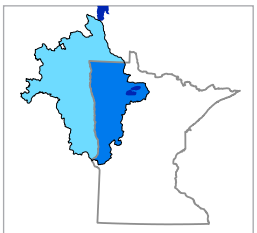
The Red River of the North

Evaluating the health of the river

- From Breckenridge, Minnesota, to the Canadian border

Despite being a popular recreation river, worries about water quality are growing.

Downstream damage: The river doesn't stop at the border. Pollutants continue north and flow into Canada's Lake Winnipeg. What are our responsibilities to our neighbors?



This land drains its water to the Red River.

More water and more pollutants: Flows are way up in the Red River because of greater precipitation, more runoff and increased drainage. Higher flows also mean more erosion. All that results in more sediment, bacteria and nutrients in the river.

Bacteria: Levels are too high at times for safe swimming. More research is needed to determine sources: human sewage, manure runoff, and/ or wildlife.

The Red River is a story of adaptation

A remnant of a vast ancient lake, the river is still cutting a course through some of the flattest land on Earth. Since the early 1800s, people have been adapting the land to serve their needs, mainly through drainage. But these changes have taken their toll on water quality, and now people are striving to protect the river.

Fish doing OK: This is good news for the thousands of people who fish the Red. But the fishery would be more diverse and healthy if people took action to improve conditions for fish, especially in the tributaries.

People are enjoying the river: More people are using the river for fishing and other recreation. Groups like the River Keepers are helping increase awareness, appreciation and stewardship for the Red.

The big picture

Major trends in the Red River

A big river in a big basin

A long river. The Red River is 550 miles long, with 400 miles on the U.S. side that form the border between Minnesota and North Dakota. It flows north, ending at Lake Winnipeg in Canada.

A big land area. Nearly 40,000 square miles in the United States drain to the river, with an additional 5,000 in Canada. The U.S. portion drains a significant portion of Minnesota and North Dakota. About 17,800 miles of streams in Minnesota flow to the river.

Mostly cloudy. Like all rivers, the Red River has always carried sediment, but row cropping is adding to the sediment levels.

Flat and flood-prone. The drainage area is very flat, meaning when the river floods, it spills over many acres of land. It floods frequently because the water takes so long to flow downstream, especially if the northern areas are still frozen when the southern parts begin their spring thaw. Many ways to mitigate flooding also help water quality, such as temporarily holding water in places so runoff doesn't flush pollutants from the land to the river.

More water and flow, more pollutants

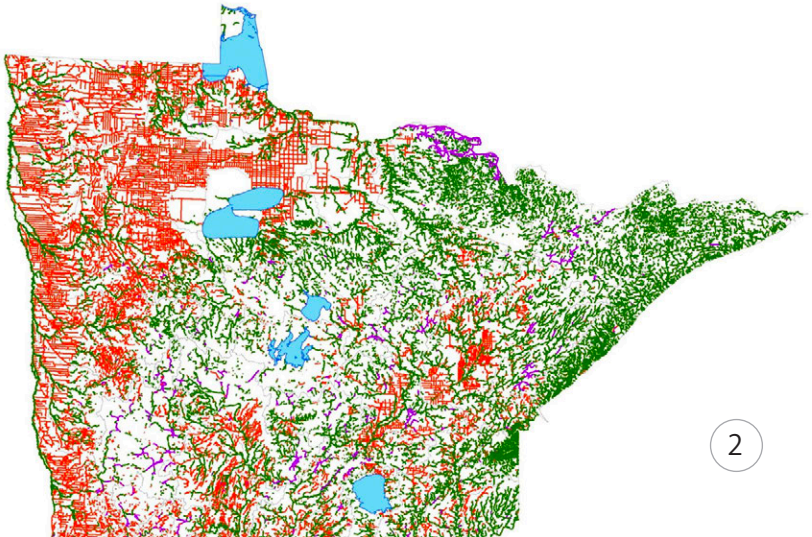
Climate changes have led to more rain and more storms. More drainage, through ditches and more recently subsurface tiling, brings much more water into the Red River:

- Drainage increases the peak flows and intensifies the low flows. These fluctuations are hard on fish and other aquatic life.
- Phosphorus, which can lead to algae, usually flows with the sediment in runoff and from eroded streambanks. While the river itself is often too cloudy for algae to grow, downstream Lake Winnipeg is suffering.
- Tile drainage leaches nitrogen fertilizer from cropland to the tributaries and the river.

There are ways to drain the land for farming while not overwhelming the main river channel and tributary streams: restoring wetlands, using controlled drainage, and taking marginal land out of production.

Tributaries in trouble

In some of the smaller watersheds flowing to the Red River, people have changed every stream to drain the land. The drainage is so effective that many streams run dry in the summer, forcing fish and other river life to move downstream or die. Meanwhile, the tributaries bring high levels of sediment and nutrients into the Red River. The nutrients can lead to lower oxygen levels for fish and other aquatic life.



A highly altered water landscape
Red lines show where stream courses have been moved or straightened (green is unaltered). This region is one of the most artificially drained areas in the world.

The big picture

Sediment high, nutrients high

The Red River has too much sediment to meet the standards designed to protect fish and other aquatic life. Cloudy water makes it harder for many fish to find food, detect predators and reproduce. The fish and bugs are doing OK, but the populations would be more diverse and healthier in clearer water.

The excessive soil in streams and rivers is coming from several sources, including wind erosion and runoff from fields, and in-stream erosion from high flows during spring runoff and summer rain events.

Phosphorus levels are high in the Red River and are having a detrimental effect downstream. Nitrogen levels are increasing, a concern because of the impact to river life and drinking water sources.

Hurting Lake Winnipeg

Canada's giant Lake Winnipeg suffers severe algae, fueled in a large part by high nutrient levels from the Red River. Based on water monitoring, Minnesota and North Dakota together send 2,600 tons of phosphorus a year to Lake Winnipeg, with roughly half coming from each state. To help the lake and honor a treaty between the U.S. and Canada, phosphorus loads need to be cut in half on both sides of the border. The two countries are implementing a plan to do that.

At nearly 9,500 square miles, Lake Winnipeg is the 10th largest lake in the world. The lake suffers severe algae that impacts its water quality.

A river we drink: watching for contamination

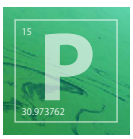
The Red River, along with two groundwater aquifers, supplies drinking water for tens of thousands of people, including residents of Moorhead, Minn., and Fargo, N.D. Big fluctuations in flow — flooding in wet years slowing to a trickle in dry years — create wide swings in water quality that increase challenges and costs for water treatment. While there are occasional spikes in nitrate, average levels are not a concern for people's health at this time. But the river is also susceptible to contamination from activities like spills and leaks, stormwater runoff, and a wide range of contaminants either from runoff or shallow groundwater in-flow.

Pollutants: What they are and where they come from

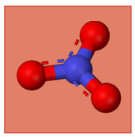
Sediment is soil from runoff and erosion that clouds the water. Sediment makes it hard for aquatic life like fish to breathe, find food, reproduce and avoid predators.

Bacteria from malfunctioning septic systems, manure, and wildlife feces can make water unsafe for swimming and other recreation.

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.



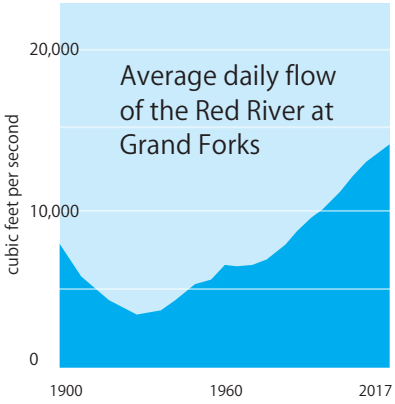
Phosphorus, from wastewater, manure and fertilizer, is a nutrient that causes algae that are detrimental to aquatic life and recreation like fishing and swimming.



Nitrate is from runoff of agricultural fertilizer and manure, and can make water unsafe for drinking. It can also be toxic to fish and other river life.

Evidence

Flow levels

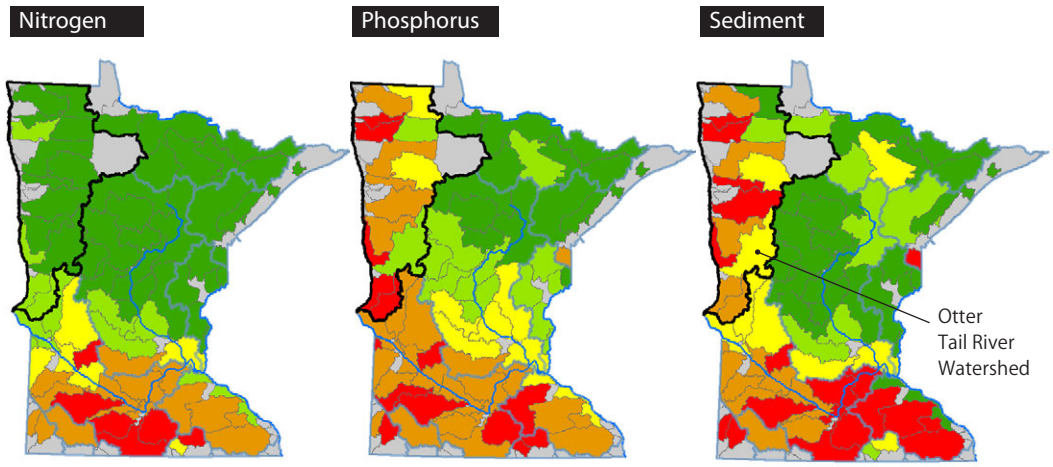


Increasing flow

Flow is increasing across the Red River basin. People have drained wetlands and ponds while installing extensive tiling and ditch systems. And a changing climate means more heavy rains.

At Grand Forks, flow appears to be increasing five times faster than precipitation over the last seven decades. This points to drainage as the primary driver of the flow increase.

Current pollution levels



Nitrogen a rising concern

Though still below the health concern for drinking water, nitrogen levels are creeping up at three sites in the Red River basin: Kragnes, Hendrum, and Robbin, Minnesota. (Red River basin is outlined in black)

Many communities, including Fargo and Moorhead, draw water from the Red River and treat it for drinking. Removing nitrogen is expensive. It's easier and cheaper to prevent nitrogen contamination through fertilizer management and better drainage practices.

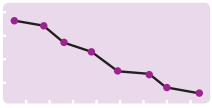
Phosphorus and sediment high

Phosphorus and sediment levels are consistently high in the Red River. Levels appear to be stable based on the data assessed.

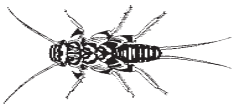
Some watersheds, like the Otter Tail River, have lower pollutant levels because of geography and land use. Row crops are one of the major land uses in the Otter Tail River watershed, but there are also significant natural wetlands, grasslands, and forests — much of it in protected status because of local efforts. Sediment levels are still a problem, but less so than in other parts of the Red River basin.

How are fish and bugs doing? OK in Red River but not so well in tributaries

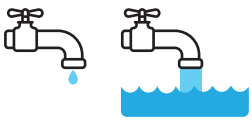
A resilient fishery. The fish in the main part of the Red River are doing OK. Their numbers and diversity meet the expectations for a river of its kind. In the tributaries, a number of factors are stressing the fish and bug life.



Less fish diversity northward. Scientists found an average of 22 species near the headwaters. But as the river flows north, through a more cultivated and drained landscape, the habitat declines and so does the diversity of the fish population. By the time the river reaches Canada, that average drops to 13 species.



Pollution-hardy bugs are OK. Another marker of river health is bugs, especially if there are species sensitive to pollution such as caddisflies. Field work shows that the bug population is doing all right, though many of them are tolerant of pollution. There is a lack of diversity in bugs that likely impacts other parts of the ecosystem, like fish.

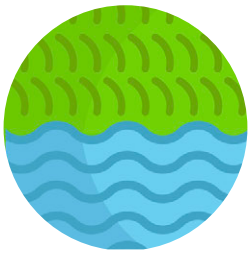


Too much, too little. In the tributaries that feed the Red River, flow levels – too much and way too little – are really stressing the fish and aquatic insects. Water temperature, habitat access, and other factors fluctuate with the flow, and the extreme fluctuations are hurting the aquatic life.

A good fishing spot. The Red is a popular fishing river offering channel catfish, walleye, and northern pike.
For fish to continue to survive in the river and support this recreation, people must make changes to prevent the extreme fluctuations in flow, reduce pollutants, and increase habitat.

How to adapt for water quality

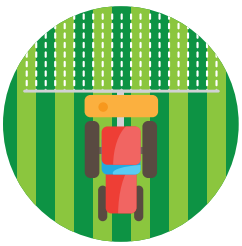
ACTIONS TO TAKE



Invest in water storage

Methods that filter and store precipitation lead to cleaner water in rivers:

- Increase areas to temporarily store water
- Manage drainage with outlet controls, grass waterways, ditch buffers
- Install more stormwater treatment basins



Improve fertilizer management

Use the **Four R's** for fertilizer management:

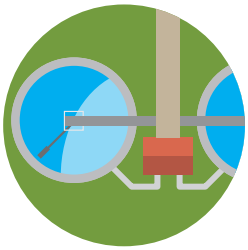
- **Right source:** Match fertilizer type to crop needs
- **Right rate:** Match amount of fertilizer type to crop needs
- **Right time:** Make nutrients available when crops need them
- **Right place:** Keep nutrients where crops can use them

Also, follow setback rules for applications.

Build soil health

Increasing soil health and organic matter also helps the land absorb more water:

- Expand use of cover crops and keep roots in the soil for more of the year
- Reduce tillage to keep valuable soil in farmers' fields



Invest in wastewater treatment

Communities have been working to reduce the phosphorus they discharge to the river from their wastewater treatment facilities. Minnesota may seek further reductions from some facilities as part of the effort to prevent algae in the river and downstream waters, including Lake Winnipeg. Some communities may be able to achieve the same phosphorus reductions more cost-effectively through a trading system. For example, a community might choose to meet its phosphorus goals by working with an upstream landowner to restore eroded streambanks.

Protecting beach ridges will help fish and bugs

The Red River is what's left of ancient Lake Agassiz that once covered much of the basin. The shoreline of Lake Agassiz is now represented by a series of sandy and rocky ridges. These ridges provide some of the best habitat for fish and aquatic insects in the Red River basin. Some fish and insect species need coarse substrate, like pebbly bottoms and riffles, to reproduce and otherwise survive. Streams that flow through these ridges are especially prone to erosion caused by increased flows from drainage and other changes in hydrology, which can result in losses in these important habitats.

Adapting and learning

Help fish reconnect to spawning habitat

Connectivity — how water features are connected and allow fish to move within a river system — is a major issue in the Red River basin. Several dams and culverts block fish passage in the Red and its tributaries. Local partners have replaced many dams in the basin with rock riffles and other structures that allow fish movement.

One example is the Sand Hill River which has some of the best spawning habitat in the Red River basin. The problem for fish was getting there. An MPCA study showed many fish species were only found downstream from control structures like dams. The Sand Hill River Watershed District replaced the barriers with rock riffles bordered with riprap. Primary funding came from the U.S Army Corp of Engineers, supplemented by state Legacy Amendment funds and local partner contributions.

Watch, and learn

The Red River basin River Watch program started in 1995 for students from four schools in the Sand Hill River watershed. Today students from 29 schools monitor water quality and aquatic insects at more than 150 sites. Teams also kayak nearby streams to better document river and shoreland conditions. Students meet each year to share findings and learn about trends. The program helps identify problem areas and pollution sources, not to mention educate and inspire students. As one student said, "We just turn on our water, and we don't care, but we need to think about where it's coming from — that's why River Watch is important."

Landowners' investments yield 450% boost in water clarity

In July 2008, clarity readings in Boyer Lake near Detroit Lakes were a paltry 2.9 feet. Chlorophyll and phosphorous levels, indicators of algae problems, were high. In 2013 the Becker County SWCD began working with landowners to install 23 water and sediment control basins, a grade control structure, and seven buffer strips. Farmers converted many acres to no-till with cover crops, to perennial alfalfa, and to native perennial grasses. Eight landowners implemented voluntary practices through contracts and cost-sharing that impacted 78% of the land draining to the lake. The result? Clarity readings in Boyer Lake in July 2017 were 16 feet, a 450% improvement from 2008.

Reach by reach

The Red River has been divided into "reaches" for the purpose of 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, swimming (aquatic recreation), and eating fish (aquatic consumption).

✓ Supports standards

✗ Fails standards

Reach description	Aquatic life	Aquatic recreation	Aquatic consumption	Impairments
Pembina Unnamed Creek to Canadian border	✗	✓	✗	• Aquatic life: Sediment • Consumption: Mercury, PCBs, arsenic
Drayton Park River, ND to Unnamed Creek, ND	✗	✓	✗	• Aquatic life: Sediment • Consumption: Mercury, PCBs, arsenic
Oslo Turtle River, ND to Park River, ND	✗	✓	✗	• Aquatic life: Sediment • Consumption: Mercury, PCBs, arsenic
Judicial Ditch 68 English Coulee to Turtle River, ND	✗	✓	✗	• Aquatic life: Sediment • Consumption: Mercury, PCBs, arsenic
Buxton Buffalo Coulee, ND to English Coulee, ND	✗	✓	✗	• Aquatic life: Sediment and low dissolved oxygen levels • Consumption: Mercury, PCBs
Nielsville Marsh River to Buffalo Coulee, ND	✗	✓	✗	• Aquatic life: Sediment • Consumption: Mercury, PCBs
Halstad Elm River to Marsh River	✗	✓	✗	• Aquatic life: Sediment • Aquatic recreation: Bacteria at threshhold (If it goes up, it won't meet the standard) • Consumption: Mercury, PCBs
Perley Buffalo River to Elm River	✗	✗	✗	• Aquatic life: Sediment and low dissolved oxygen levels • Aquatic recreation: Bacteria • Consumption: Mercury, PCBs, arsenic
Fargo Wild Rice River to Buffalo River	✗	✗	✗	• Aquatic life: Sediment • Aquatic recreation: Bacteria • Consumption: Mercury, PCBs
Wahpeton Otter Tail River to Wild Rice River	✗	✗	✗	• Aquatic life: Sediment • Aquatic recreation: Bacteria • Consumption: Mercury, PCBs, arsenic

Aquatic life: Measurement of fish and water insects 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

About this study

The Minnesota Pollution Control Agency (MPCA) studied pollutant levels and aquatic life of the Red River from its origin at the outlet of the Otter Tail River to the Canadian border near Pembina, ND. While the agency has studied the smaller Minnesota watersheds that drain to the Red River, this is Minnesota's first comprehensive look at the entire 400 miles of the river as a whole on the U.S. side.

While flooding is often the focus of Red River studies, this effort focuses on water quality for recreation, human health, and fish and insects. The purpose of this study is to collect data that government agencies and citizen-led groups can use to plan for protecting good water quality and restoring poor 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 such as aquatic insects
- 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 swimming and boating, 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 – This study includes data spanning 10 years, gathered from 37 monitoring sites along the river. The study also used data from state agencies in Minnesota and North Dakota, as well as local partners.

Additional resources

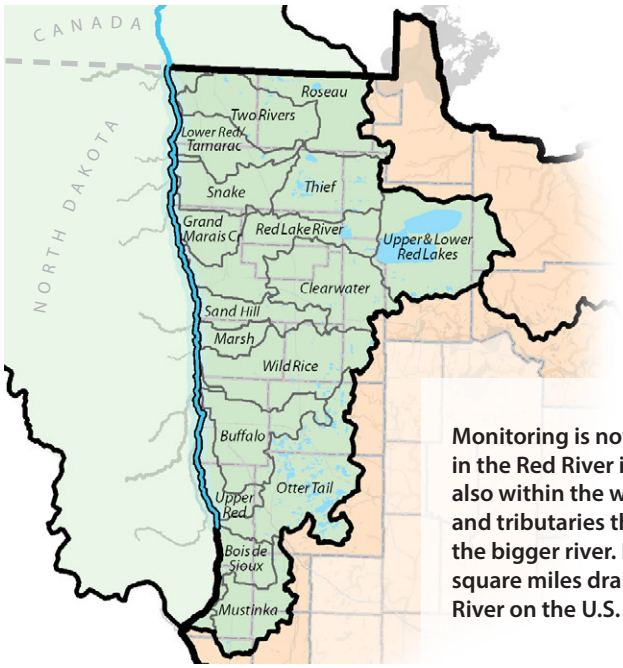
A River Runs North: Managing an International River
Red River Basin Commission

Minnesota Nutrient Reduction Strategy, an MPCA study

More information is available here:
www.pca.state.mn.us/red-river-study

Questions

Cathy Rofshus, 507-206-2608
catherine.rofshus@state.mn.us



Monitoring is not only done in the Red River itself, but also within the watersheds and tributaries that drain to the bigger river. In all, 40,000 square miles drain to the Red River on the U.S. side.

Many people are doing work to improve the water

As the Red River Basin Commission notes in *A River Runs North, Managing an International River*, water management issues in the basin are numerous, complex and difficult to resolve.

There are multiple variables constantly changing in the basin, including climate, cropping, flows, condition of tributaries, and more. The U.S., Canada and joint bodies oversee various aspects of the Red River basin. In all, there about 1,500 government entities at all levels in the basin. There are also several hundred special interest and stakeholder groups. Trying to get all entities involved to agree on policies and priorities is difficult. That complexity is one reason why it's so important for local governments and parties to take action on restoration work in the tributary watersheds.

People working to protect and restore waters in the Red River basin:

- Individuals like farmers using conservation practices, city residents planting rain gardens, and interested citizens advocating for changes.
- Tribal nations monitor and protect water quality on tribal lands in the basin.
- There are many citizen organizations and water-related associations who work tirelessly to increase awareness, educate people, initiate projects and manage programs.
- Government partners include cities; counties; soil and water conservation districts; watershed districts and partnerships; and state, federal and international agencies who monitor water quality, engage citizens, develop plans, provide funding, enforce laws, and oversee programs to protect the river.

Without all these efforts, the river's water quality would be much worse. Many key pieces are falling into place for a much healthier Red River. As the Red River Basin Commission says in its publication, "Coping with the forces of nature at work in the Red River Basin has always been a matter of adapting, and to adapt, one must change."