Tracing the course of phosphorus pollution in Lake Pepin

November 11 2014

In recent years, many lakes in the upper Midwest have been experiencing unprecedented algae blooms. These blooms threaten fish and affect recreational activities. A key culprit implicated in overgrowth of algae in lakes is phosphorus (P). Lake Pepin, located on the Minnesota/Wisconsin border, has seen increasing phosphorus concentrations over time. Researchers are now trying to identify upstream factors that could explain this increase.

Satish Gupta, a University of Minnesota professor, and Ashley Grundtner, recently published a paper about their research regarding phosphorus contamination of Lake Pepin in the *Journal of Environmental Quality*.

Their study aimed to determine the role that riverbank materials play as sources and carriers of phosphorus to Lake Pepin. The study had three goals:

1. To assess how riverbank sediments acted as a source of P to the Minnesota River and Lake Pepin.

2. To determine whether riverbank soil could adsorb P from river waters and then carry it to the lake.

3. To identify factors that could explain increasing P concentrations in Lake Pepin over time.

Previous studies implicated agricultural activity and fertilizer use as the main sources of high phosphorus.

The results of the UMN research showed that selective transport of fine particles eroded from the riverbanks was the main source of phosphorus in Lake Pepin sediment before 1850, not agriculture. In this process, heavier particles such as sand (with lower phosphorus concentrations) remain behind in the river basin. Fine particles such as silt and clay (with higher phosphorus concentrations) are transported to downstream lakes. After 1850, the riverbanks absorbed P from the polluted river water providing additional phosphorus that could be transported downstream into Lake Pepin.

History of the Lake Pepin area supports the findings: In the 1880s, a series of meat-processing plants began operation along the Mississippi river upstream of Lake Pepin. Prior to the 1930s, there were also no sewage treatment plants. As a result, "all domestic raw sewage and industrial waste was dumped in the rivers upstream of Lake Pepin," says Gupta. In the 1940s, detergents used in washing machines also became a key source of phosphorus in rivers.

These results contradict the previously held view that agriculture was the biggest contributor of phosphorus in Lake Pepin, as it is in some other lakes and rivers. "Our research shows that [for Lake Pepin] most sediment phosphorus is likely the sewage and industrial phosphorus that was picked up by riverbank sediments," says Gupta.

The best solution will be to control phosphorus pollution upstream of Lake Pepin, thus controlling the amount of phosphorus that could be adsorbed by the river banks. "Upgrading of sewage treatment plants should continue, not only near the Twin Cities, but in the rest of the Minnesota and Mississippi river basins upstream," concludes Gupta.

More information: www.agronomy.org/publications/ …/abstracts/43/6/1903

Provided by American Society of Agronomy