The Land of 10,000 Dying Lakes

A Visual Field Guide of Eutrophication in Minnesota Lakes:

Date 09/30/19 Time 9:59 AM Weather *Gloomy but potential for improvement!*

Location *Minnesota*

Notes

eutrophication /yü-ˌtrō-fə-ˈkā-shən/ n.

:the process by which a body of water becomes enriched in dissolved nutrients (such as phosphates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen

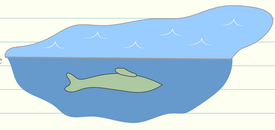
In many of Minnesota's 11,842 lakes, boaters, swimmers, and fisherpersons enjoyed the clean and lively waters thanks to a host of friendly fish and underwater vegetation.

fig 1. wild celery

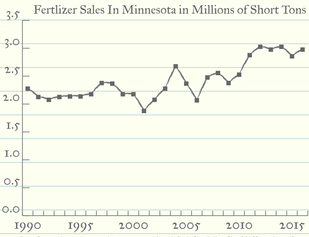
fig 2. northern watermilfoil

The underwater pondweeds and watermilfoil generated an oxygenated lake as they undergo photosynthesis, releasing dissolved oxygen into the water. Clear water assisted the vegetation by allowing sunlight through to power photosynthesis

This dissolved oxygen release additionally helped support fish life in the lake via a rich oxygen supply. However, algal blooms and water turbidity can reduce the ability of submerged plants to generate oxygen as sunlight is obscured.



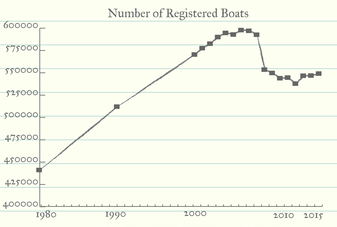
In the 1960's, recreational boating and fertilizer use exploded, leading to negative effects on lake health in Minnesota. Even in recent decades, fertilizer and boat numbers continue to grow despite apparent effects on lake health.



Data Source: https://www.mda.state.mn.us/sites/default/files/inline-files/2016fertsales.pdf

The additional fertilizer inputs from both feedlots and cropland runoff is contributing to the eutrophication of Minnesota lakes. The additional phosphorus and nitrogen inputs from animal manure runoff and fertilizer application feed increasingly frequent algal blooms.

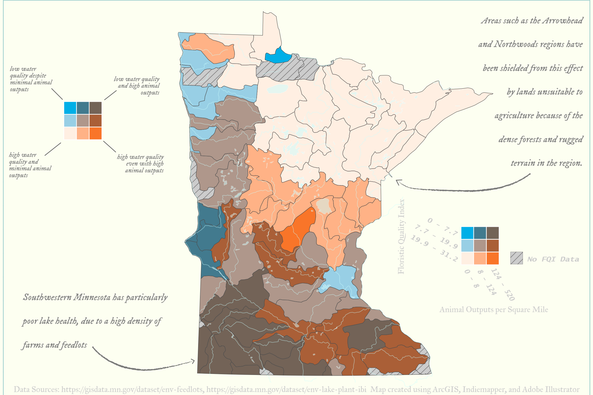
The runoff from feedlots combined with the disturbance of the lake bed from the boat propellors also contributes to the reduction in dissolved oxygen in Minnesota lakes. The 2008 recession's effects on boat sales may offer lakes a much needed repreive from propellor disturbances.



Data Source: Minnesota Department of Natural Resources

The Minnesota DNR maintains a lake plant eutrophication index for each lake, characterized by Floristic Quality Index and Taxonomic Index. The indices quantify the adverse effects of eutrophication on lake health. Floristic Quality index scales from 0 to 35 with 0 representing a compromised lake and 35 representing a lake undistrubed by anthropogenic effects. Overall this index allows for the examination of anthropogenic lake eutrophication.

Sketch or Photo



Data Sources: https://gisdata.mn.gov/dataset/env-feedlots, https://gisdata.mn.gov/dataset/env-lake-plant-ibi Map created using ArcGIS, Indiemapper, and Adobe Illustrator

Common Name

Latin Name

The animal outputs per square mile is aggregated from a data set of feedlots in Minnesota. The data set includes animal counts and a normalized animal output summary for each feedlot. This feedlot data was aggregated by summing the animal outputs in each watershed and normalizing by the area of the respective watershed. Comparing this animal output density to the average Floristic Quality Index for lakes within each watershed offers an illustrative spatial picture of the relationship between feedlots and the lakes in shared watersheds.

However, there are some options to slow or reverse the process of deteriorating lake health. Intelligent runoff control practices can help protect Minnesota lakes from eutrophication! Feedlots can implement practices such as...

- Total Runoff Collection
- Rooftops over feed areas
- Runoff Containment when collection is not feasible

As for returning impaired lakes to healthy status in the short term, changes in lake use, liming solutions, and removing sediments can all speed up the process of lake restoration. At the household level, the protection of native grasses to prevent unnecessary erosion can also help prevent nutrient overloading of lakes. Most importantly, education and awareness can change perceptions of the issue.

Sources

Minnesota Natural Resources Department. Lake Plant Eutrophication IBI. (2018) St.Paul, Minnesota: Paul Radomski. Available: Minnesota Geospatial Commons

https://gisdata.mn.gov/dataset/env-lake-plant-ibi

Radomski, P., and D. Perleberg. 2012. Application of a versatile aquatic macrophyte integrity index for Minnesota lakes. Ecological Indicators 20:121-128.

"Lake Eutrophication." RMBEL, https://www.rmbel.info/primer/lake-eutrophication/.

2016 Crop Year Fertilizer Sales Report. Minnesota Department of Agriculture, https://www.mda.state.mn.us/sites/default/files/inline-files/2016fertsales.pdf.

"Eutrophication." Merriam-Webster, Merriam-Webster, https://www.merriam-webster.com/dictionary/eutrophication.

Minnesota Natural Resources Department. Feedlots in Minnesota. (2016) St.Paul, Minnesota: David Fawcett. Available: Minnesota Geospatial Commons

https://gisdata.mn.gov/dataset/env-feedlots