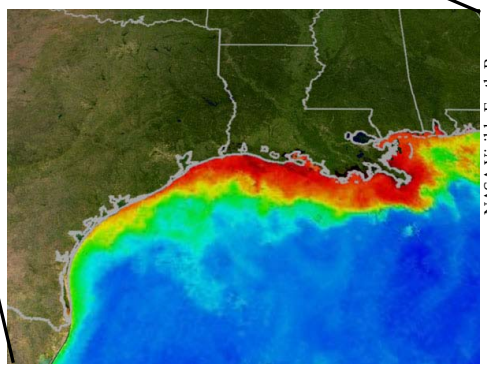
DOWNSTREAM IMPACTS

ASK an EXPERT ABOUT THE MINNESOTA RIVER

Nitrates and the Dead Zone

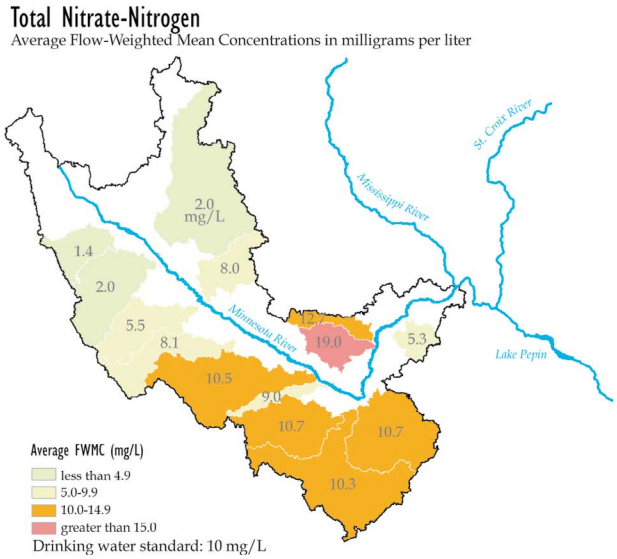
The Minnesota River and the Dead Zone

As the Minnesota River flows into the Mississippi River, it carries excess sediment and nutrients which impact downstream receiving waters. The Minnesota River has been identified as a substantial contributor of excess nitrate to the Mississippi River and the Gulf Region.



NASA Visible Earth Program
Image from 2004

In 2008, the Dead Zone in the Gulf of Mexico stretched 7,988 square miles measuring second largest since measurements began in 1985.
Source: NOAA, 2008



This map shows the average flow-weighted mean concentrations of Nitrate-Nitrogen across the Minnesota River Basin 2000-2005. Elevated Nitrate levels can stimulate excessive levels of algal growth in streams.

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Nitrates and the Dead Zone

Algal blooms and dead fish

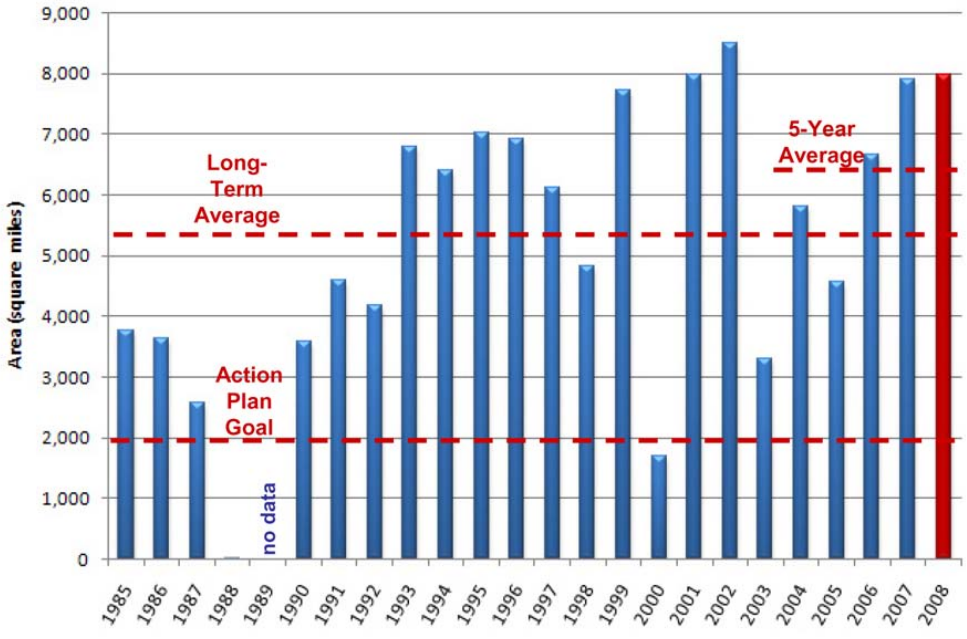
Gulf of Mexico algal blooms

What is the Dead Zone?

In recent years, this problem has been particularly severe in the Gulf of Mexico where development of a hypoxic zone (hypoxia means "low oxygen") has been linked to elevated nitrate levels carried to the Gulf by the Mississippi River. Reduced oxygen levels in the hypoxic zone, brought on by decomposition of algae, have damaged the shellfish industry and continue to threaten the aquatic ecosystem of the Gulf Region.

Size of the Gulf of Mexico Dead Zone

Area of Mid-Summer Bottom Water Hypoxia (Dissolved Oxygen <2.0 mg/L)



The size of the Gulf of Mexico Dead Zone is increasing. The average size of the Dead Zone over the past 5 years has been 6,600 square miles. The long term average is 5,300 square miles (NOAA, 2008).

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Lake Pepin Sediment Excess

Lake Pepin is filling in with sediment at about 10 times its natural rate. At this rate, it will be completely filled with sediment within 340 years. Lake Pepin lies downstream of the confluence of the Minnesota and Mississippi Rivers. It is a naturally occurring lake, and part of the Mississippi River on the border between Minnesota and Wisconsin.

Lake Pepin is filling in

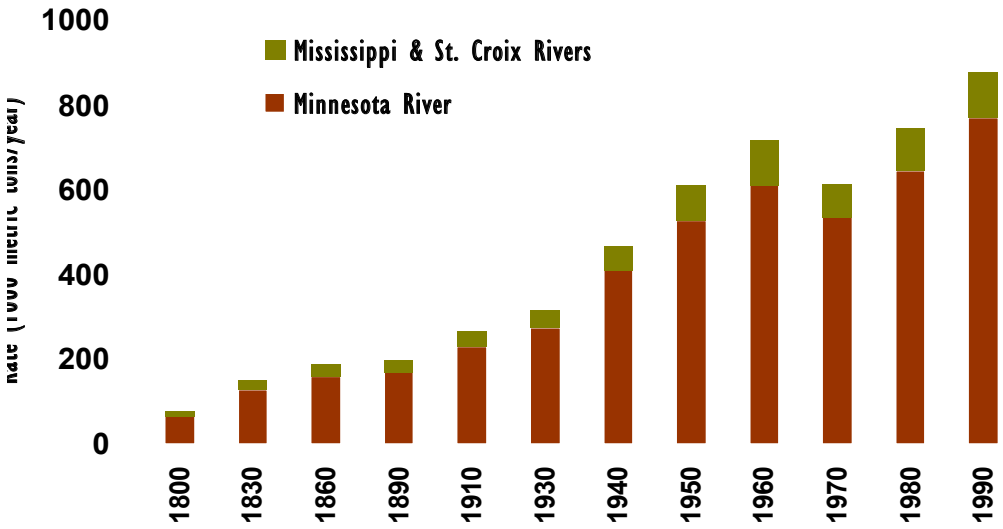
As the Minnesota River flows into the Mississippi, it carries excess sediment and nutrients. Three rivers contribute sediment to Lake Pepin: The Minnesota, St. Croix, and Mississippi Rivers. Scientists have studied sources of sediment into the lake and determined that the Minnesota River contributes approximately 85 percent of the sediment load.

Total Suspended Sediment Yield

(Pounds per acre, per year)

Sources: Engstrom and Almendinger, 2000
Nater and Kelley, 1998

Sediment Accumulation and Sources Lake Pepin, 1800s-1990s



Sources: Kent Johnson, Metropolitan Council, 2000 & Engstrom and Almendinger, 2000

DOWNSTREAM IMPACTS

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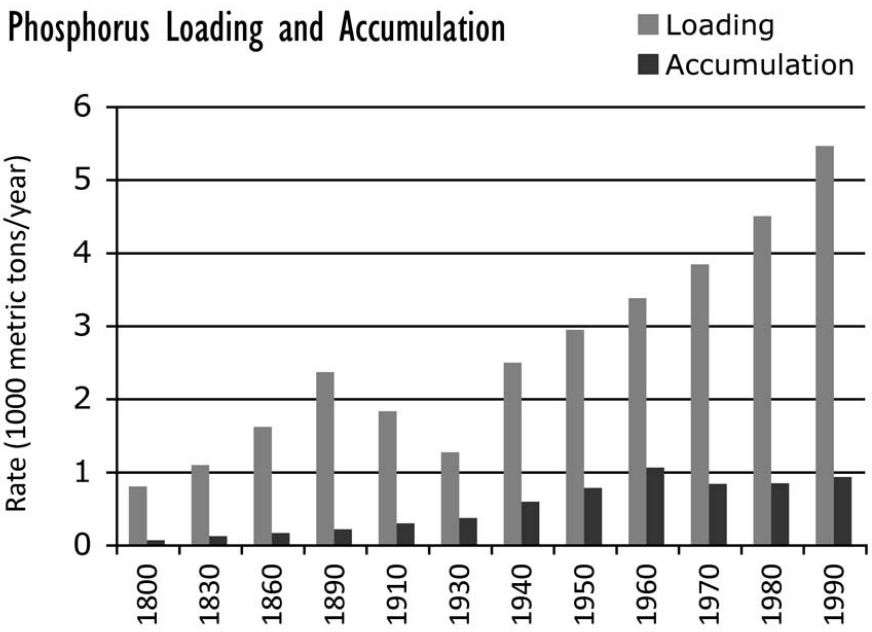
Lake Pepin Phosporus Levels

Elevated Phosphorus Levels

Phosphorus is accumulating in the sediment at 15 times the natural rate. Phosphorus loading to the lake appears to have increased by about seven times (or more) above natural rates. Lake water Total Phosphorus concentrations have increased from about 50 ppb (parts per billion) to 200 ppb, making Lake Pepin highly eutrophic. Eutrophic means waters rich in mineral and organic nutrients promote a proliferation of plant life, especially algae (see photo below), which reduces the dissolved oxygen content and can cause fish kills.

Lake Pepin

Excess phosphorus concentrations can lead to algal blooms in Lake Pepin.



Total phosphorus loading and accumulation from 1800 to 1990.
Source: Engstrom and Almendinger, 2000

"Ask an Expert about the Minnesota River" project profiles scientists and citizens answering questions about the health of the Minnesota River. More answers to questions about the Minnesota River can be found at: mrbdc.mnsu.edu/learn

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