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

DUNCANSON, Sam P.\(^1\), THEISSEN, Kevin M.\(^2\), HOULE, Gabrielle R.\(^2\) and EDLUND, Mark B.\(^3\)

\(^1\)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, \(^3\)dunc3452@stthomas.edu
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• University of St. Thomas Geology+ Biology Department
• Comfort Lake- Forest Lake Watershed District (CLFLWD)
• 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, the district 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.
~47 square miles (30,000) acres in size

Duncanson, CLFLWD 04/2017
Methods

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

Composition and Timing
Key Findings

• All three lakes, to various degrees, have been altered from their natural, pre-European settlement conditions.

• Final data updates from the SCWRS will provide a clearer picture on history of the lakes.
Shields Lake
Area: 30 acres. Depth: 25ft
2015: 349 μg/L phosphorous*
Lake Grade: F+

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

Shields LOI

Mag. Susceptibility

XRF concentrations

Sediment DMAR

g/cm²/yr

Alum treatment

0.852 g/cm²/yr

0.036 g/cm²/yr

210Pb calibrated age (calendar yr)

Initial settlement

Settlement cont.

1950

1975

2000

1925

1900

1875

1850

1825

1800

0 25 50 75 100 0 4 8 e^7 e^6 e^9 e^10 e^11 e^12 e^13

Organic

CaCO₃

Inorg.

Mag. shields

Mn

Ca

Ti

K

Fe
Moody

Area: 41 acres. Depth: 47ft
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: 45ft
31 μg/L phosphorous
2015: Lake Grade: C+

Water from district exits through Comfort Lake to the Sunrise River
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.
- Remediation efforts should continue, with major focuses on reduction of internal and external sources of phosphorus within the lakes.

![Graphs showing sedimentation rates over time.](image)
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
Thank you!