Drastic sedimentation changes in a Twin Cities Metro Area watershed on the urban-rural boundary

DUNCANSON, Sam P., THEISSEN, Kevin M., HOULE, Gabrielle R. and EDLUND, Mark B.

1)Geology, University of St. Thomas, 2115 Summit Ave, Saint Paul, MN 55105, (2)St. Croix Watershed Research Station, Science Museum of Minnesota, Marine on St. Croix, MN 55047, dunc3452@stthomas.edu
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• University of St. Thomas Geology+ Biology Department
• LACCORE- National Lacustrine Core Facility, University of MN
Goals

• Comfort Lake-Forest Lake Watershed is interested in remediation and management of impaired lakes and surface water.

• By using a paleo-ecological approach, watershed managers will be better informed for remediation and management.

• Shields, Moody, and Comfort Lake

• Using sediment cores and geochemical proxies to look at sediment loading and nutrients in the basins.
Comfort Lake-Forest Lake Watershed with its four subsections

30,000 acres in size
Duncanson, GSA 03/2017
Methods

• Magnetic susceptibility
• Loss On Ignition (LOI)
• XRF analysis
• $^{210}\text{Pb}$ age dating
• $P$ Fractions
Shields Lake

Area: 30 acres. Depth: 7.8m

2015: 349 μg/L phosphorous*

Lake Grade: F+

*Lakes in central and southern Minnesota have a eutrophic standard of 40-60 μg/L P

Duncanson, GSA 03/2017
Golf course construction

Shields LOI

Mag. Susceptibility

XRF concentrations

Sediment DMAR

$852 \text{g/cm}^2/\text{yr}$

$.036 \text{g/cm}^2/\text{yr}$
Moody
Area: 41 acres. Depth: 14.3m
2015: 118 μg/L phosphorous
Lake Grade: D-

Headwaters of CL-FL Watershed
1860: 22,132 acres (7.8%) of Chisago co. are farmland
1940: Conventional agriculture begins to implemented in the county (fertilizer, drainage tile)
Comfort Lake
Area: 218 acres. Depth: 13.72m
31 $\mu$g/L phosphorous
2015: Lake Grade: C+

Majority of water flows to Comfort Lake, “end” of watershed
Preliminary results suggest notable event at ~120cm
Key Findings

- All three lakes, to various degrees, have been altered from their natural, pre-settlement conditions.
- The Shields record has been firmly tied to specific land use changes, and moody.
- Remediation efforts should continue, with major focuses on reduction of internal and external sources of phosphorus within the lakes.
Further work

• Receive final $^{210}\text{Pb}$ age dating for Comfort, P fractions for Comfort and Moody
• Diatom analysis for phosphorous in the water column
• Future lakes to be cored and tested
Remediation:

• All three lakes will be implementing vegetated buffer strips
• Moody Lake undergoing wetland reconstruction, removing phosphorous-laden sediment
Thank you!