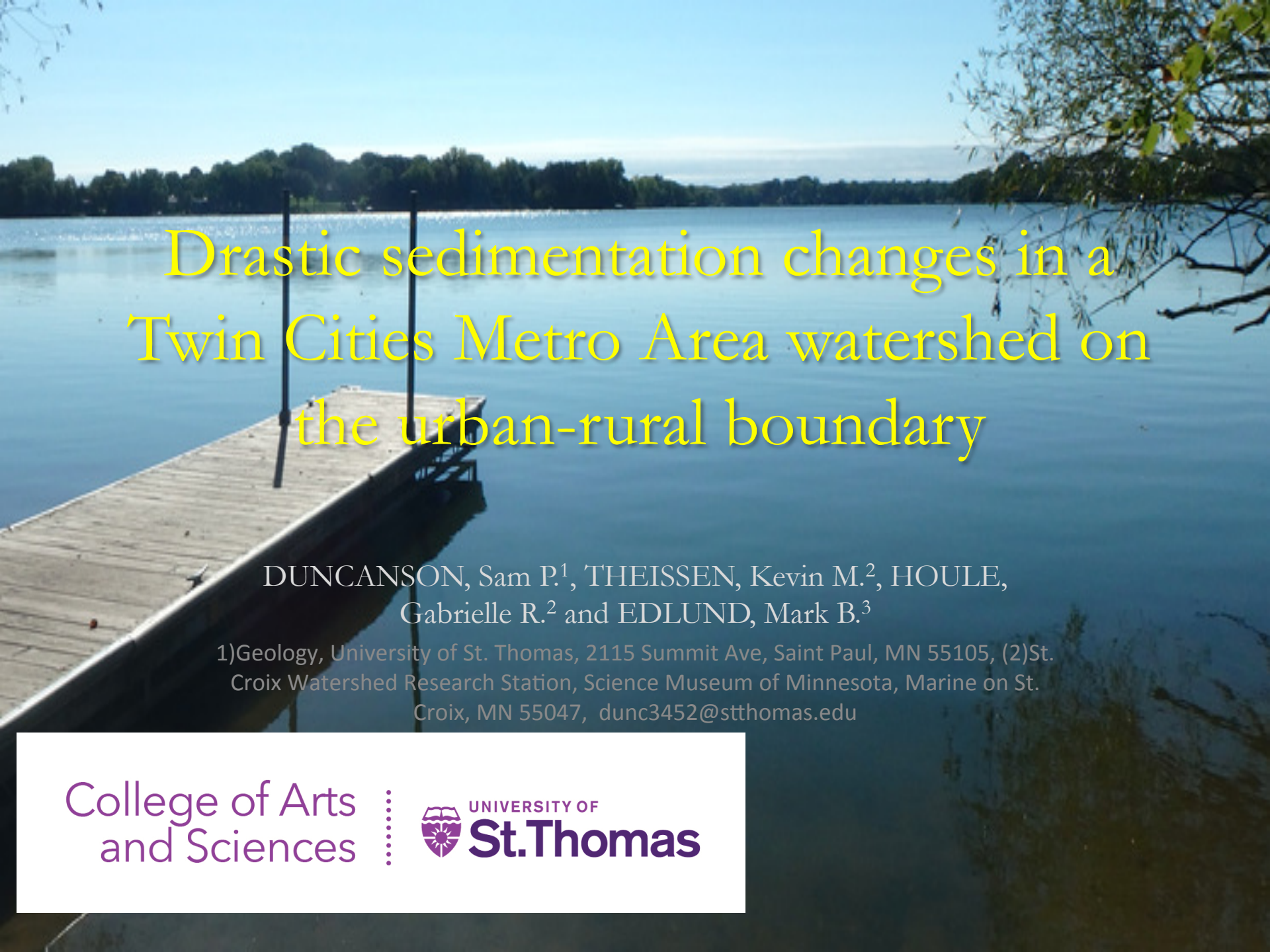

Drastic sedimentation changes in a Twin Cities Metro Area watershed on the urban-rural boundary

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College of Arts and Sciences

UNIVERSITY OF St.Thomas

Acknowledgments

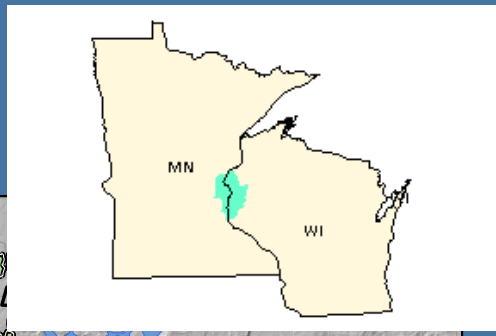
- City of Forest Lake, MN
- Mark Edlund- St. Croix Watershed Research Station, Science Museum of MN
- University of St. Thomas Geology+ Biology Department

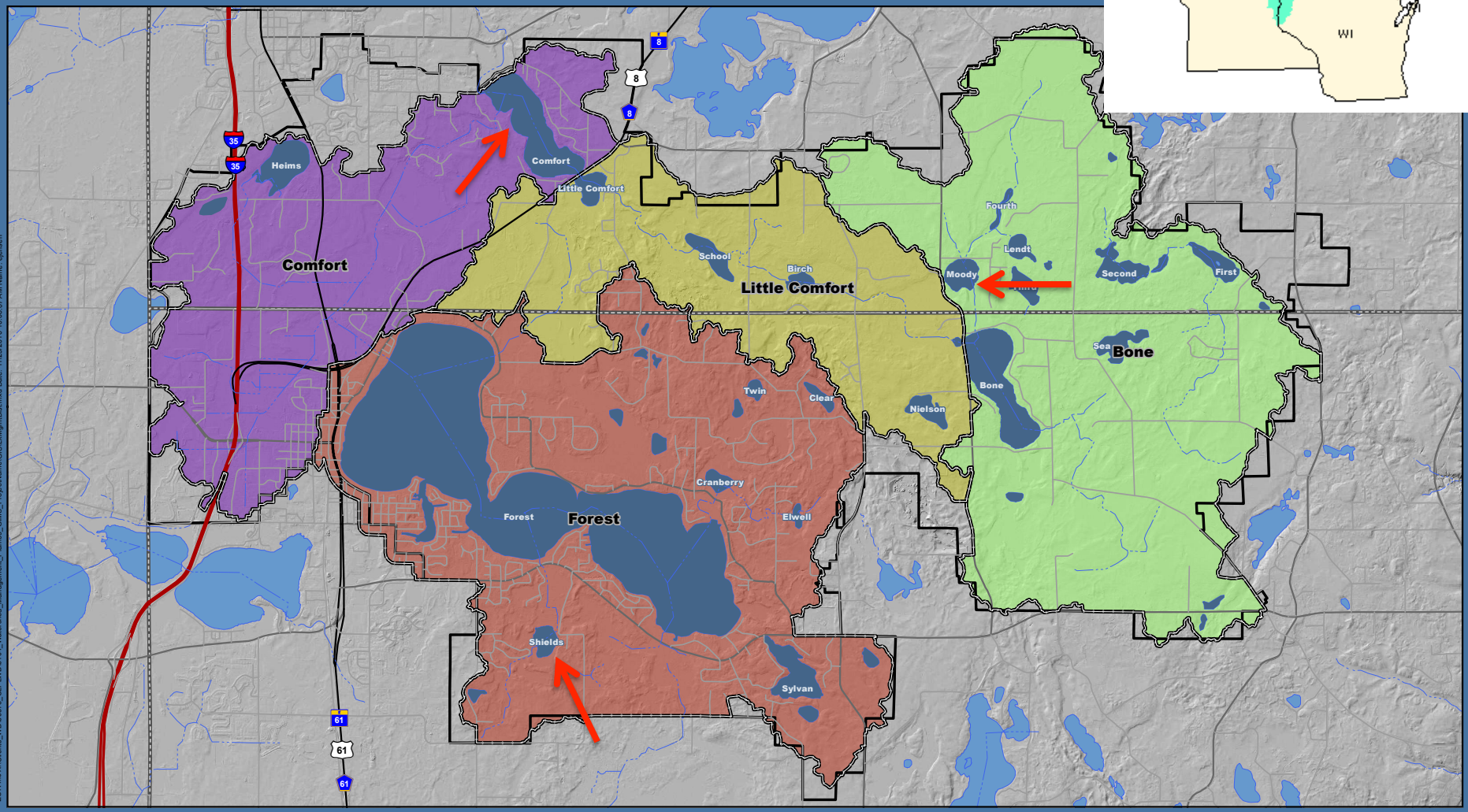
- LACCORE- National Lacustrine Core Facility, University of MN

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 it's four subsections





Political Boundary
County Boundary
Lake Managment District

30,000 acres in size

Duncanson, GSA 03/2017

EOR
www.eorinc.com

N

0 0.5 1 Miles

Methods

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

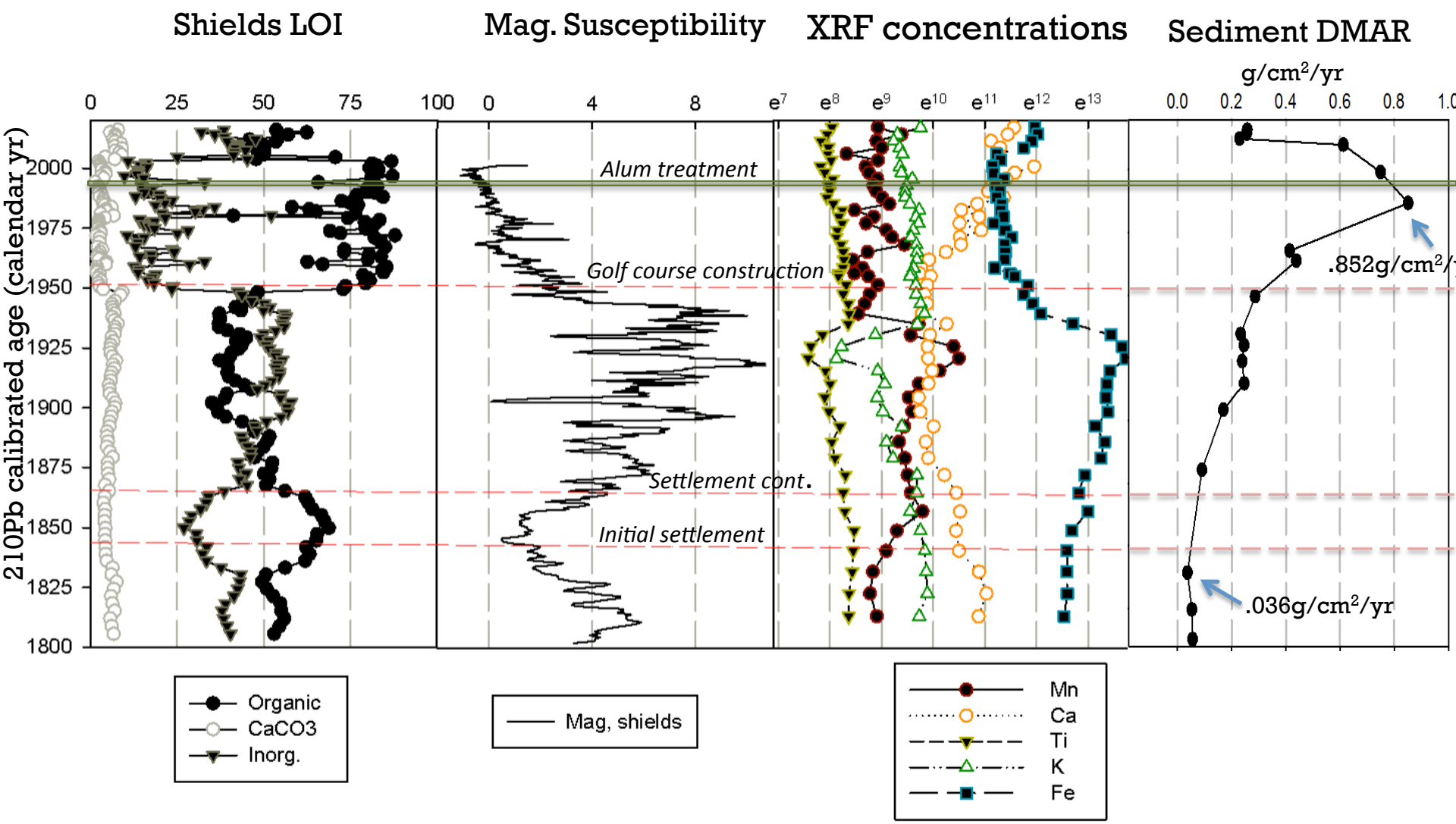
Shields Lake

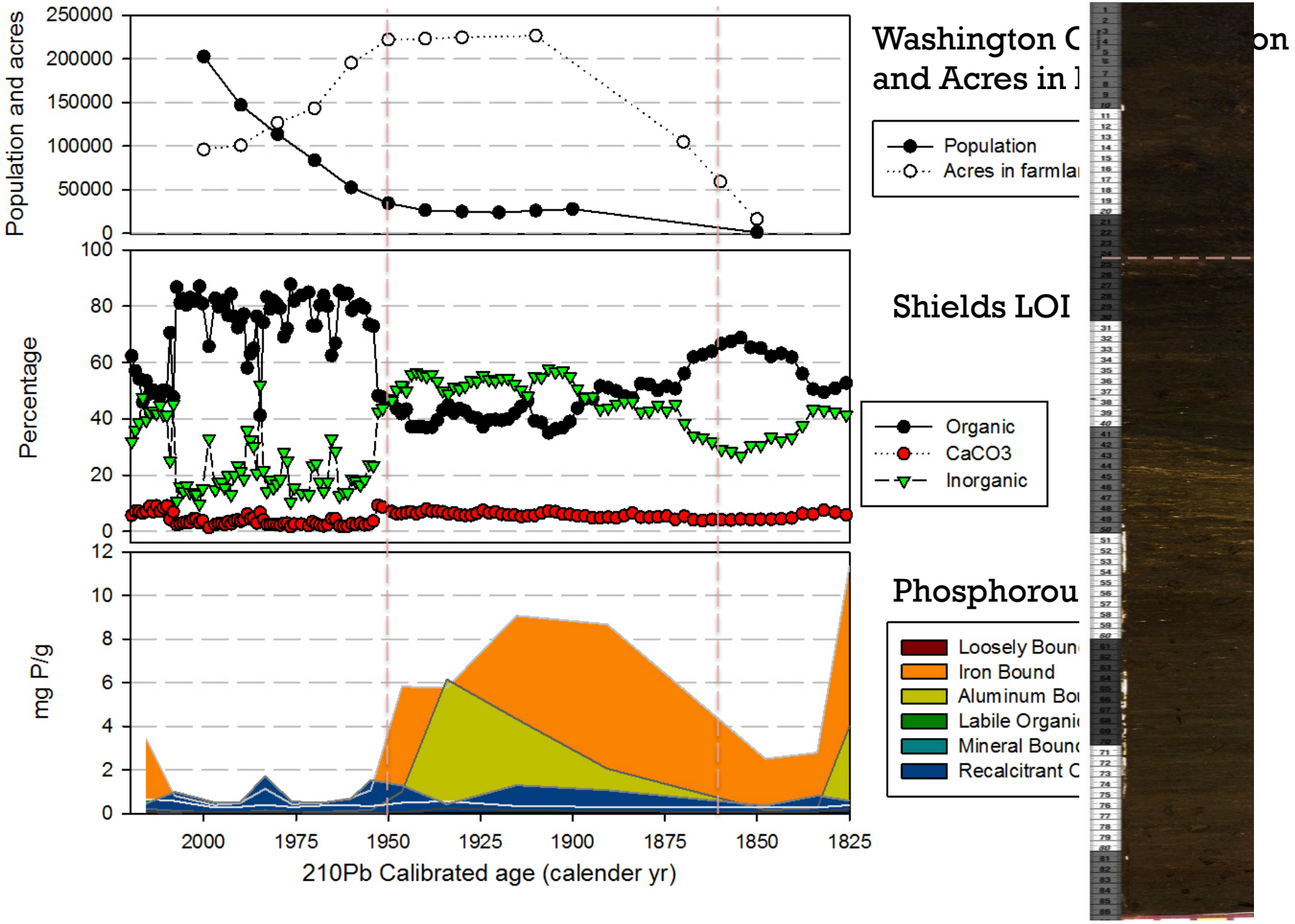
Area: 30 acres. Depth: 7.8m

2015: 349 µg/L phosphorous*

Lake Grade: F+

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


Shields LOI
Mag. Susceptibility
XRF concentrations
Sediment DMAR
g/cm²/yr
0
25
50
75
100
0
4
8
e⁷
e⁸
e⁹
e¹⁰
e¹¹
e¹²
e¹³
0.0
0.2
0.4
0.6
0.8
1.0
210Pb calibrated age (calendar yr)
2000
1975
1950
1925
1900
1875
1850
1825
1800
Alum treatment
Golf course construction
Settlement cont.
Initial settlement
.852g/cm²/
.036g/cm²/yr
Organic
CaCO3
Inorg.
Mag, shields
Mn
Ca
Ti
K
Fe


Population and acres
250000
200000
150000
100000
50000
0
Washington C
and Acres in I
on
Population
Acres in farmla
Percentage
100
80
60
40
20
0
Shields LOI
Organic
CaCO3
Inorganic
mg P/g
12
10
8
6
4
2
0
Phosphorou
Loosely Boun
Iron Bound
Aluminum Bou
Labile Organi
Mineral Boun
Recalcitrant C
2000
1975
1950
1925
1900
1875
1850
1825
210Pb Calibrated age (calender yr)

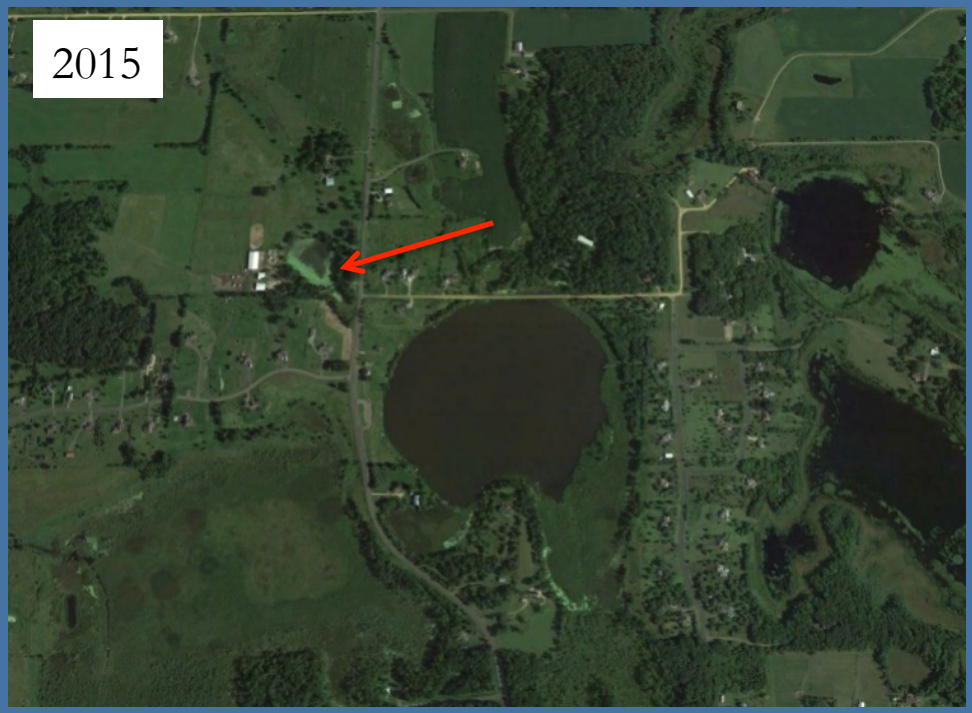
Moody

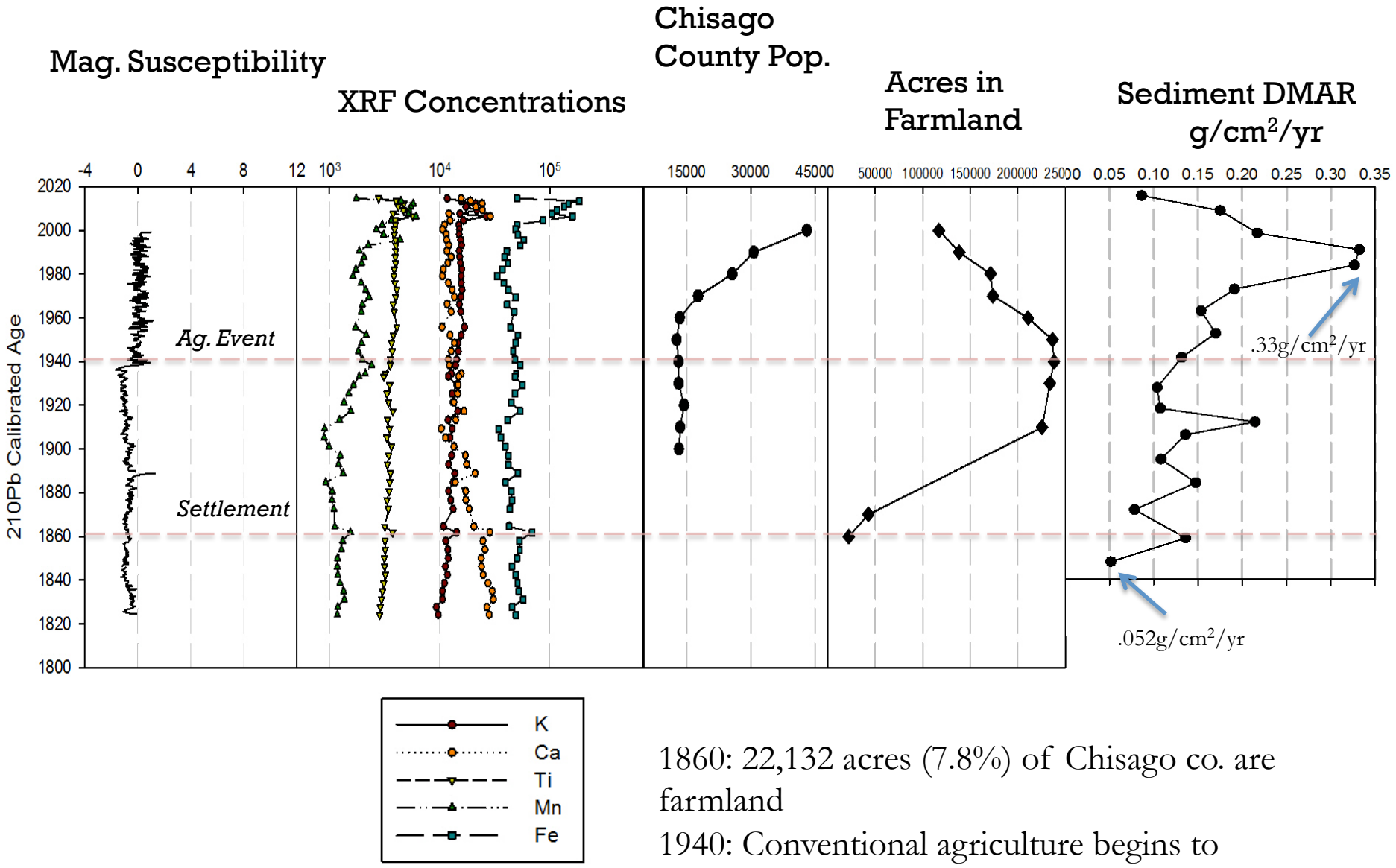
Area: 41 acres. Depth: 14.3m

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

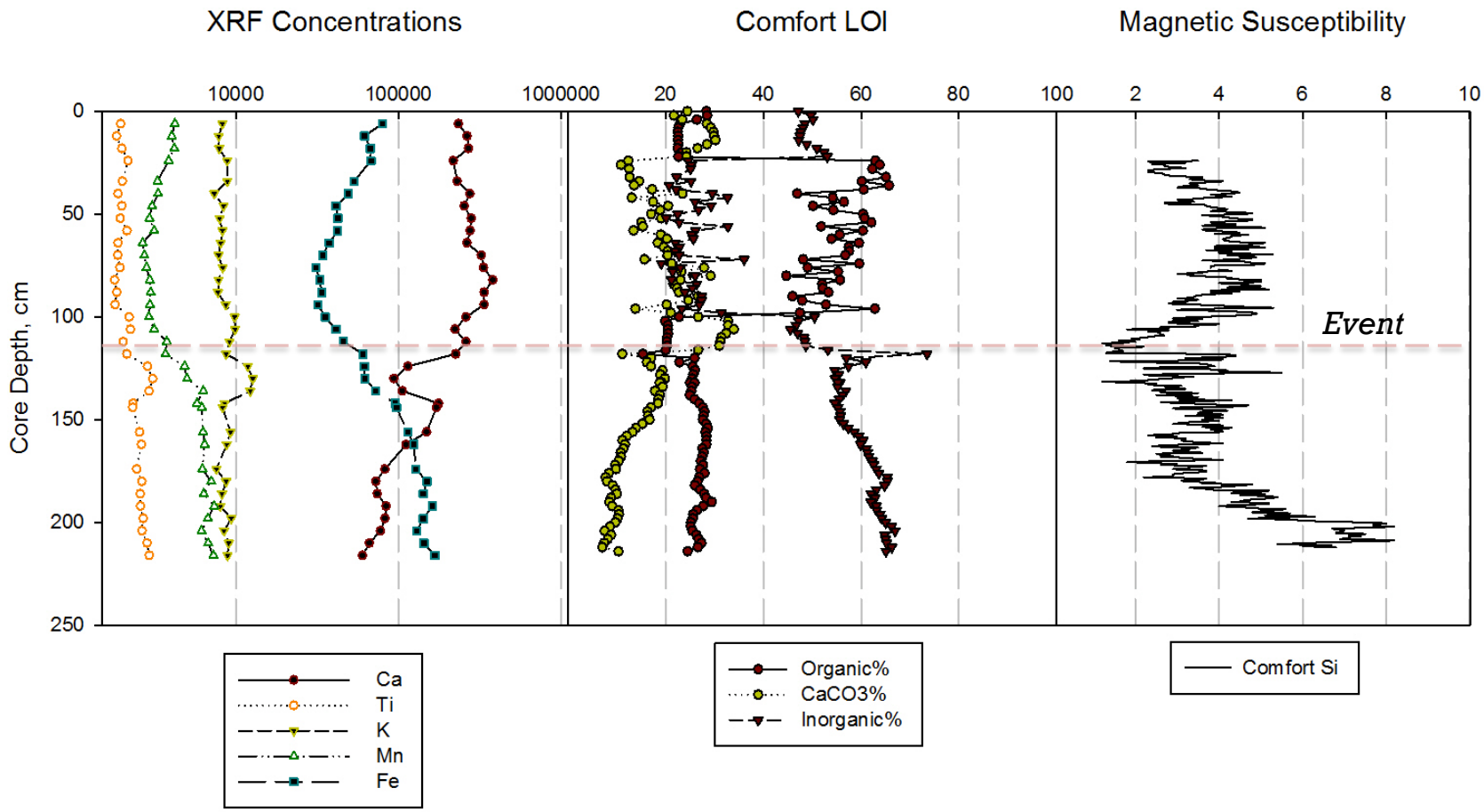
Area: 218 acres. Depth: 13.72m

31 µg/L phosphorous

2015: Lake Grade: C+

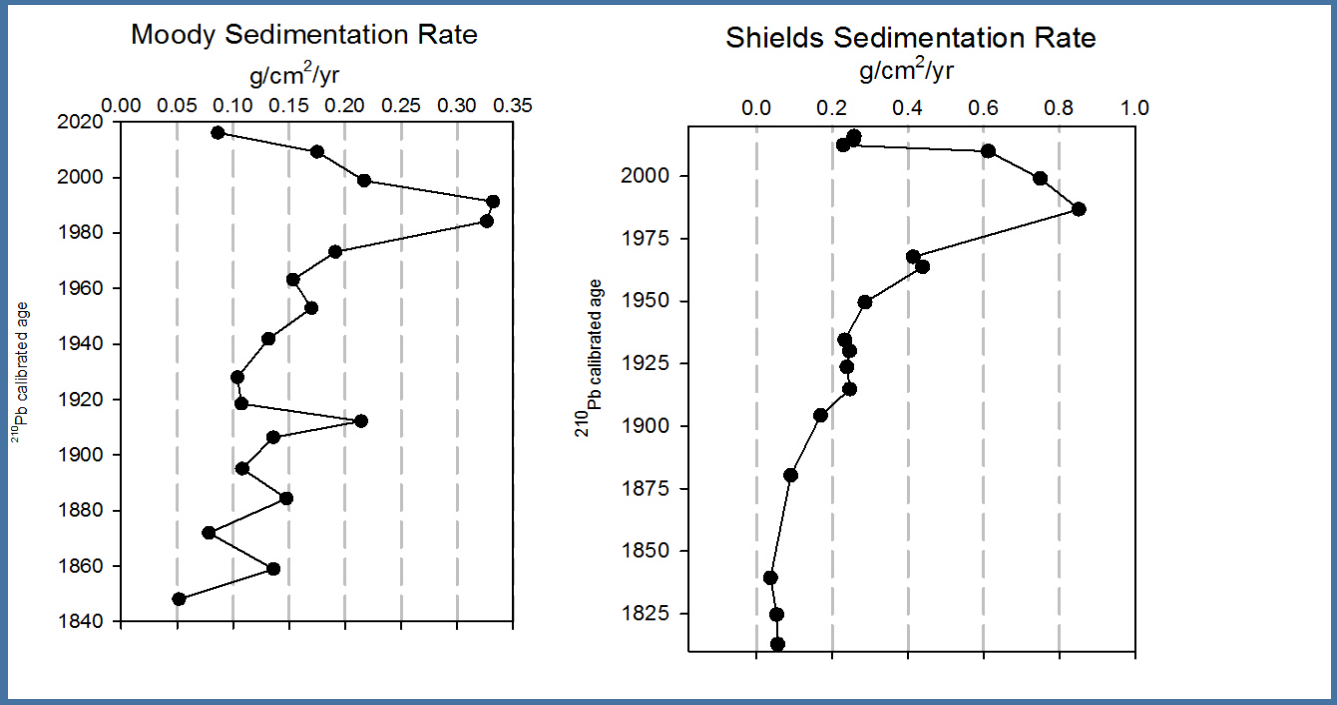
Majority of water flows to Comfort Lake, "end" of watershed

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}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!