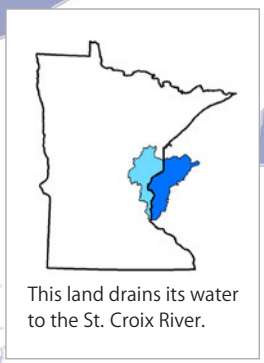
The St. Croix River

Study of the river's health

- From the Minnesota/Wisconsin border to Lake St. Croix

A wild and scenic river in need of continued protection



This land drains its water to the St. Croix River.

Protection crucial: This river faces threats from changes in land use, both different ag practices and expanding urban development, so protection is crucial. Climate change is also a threat.

Healthy biology: The fish and bugs are in good to excellent condition. And this river is one of the few of its size in the United States with a thriving mussel population.

Popular: The St. Croix River is extremely popular because of its high water quality, exceptional recreation, and ease of public access.

Nutrient diet prescribed: Many partners are working to reduce phosphorus in Lake St. Croix to prevent algal blooms. The stretch of the river coming into the lake also needs reductions in nutrients.

Hayward
Hinckley
Pine City
Taylors Falls
Stillwater
Afton
Prescott

St. Croix River: Keep safeguarding this treasure

The St. Croix River is indeed a treasure, with good water quality, excellent fisheries, and a thriving mussel population. This river has a healthy ecosystem, in large part because of relatively little disturbance to its wetlands, floodplains and other features. This condition helps makes the basin more resilient to climate change. Located near major metropolitan areas, the St. Croix offers exceptional recreation for hundreds of thousands of people every year. But that attraction also poses threats. Development—for housing, recreation and agriculture—means more runoff, and more runoff means more pollutants. One of the first rivers in the United States to be designated as wild and scenic, with special protections, the St. Croix now needs protective measures more than ever.

The big picture

Major trends in the St. Croix River

Wild and scenic, yet very public

By the numbers:
The St. Croix River starts near Solon Springs, Wis., and flows toward Minnesota, covering more than160 miles until it joins the Mississippi River at Prescott, Wis. The last 25 miles, from Stillwater to Prescott, are considered Lake St. Croix. About 80% of the river - 128 miles - makes up the border between Minnesota and Wisconsin. In all, 7,760 square miles in Wisconsin (56%) and Minnesota (44%) drain to the river.

First river designated:
Congress adopted the Wild and Scenic Rivers Act in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The St. Croix River, and its tributary river, the Namekagon, make up the St. Croix National Scenic Riverway, the nation's first wild and scenic river-national park.

Outstanding:
Both Minnesota and Wisconsin designate the St. Croix River as an "Outstanding Resource Water" for its good water quality, valuable fish and wildlife habitat, and outstanding recreational opportunities. This designation calls for protective measures to maintain these features.

An approachable river:
Despite flowing through some of the most scenic and least developed country in the Upper Midwest, the St. Croix River is truly a public river, in that people can easily access it. Numerous boat landings, parks and campsites offer access.

Overall water quality good

Overall, the St. Croix River offers good water quality, according to an assessment by the Minnesota Pollution Control Agency (MPCA). In the upper reaches of the river, the water quality fully supports standards designed to protect aquatic life and recreation. This good water quality is a reflection of the surrounding land, which is mostly forests and wetlands.

As the landscape becomes more developed, for urban and agricultural uses, more phosphorus comes into the river from runoff and wastewater discharges. Phosphorus is a nutrient that causes algae. Two sections of the river are considered impaired: from Taylor Falls, Minn., to Lake St. Croix, and then the lake itself from Stillwater, Minn., to Prescott, Wis. The impairments mean they fail to meet water quality standards designed to minimize algal growth that could inhibit recreation and harm aquatic species.

The good news is that local and regional partners have been working for several years to decrease phosphorus levels with some success. The concentration of phosphorus—the amount per liter of water—decreased from 1976-2015, according to long-term monitoring by Metropolitan Council Environmental Services at Stillwater and Prescott. This decrease means strategies like fertilizer management and wastewater treatment are working.

Intact ecosystem protects against climate change

The St. Croix is one of the few North American rivers of its size to have a relatively intact ecosystem. People have preserved its tributaries, shoreland, wetlands, floodplains and other features.

That intact ecosystem makes it resilient to climate change, with its tributaries and wetlands better able to absorb the higher flows from more frequent and severe rain events. In the last 20 years, record peak flows and record average flows have been recorded in the basin. Those increasing flows can lead to erosion and other problems that impact fish and other aquatic species. This resiliency helps protect the many sensitive species in the basin that would otherwise suffer from increased runoff of pollutants, extreme fluctuations in flow, and related conditions like increasing water temperatures.

Fish, bugs thriving

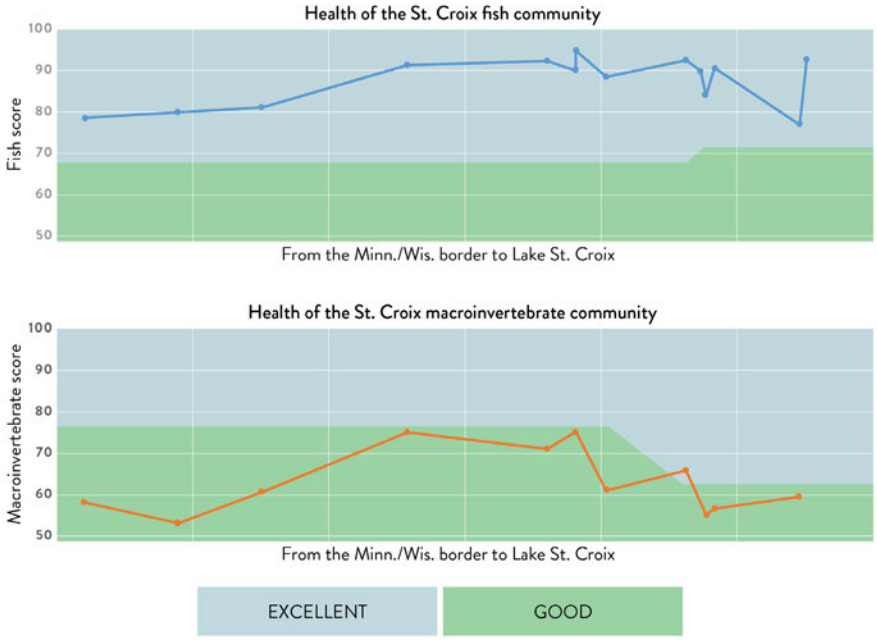
Scientists monitored 13 stations for fish and found 63 species overall in the St. Croix River, with 30 of those considered sensitive to pollution and 4 of special concern, meaning they are rare or have special habitat needs to be sustainable.

They also found healthy communities of macroinvertebrates, which are creatures without backbones like snails and caddisflies, often called "bugs."

That diversity provides a strong signal that the health of the St. Croix River is good, including the condition of its water quality and habitat. Scientists use a tool called an Index of Biological Integrity to assess the biological conditions of water resources. As shown in the chart at right, the higher the score, the healthier the community of fish and macroinvertebrates.

The river is rare in that its native mussels continue to thrive. A total of 41 different types of mussels call the St. Croix home, and 5 are federally listed as endangered.

Four fish species found during this study of the St. Croix River are of special concern (clockwise from top left): crystal darter, gilt darter, lake sturgeon, and blue sucker.



River's popularity, proximity also its threats

Due to its outstanding condition and accessibility, the St. Croix River is immensely popular for recreation. That popularity increases the need to guard against disturbance of habitat and increases in pollution.

Increasing development—for residents, industries and agriculture—is a threat to the river:

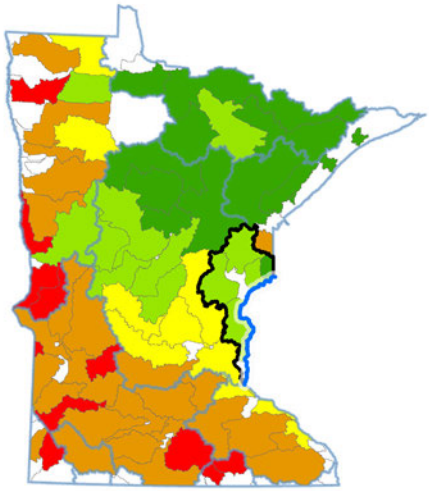
- 52 municipal and industrial wastewater facilities discharge to the basin. The discharges can increase phosphorus levels that grow algae, along with other pollutants such as chloride.
- 25 municipalities regulated for stormwater runoff discharge to the basin. Urban stormwater can bring pollutants like phosphorus into the river. In addition, urban stormwater can raise the temperature of streams, potentially hurting fish and mussels. In the St. Croix River, 26 of the 41 mussel species live in water that is close to the maximum temperature that they can tolerate. So preventing further warming of the water is crucial.
- 12 concentrated animal feeding operations, or CAFOs, are located in the basin. Following proper rates, setbacks and other best practices for manure application is important for preventing contaminated runoff.
- Per- and polyfluoroalkyl substances (PFAS), a large group of synthetic chemicals used in many consumer products for their resistance to heat, water and oil, have been found in the river. A few are known to be hazardous to human health. Two ways that PFAS enter water resources are directly from sources that use the chemicals in their processes, and indirectly through conduits like wastewater treatment plants that are not designed to remove them. For details, visit the MPCA website: www.pca.state.mn.us/waste/pfas-pollution.
- Chloride, from road salt treatments and water softener discharges, is a threat to Minnesota's freshwater fish and other species. While still relatively low, chloride levels are starting to increase in the St. Croix River. For more information about chloride reduction in Minnesota, visit this webpage: www.pca.state.mn.us/water/chloride-salts.

Water quality data

Current pollution levels

Less More Insufficient data

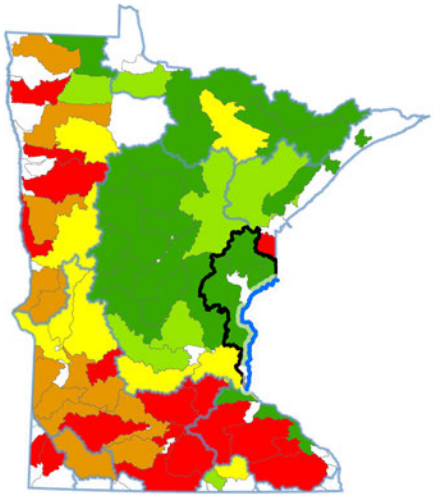
Phosphorus



Phosphorus

While phosphorus levels in the Minnesota tributaries feeding the St. Croix River are low, compared to other watersheds in the state, the nutrient is still a problem in two sections of the river. The section above Lake St. Croix has phosphorus levels high enough at times to cause algae, as does Lake St. Croix. Partners are making progress toward reducing those phosphorus levels.

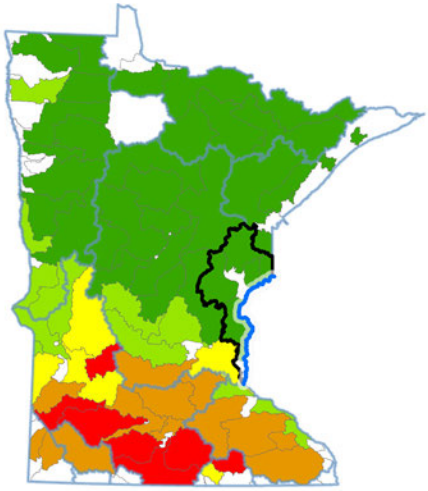
Sediment



Sediment

Sediment levels in the tributaries flowing into the St. Croix River from Minnesota are among the lowest in the state. The low sediment concentrations are a positive reflection of responsible land use and limited alteration to the watershed. Maintaining natural wetlands and water storage areas decrease the amount of sediment running off directly into the river during large storm events. Undisturbed floodplains along rivers protect streambanks from erosion during heavy rainfall and runoff events.

Nitrogen

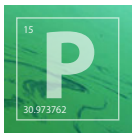


Nitrogen

Nitrogen levels in the Minnesota tributaries feeding the St. Croix River are among the lowest in Minnesota. Again, forests and wetlands are the dominant land cover, so keeping them in place is essential to keeping nitrogen levels low. Nitrogen levels are higher in other parts of Minnesota, due to runoff and leaching of crop fertilizer in agricultural areas.

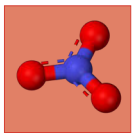
Pollutants: What they are and where they come from

Sediment is soil from runoff and erosion that clouds the water. Sediment makes it hard for aquatic life like fish to breathe, find food, reproduce and avoid predators.



Phosphorus is a nutrient that causes algae that are detrimental to aquatic life and recreation like fishing and swimming. Sources include runoff of manure and fertilizer, and discharges of treated wastewater.

Mercury, PCBs, other toxins can accumulate in fish, leading to limits on how much to eat. They come from burning coal, as well as industrial products and processes.



Nitrate is a nutrient that can make water unsafe for drinking. It can also be toxic to fish and other river life. Sources include runoff of manure and fertilizer, and discharges of treated wastewater.

Bacteria from malfunctioning septic systems, manure runoff and wildlife feces can make water unsafe for swimming and other recreation. Bacteria levels in the St. Croix River are low enough that the river fully supports swimming and other contact recreation.

Reach by reach

The St. Croix River has been divided into "reaches" or sections for determining if water quality standards are being met. These standards are the benchmarks used to determine the ability of waters to support healthy aquatic life (fish and bugs), aquatic recreation (swimming), and aquatic consumption (eating fish).

✓ Supports standards

✗ Fails standards*

*Note: It is common for Minnesota lakes and streams to have limits on fish consumption because of mercury levels. The main source is global air emissions from burning coal, with mercury from the emissions depositing on land and water.

Reach description	Aquatic life (AQL)	Aquatic recreation (AQR)	Aquatic consumption (AQC)	Impairments
Minn./Wis. border to Snake River	✓	✓	✗	• Aquatic consumption: Mercury, PCBs
Snake River to Sunrise River	✓	✓	✗	• Aquatic consumption: Mercury, PCBs
Sunrise River to Taylor Falls Dam	✓	✓	✗	• Aquatic consumption: Mercury, PCBs
Taylor Falls Dam to Lake St. Croix	✗	✓	✗	• Aquatic life: Nutrients • Aquatic consumption: Mercury, PCBs
Lake St. Croix * to Mississippi River	No applicable standard	✗	✗	• Aquatic recreation: Nutrients • Aquatic onsumption: Mercury, PCBs

Aquatic life: Measurement of fish and macroinvertebrates or a pollutant that affects them.

Aquatic recreation: Measurement of conditions that affect swimming and boating.

Aquatic consumption: Contaminants that affect how much fish people can safely eat. See www.health.state.mn.us/fish

* Lower St. Croix River and Lake St. Croix

Minnesota has water quality standards for nutrients for both lakes and rivers. They differ in the beneficial use that they are designed to protect. For lakes, the goal is to limit excess nutrients and nuisance algae growth to support recreation such as swimming. For rivers, the goal is to support aquatic life such as fish and mussels. In the case of the St. Croix, the stretch of river that flows into Lake St. Croix has nutrient and algae levels that are too high at times to meet the river standard. Lake St. Croix—the lower 25 miles of the river between Stillwater, Minn., and Prescott, Wis.—has too much phosphorus and algae to meet the lake standard. Several partners are working to reduce phosphorus and the resulting algae in the river and lake.

Protecting aquatic life and recreation is the goal of nutrient standards for the St. Croix River and Lake St. Croix.

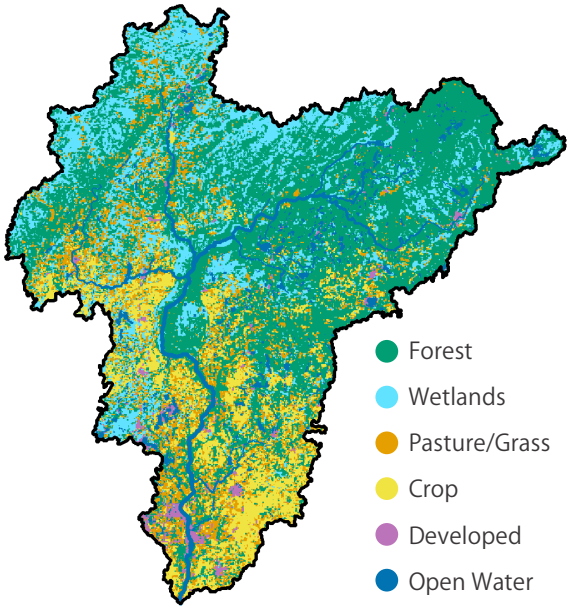
Protection crucial

Protection strategies are crucial for the St. Croix River to continue to offer good water quality, as well as excellent conditions for fish and other aquatic species.

Protection strategies include maintaining wetlands, forests and other conditions that foster healthy water quality. Any major changes in the land draining to the river, such as expanding urban development and feedlot operations, will need careful consideration on how to protect the river from any negative impacts.

In the northern parts of the Minnesota portion of the basin, more than 90% of the wetlands are still intact from pre-European settlement. Wetlands are especially important in the face of climate change because they hold and filter precipitation and runoff. They are needed to help absorb an increase in the frequency and severity of rain events.

Land cover in the St. Croix River Basin



Preserving the wetlands and forests in the St. Croix River Basin is a top protection strategy, especially for the good water quality in the upper parts of the river.

Partners in protection

Several groups partner in the St. Croix River Basin to protect the river and its many unique features. Local partners use the data collected about the condition of the St. Croix River to develop protection and restoration plans. The data helps sets priorities for where to target funding and efforts.

In addition to maintaining wetlands as described above, important strategies in the basin include:

- Maintain and expand agricultural best management practices (BMPs). Examples include conservation tilllage and cover crops, along with improved management of fertilizer and manure applications.
- Implement sustainable harvest and stewardship plans to preserve and manage forests.
- Continue to upgrade wastewater treatment facilities and limit phosphorus in wastewater discharges.
- Expand urban stormwater management practices to prevent runoff of pollutants and increasing water temperatures that may be harmful to recreation and aquatic species. Examples include water retention ponds and rain gardens.
- Continue practices to prevent and manage invasive species populations. Examples include fish barriers.
- Reduce chloride in road treatments and wastewater discharges.
- Support efforts to study PFAS contamination and ways to reduce it.

The Carnelian-Marine-St. Croix Watershed District worked with a local producer to re-establish a grassed waterway in a field to reduce runoff—and sediment and phosphorus in it—to the St. Croix River, helping protect the water quality of the river.

Water quality a reflection of land use

Local partners in the Lower St. Croix River Watershed often work on projects to restore and implement agricultural Best Management Practices (BMPs) to help with soil productivity and water resources protection. For example, practices that prevent erosion also help prevent loss of top soil and reduce runoff that can carry pollutants into water resources. One such practice is a grassed waterway. In the photo above, the Carnelian-Marine-St. Croix Watershed District worked with a local farm to re-establish a grassed waterway across a field. This will re-establish a stable flow path to slow water moving across the landscape, allowing sediment to settle out before discharging to the St. Croix River. Phosphorus attaches to sediment, so slowing down the water will also decrease phosphorus going to the river, where it can grow algae.

Nutrient diet

Several partners are implementing practices to reduce phosphorus pollution in the lakes and streams of the St. Croix River Basin, as called for in the Total Maximum Daily Load Study for Lake St. Croix: www.pca.state.mn.us/water/tmdl/lake-st-croix-excess-nutrients-tmdl-project.

About this study

The MPCA studied pollutant levels and aquatic life in the 128 miles of the St. Croix River that straddle the Minnesota-Wisconsin border. While the agency has studied the smaller Minnesota watersheds that drain to the St. Croix, this is the MPCA's first comprehensive look at the main section of the river from the Minnesota/Wisconsin border to the Mississippi River confluence.

This effort focuses on water quality for recreation, human health, and fish and macroinvertebrates. The purpose of this study is to collect data that government agencies and citizen-led groups can use to plan for protecting the river's good water quality.

Monitoring

The MPCA and partners study lakes and streams for:

- Levels of nutrients, sediment, bacteria, toxics, dissolved oxygen, chloride, pH, ammonia
- Communities of fish and macroinvertebrates
- Flow of rivers and streams
- Contaminants in fish such as mercury

Assessment – The MPCA and local partners use the data and determine whether the condition of water bodies meets water quality standards. Water quality standards are the thresholds used to determine the suitability of waters for beneficial uses such as swimming, and their overall biological health. Water quality standards are not "one size fits all." In many cases they are regionalized for different parts of the state, and tailored to different types of water bodies.

Data – For this study, the MPCA collected water monitoring data over two years from 17 sites along the river. For assessing whether the river sections met standards, the MPCA used data from its monitoring efforts and from partners spanning 10 years (2009-2018) and 74 monitoring sites. Data came from the National Park Service, U.S. Geological Survey, Metropolitan Council Environmental Services, and Wisconsin Department of Natural Resources.

Monitoring continues – The MPCA and partners continue to monitor the health of the St. Croix River through work by local partners.

The MPCA and partners monitor water quality in the major watersheds in Minnesota that drain to the St. Croix River.

Acknowledgments

Many people are working to restore and protect the waters of the St. Croix River Basin. Among them are:

- St. Croix River Association (www.stcroixriverassociation.org)
- Minnesota Department of Natural Resources
- Metropolitan Council Environmental Services
- National Park Service
- Wisconsin Department of Natural Resources
- Science Museum of Minnesota
- United States Geological Survey
- St. Croix Chippewa Indians of Wisconsin
- Local government units of the St. Croix River Valley
- St. Croix Basin Water Resources Planning Team

More information

- MPCA website: www.pca.state.mn.us/water/st-croix-river-wild-scenic
- State of the St. Croix River Report, 2020, St. Croix River Assoc. www.stcroixriverassociation.org/state-of-the-st-croix-river-report/

Questions

Jordan Donatell
Environmental Specialist
MPCA
jordan.donatell@state.mn.us
651-757-2254

Mike Feist
Research Scientist
MPCA
mike.feist@state.mn.us
651-757-2351

MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT