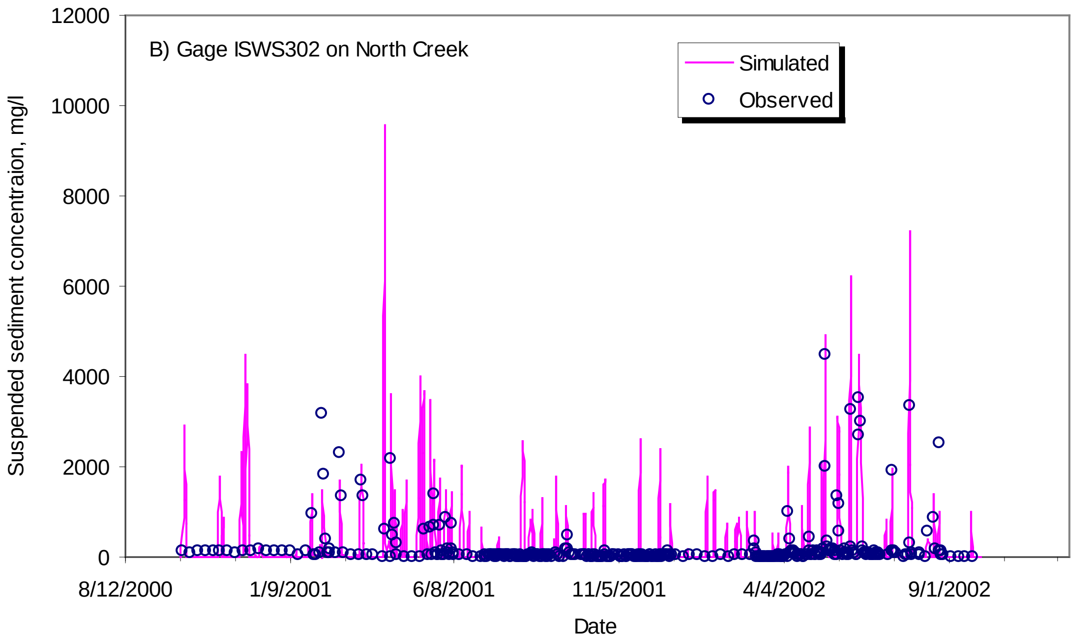


Figure 4-10. Preliminary results of model calibration for suspended sediment concentration simulation for the Court Creek watershed

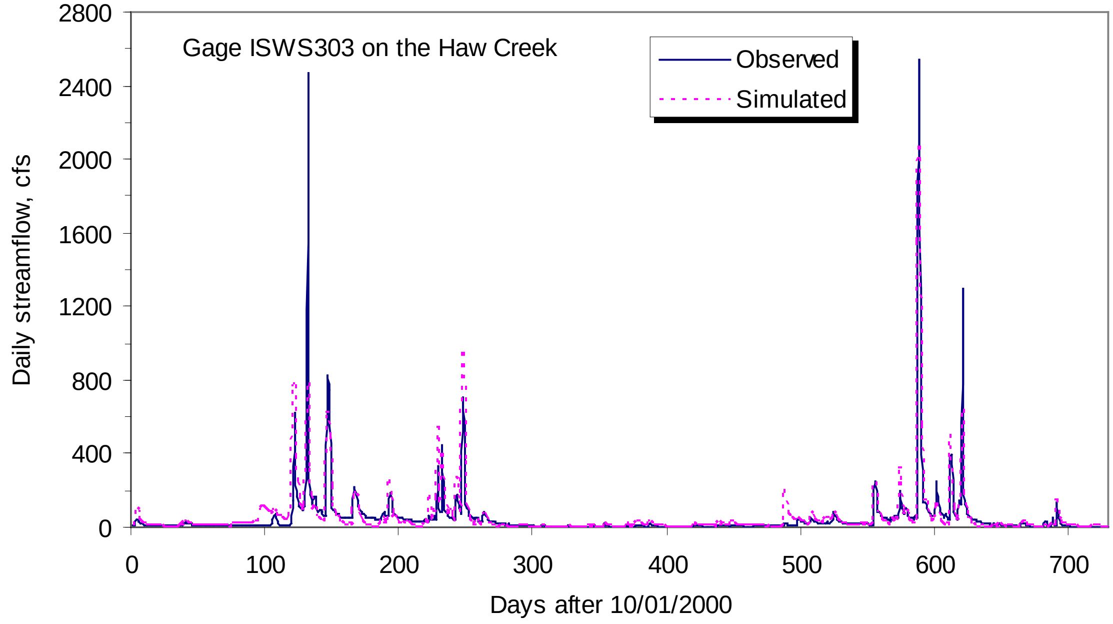


Figure 4-11. Comparison of observed and simulated streamflow by the Haw Creek watershed model developed using the calibrated parameters from the Court Creek watershed model

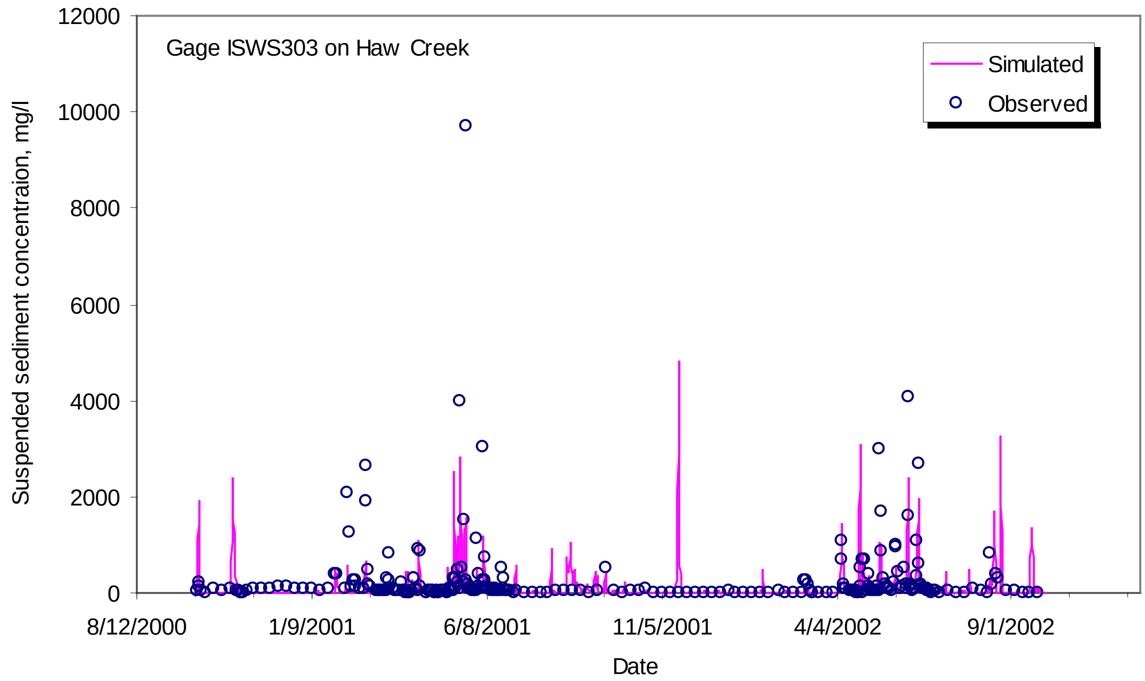


Figure 4-12. Preliminary results for suspended sediment concentration from the Haw Creek watershed model developed using the calibrated parameters from the Court Creek watershed model

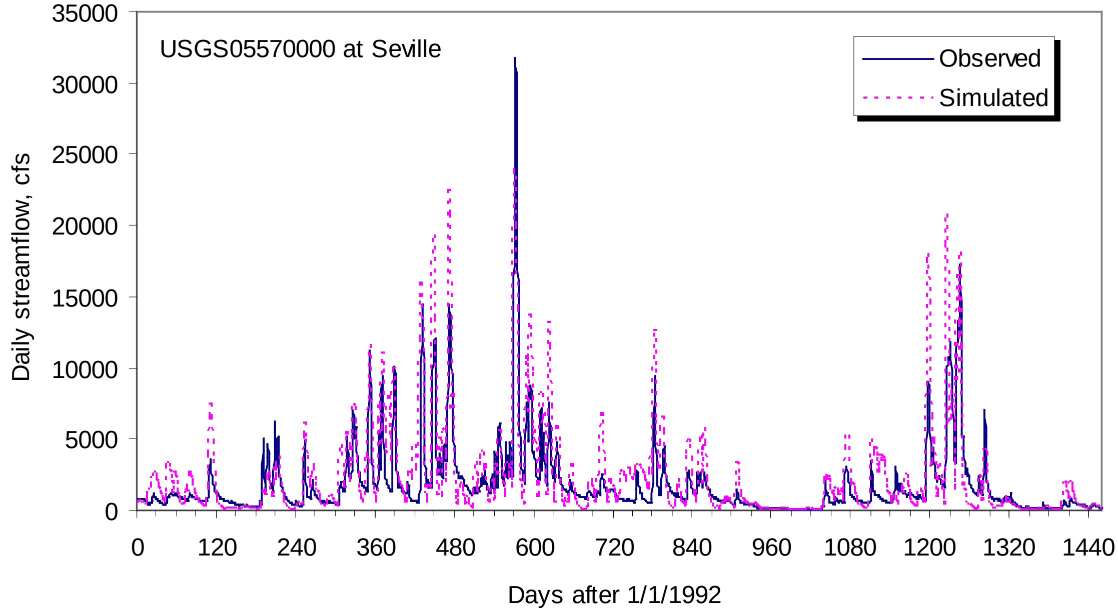


Figure 4-13. Comparison of observed and simulated streamflow simulation by the Spoon River watershed model developed using the calibrated parameters from the Court Creek watershed model

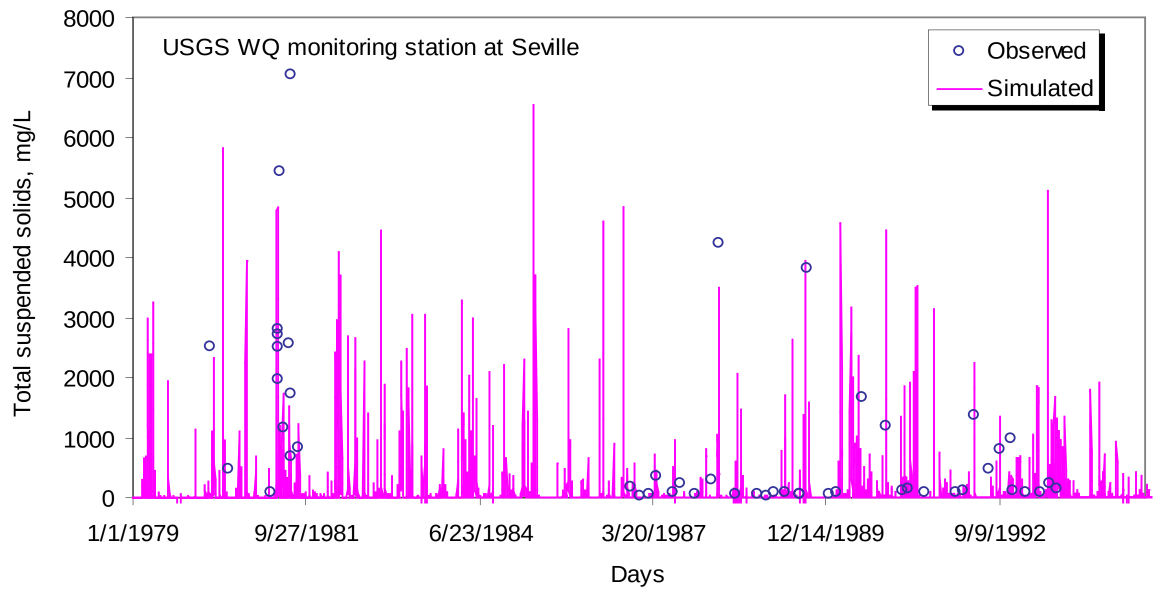


Figure 4-14. Preliminary results for suspended sediment concentration from the Spoon River watershed model developed using the calibrated parameters from the Court Creek watershed model

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 eight 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 wet year 2002 stands out as the year with the highest yield, the general trend for most stations is a gradual decrease, except for station 2002. Again, these are short term trends and any major climatic or hydrologic variability in the coming year could change the trends.

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 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

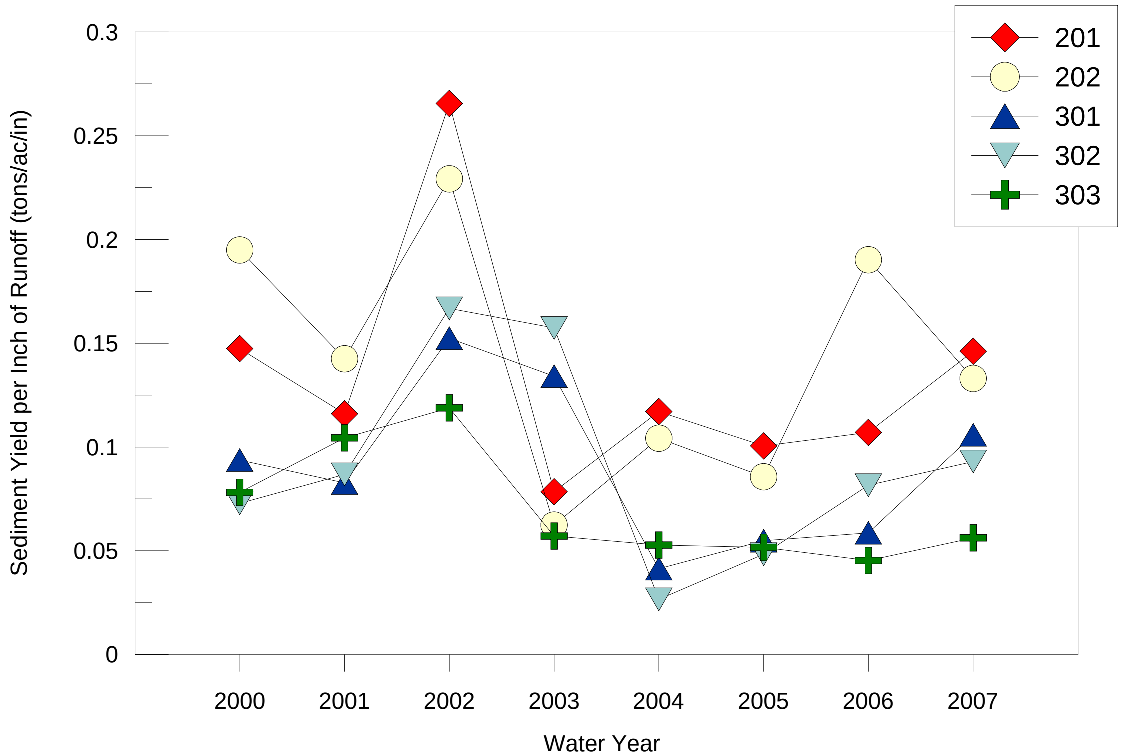


Figure 5-1. Variability of sediment yield per inch of runoff for CREP monitoring stations

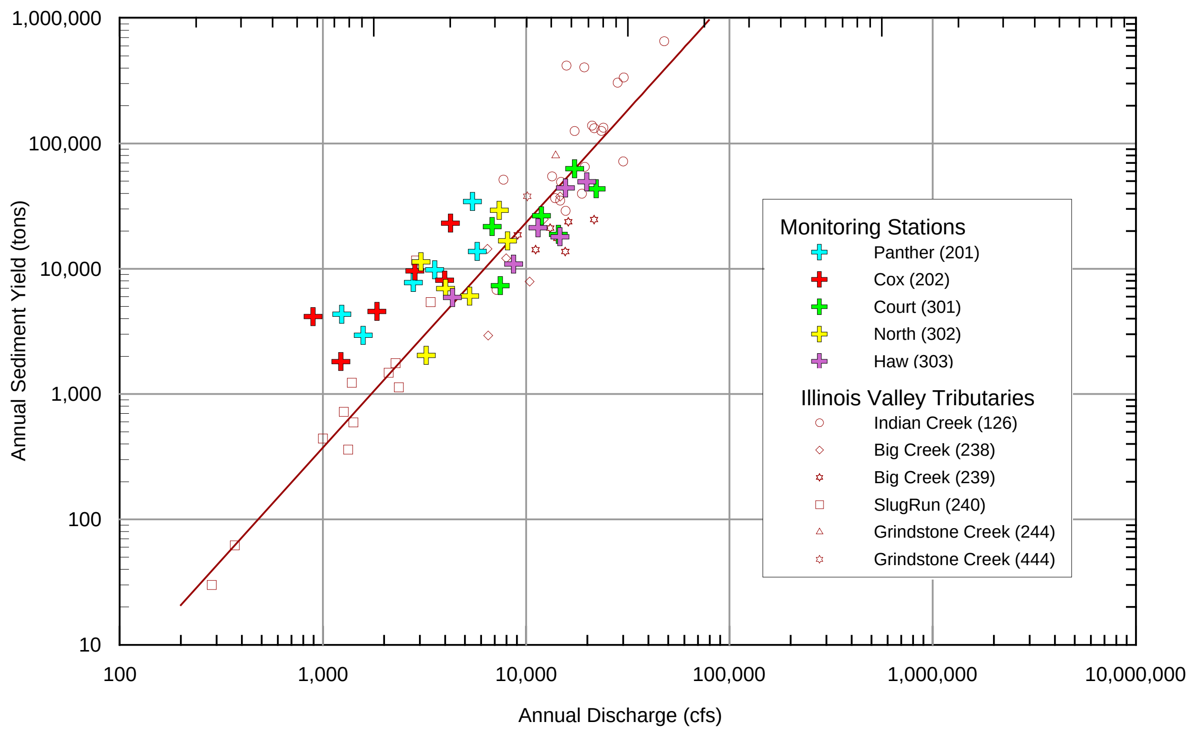


Figure 5-2. Comparison of sediment load from CREP monitoring stations with historical sediment data for small watersheds by the USGS

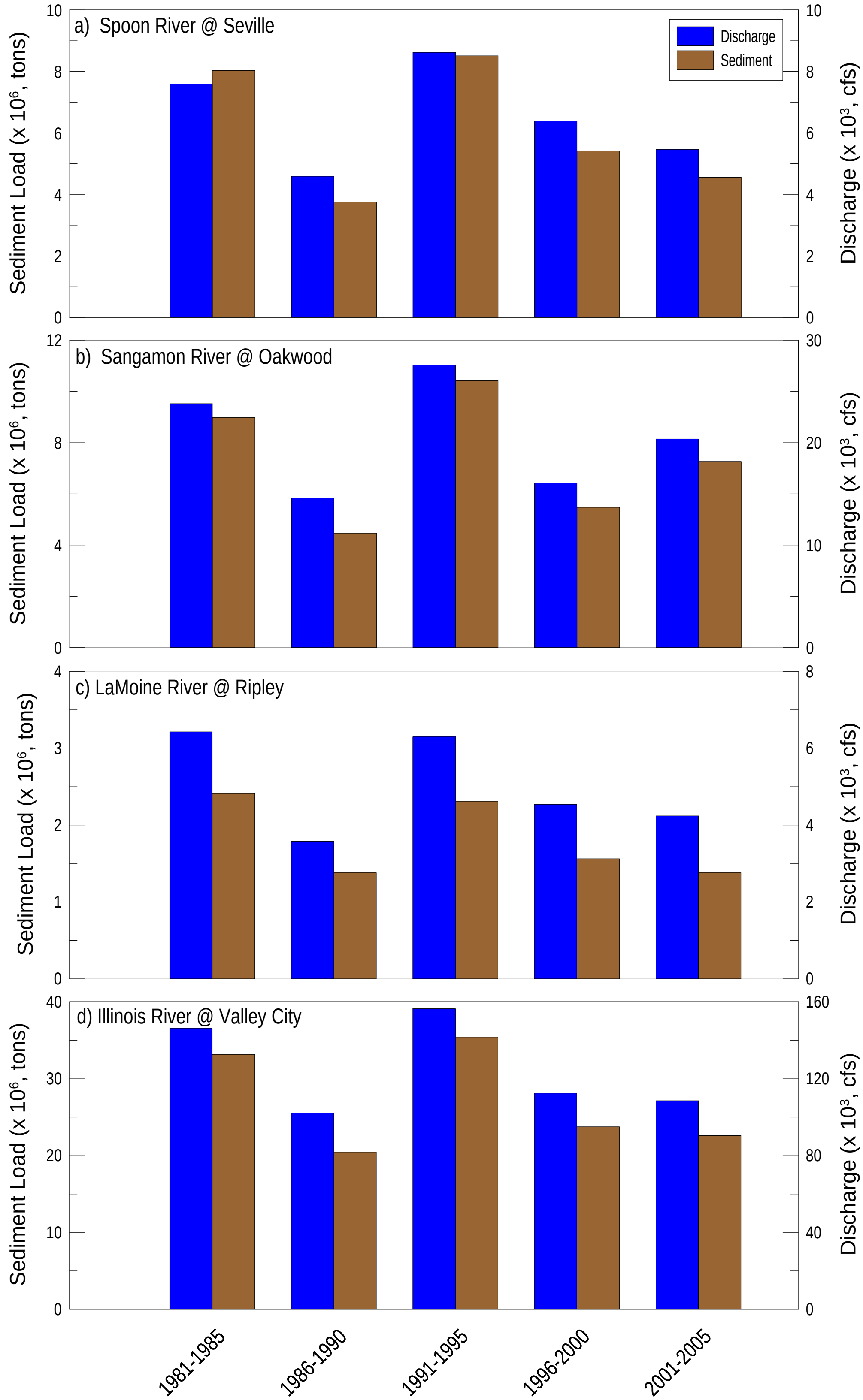


Figure 5-3. Sediment delivery from the three major tributary watersheds to the Illinois River and sediment outflow from the Illinois River at Valley City

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 25 years have been processed and analyzed to observe trends in sediment concentrations and loads (Crowder et al., 2008). 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.

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 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. 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 loads do not show any significant trend except for the jump in yield from 2000 to 2001 for stations 201 and 202. Figure 5-8 shows a slight decreasing trend for total phosphorous similar to the one observed for sediment.

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.

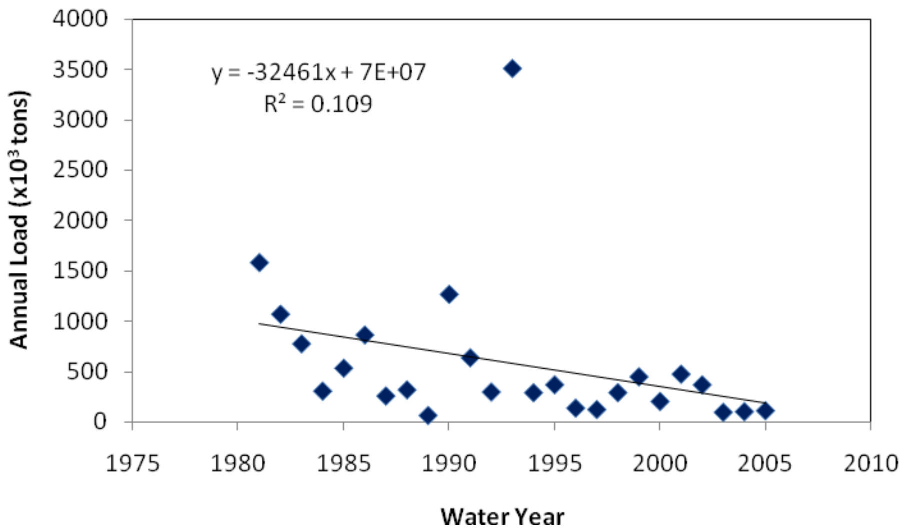


Figure 5-4. Trends in sediment load at Spoon River at London Mills (after Crowder et al., 2008)

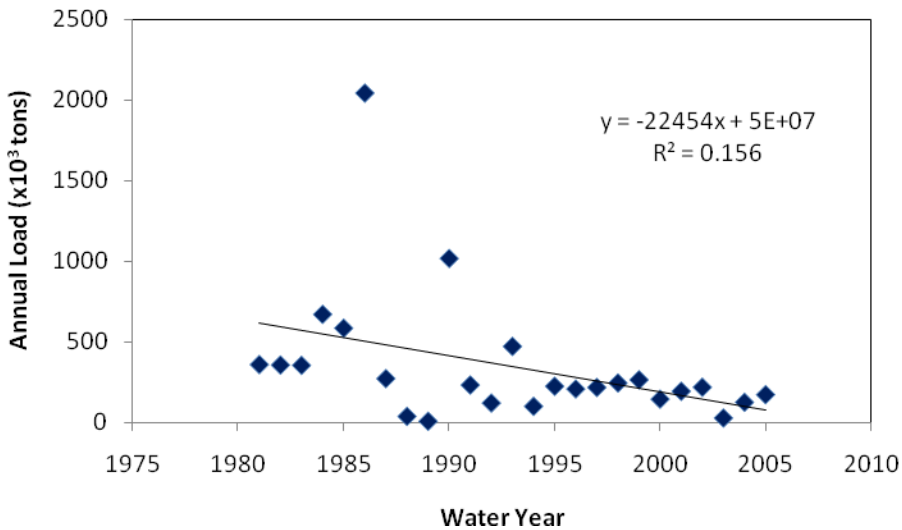


Figure 5-5. Trends in sediment load at LaMoine River at Ripley, IL (after Crowder et al., 2008)

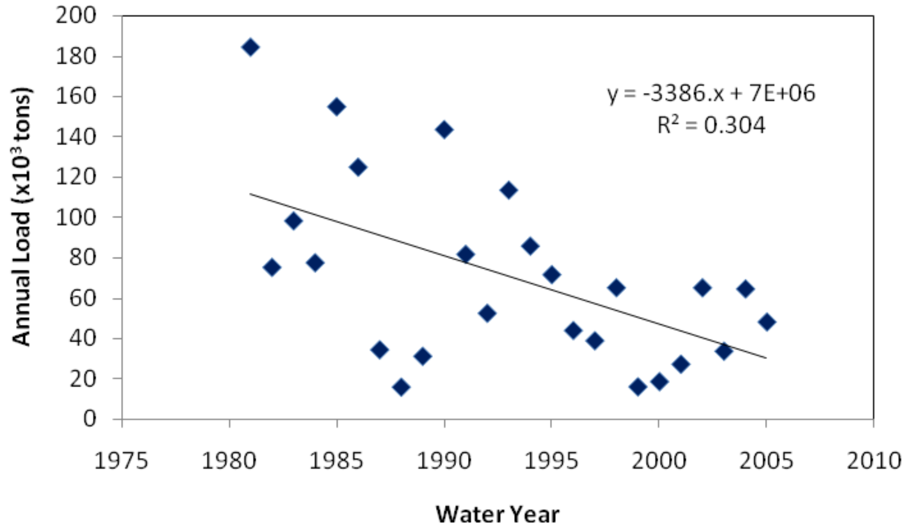


Figure 5-6. Trends in sediment load at Sangamon River at Monticello, IL
(after Crowder et al., 2008)

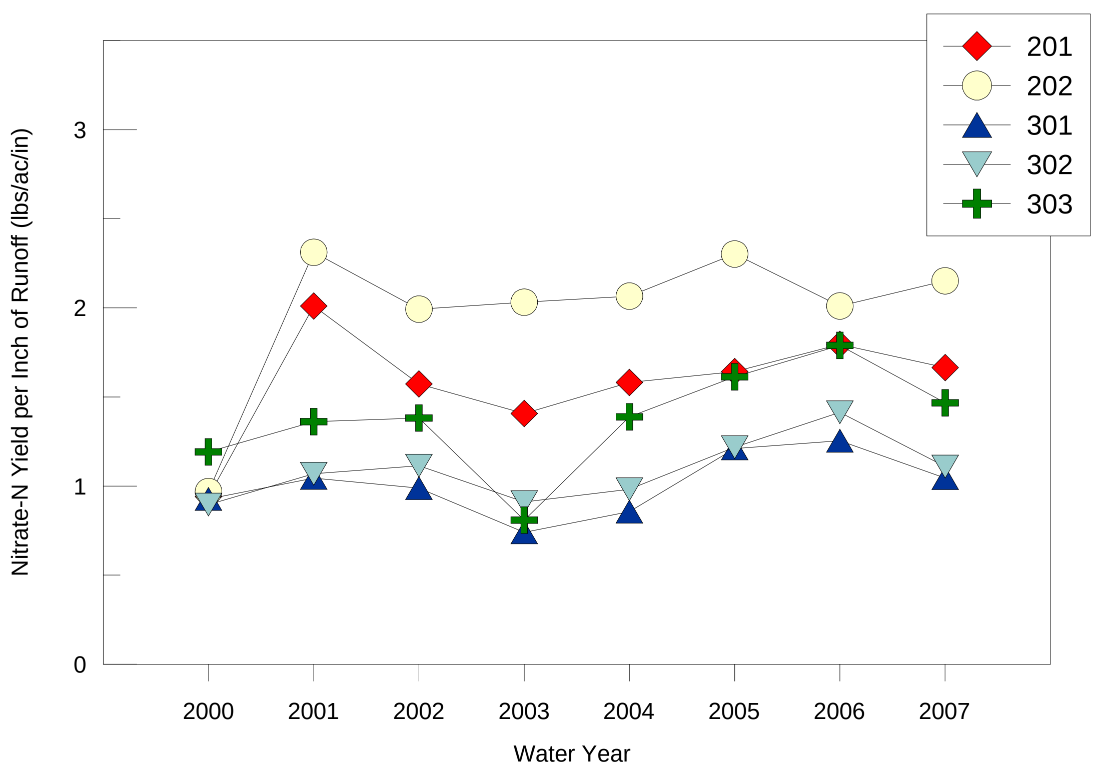


Figure 5-7. Variability of nitrate-N yield per inch of runoff for CREP monitoring stations

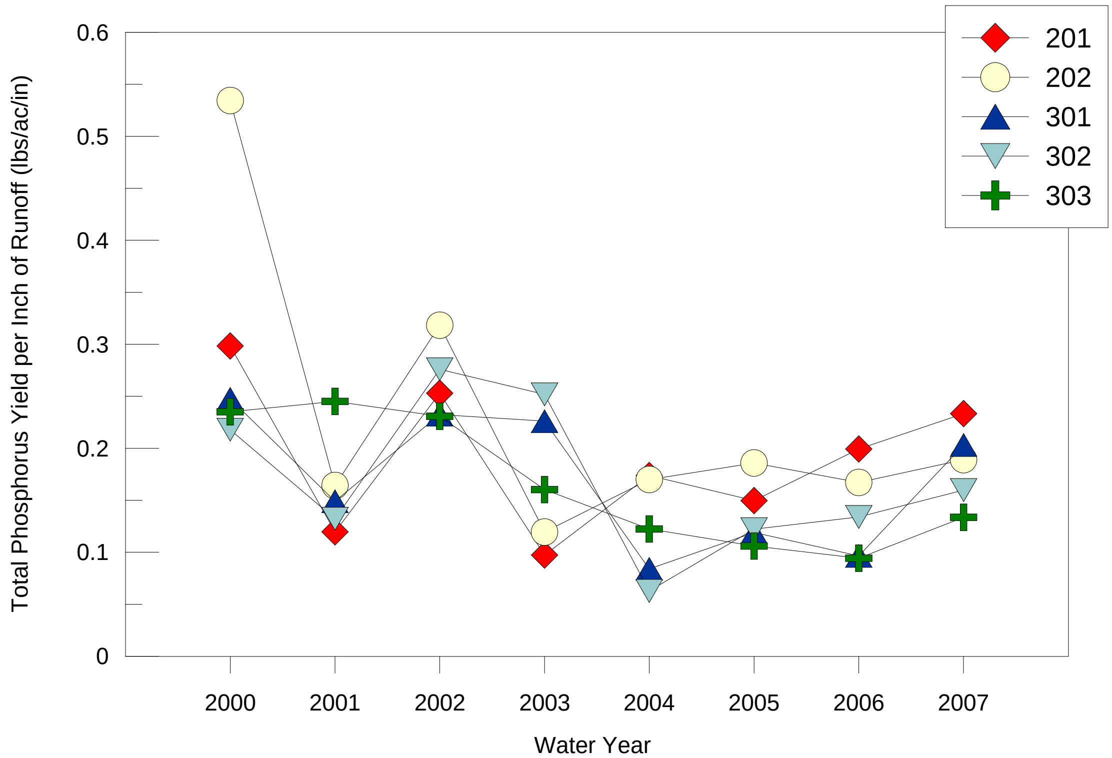


Figure 5-8. Variability of total phosphorous yield per inch of runoff for CREP monitoring stations

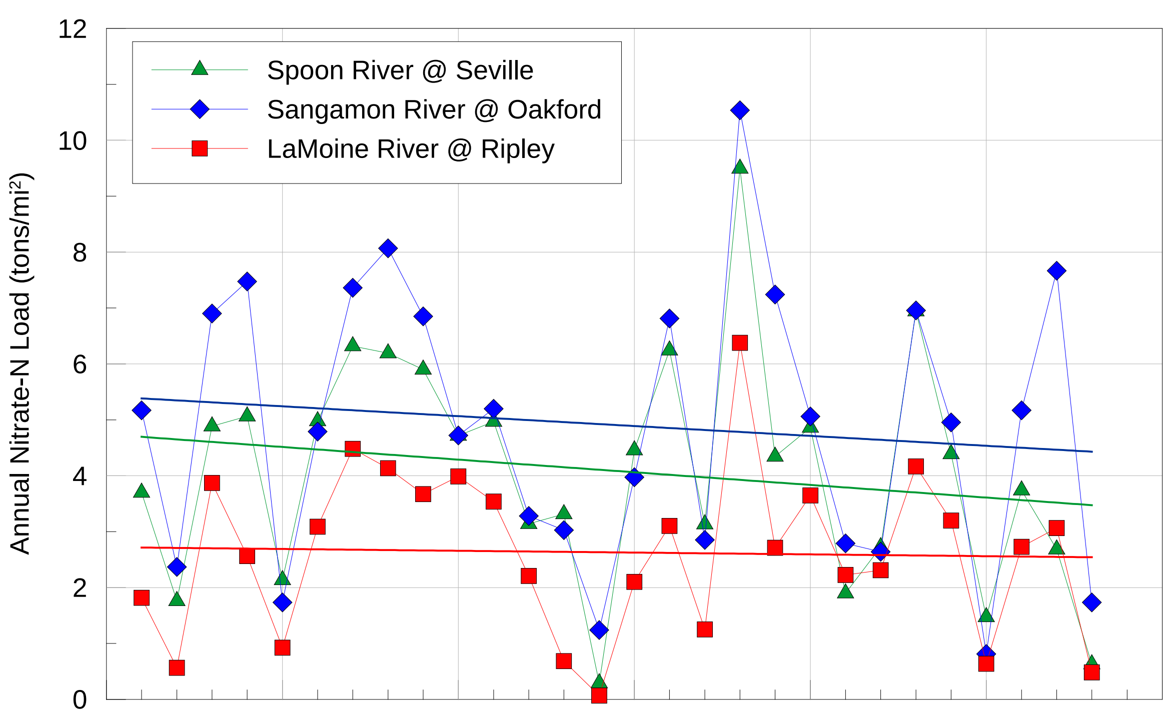


Figure 5-9. Annual nitrate-N loads for the three major tributary watersheds to the Lower Illinois River

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 mi^2 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.

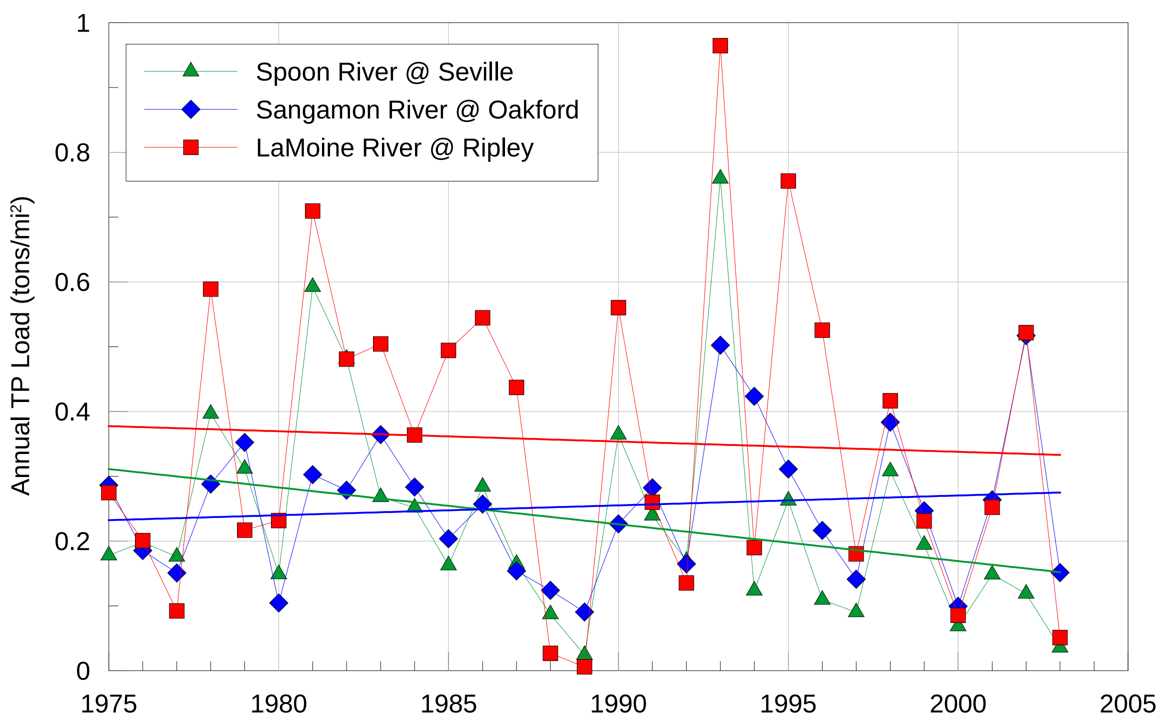


Figure 5-10. Annual total phosphorous loads for the three major tributary watersheds to the Lower Illinois River

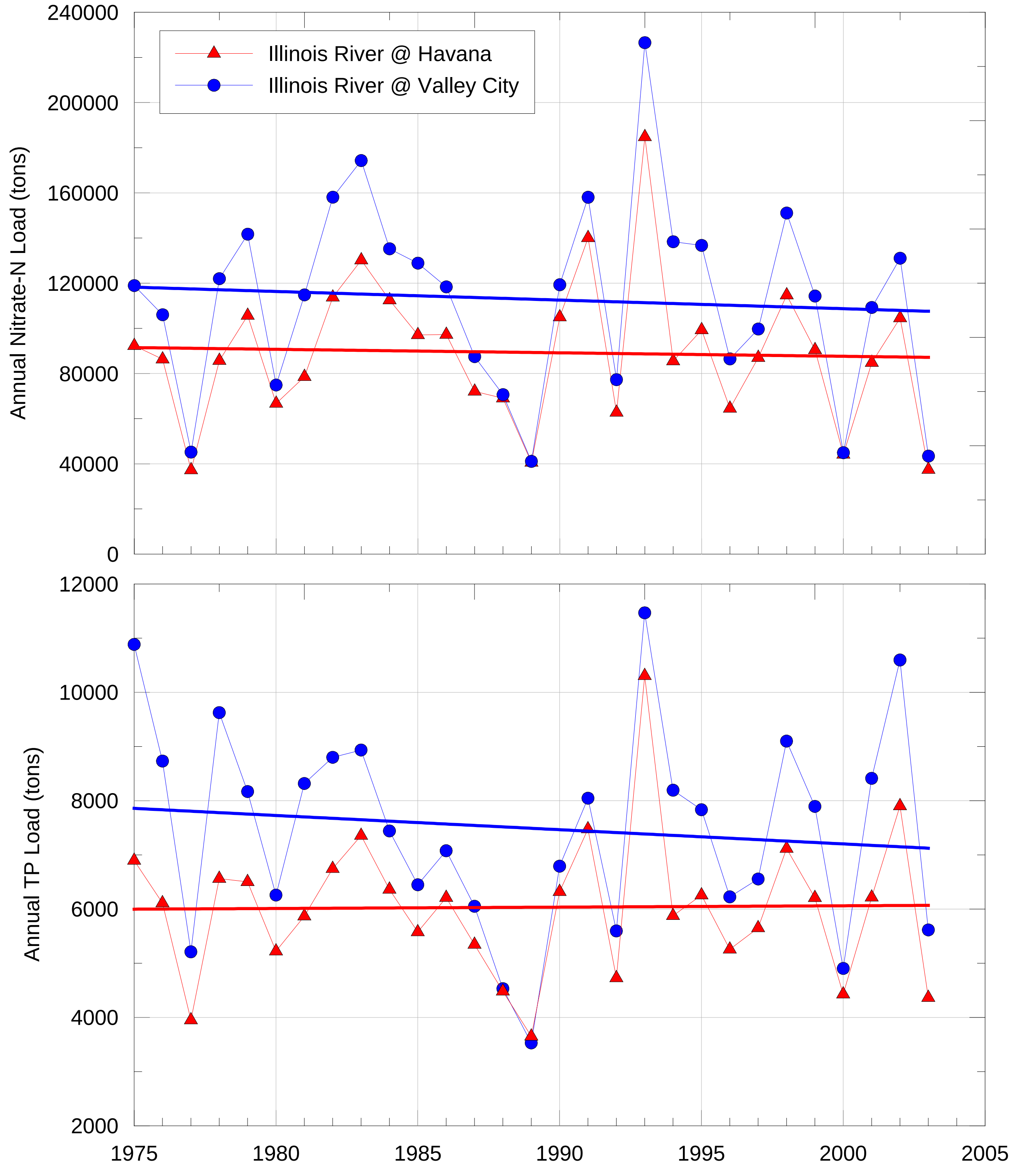


Figure 5-11. Nitrate-N and total phosphorous loads along the Lower Illinois River

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.

7. References

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