



St. Louis River Watershed Mercury TMDL Study

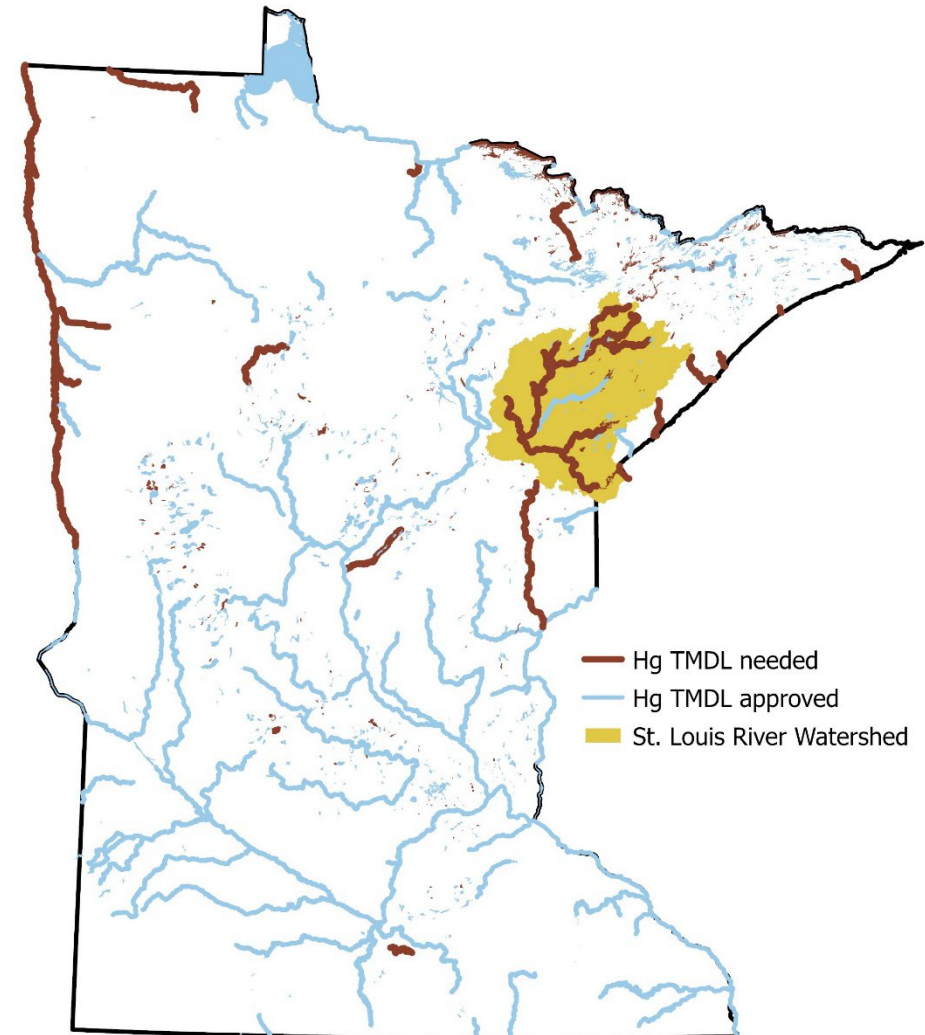
Annual Statewide Mercury TMDL Implementation Plan Oversight Committee



Andrea Plevan | TMDL Lead
Jennifer Brentrup | Project Lead
9/21/2023

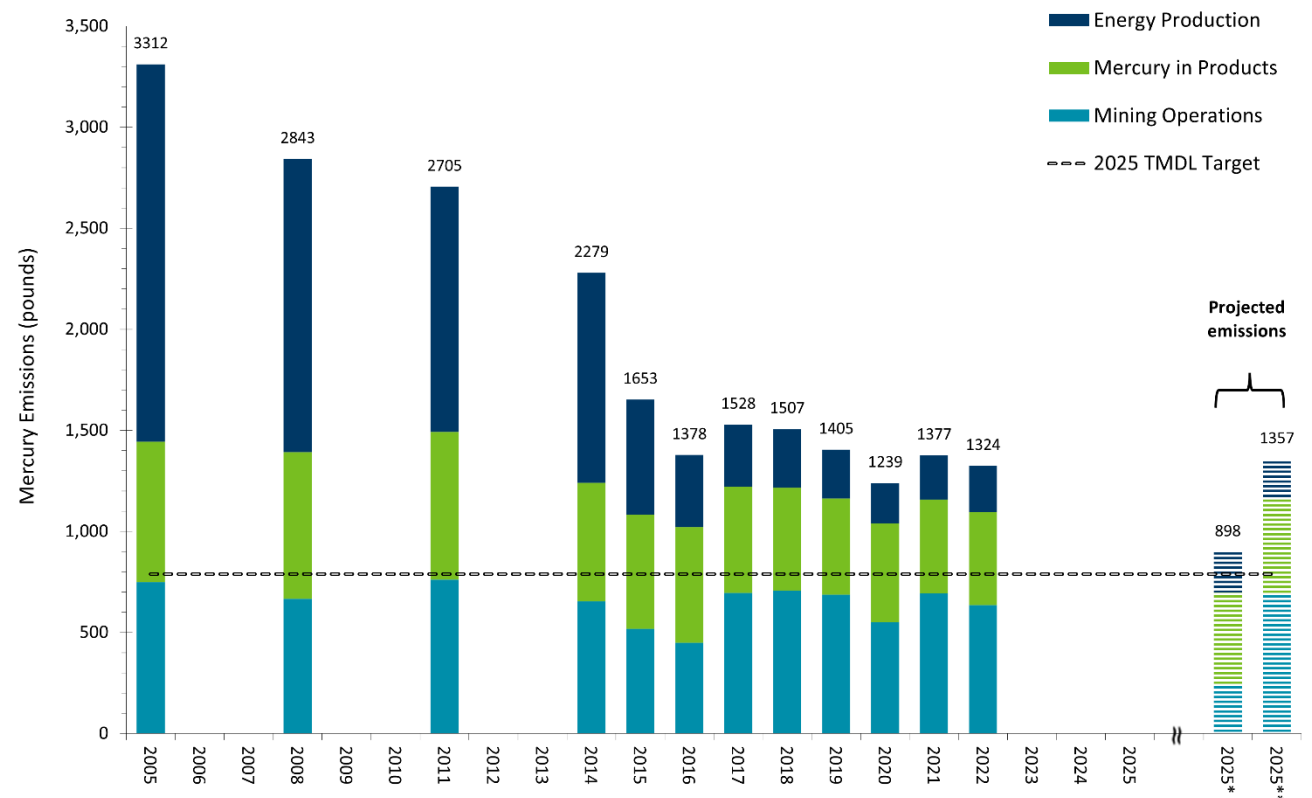
First MN mercury TMDL beyond statewide TMDL

- Statewide, 25% of water bodies with mercury impairments need reductions beyond those called for in the statewide TMDL to meet mercury standards
- 18% of these remaining impairments are in the St. Louis River Watershed
- TMDLs are needed (Clean Water Act)



Statewide TMDL and St. Louis River Watershed TMDL

- Mercury reductions called for in the statewide TMDL are needed to meet the St. Louis River Watershed TMDLs
 - Air emissions
 - Wastewater
- St. Louis R Watershed TMDLs will go beyond the statewide reductions



* This projection is based on the ferrous mining/processing industry in northern MN meeting the required 72% reduction specified in Minn. R. 7007.0502.

** This projection is based on the ferrous mining/processing industry's proposed reductions in each mercury reduction plan applied to the baseline emissions as calculated by MPCA.

St. Louis River Area of Concern and St. Louis River Watershed TMDLs

Addressing mercury — how multiple programs work together

Three federal and state programs work to reduce mercury in the St. Louis River Watershed.



www.pca.state.mn.us/slr-mercury



MERCURY SOURCES

Legacy aquatic sediment contamination (before 1970s environmental regulations)

Watershed tributary inputs

Atmospheric deposition local, regional, and global sources to the air

PROGRAMS

St. Louis River Area of Concern (AOC)

St. Louis River Total Maximum Daily Load (TMDL)

Addresses mercury concentration in fish $>.572$ mg/kg

Statewide Total Maximum Daily Load (TMDL)

Addresses mercury concentration in fish <0.572 mg/kg

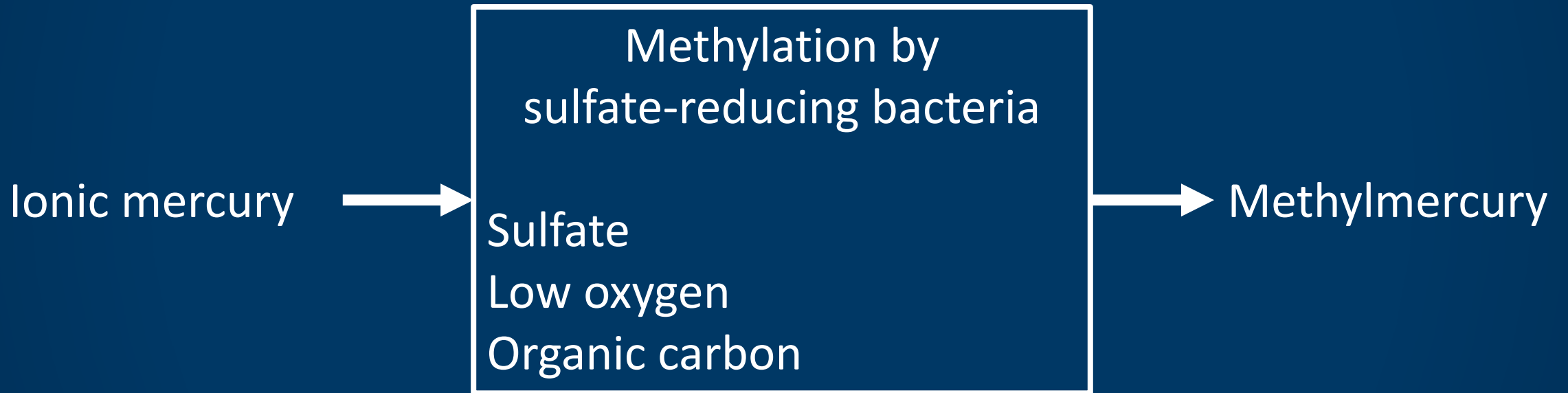
GOALS

Reduction of legacy mercury from sediment into the food web

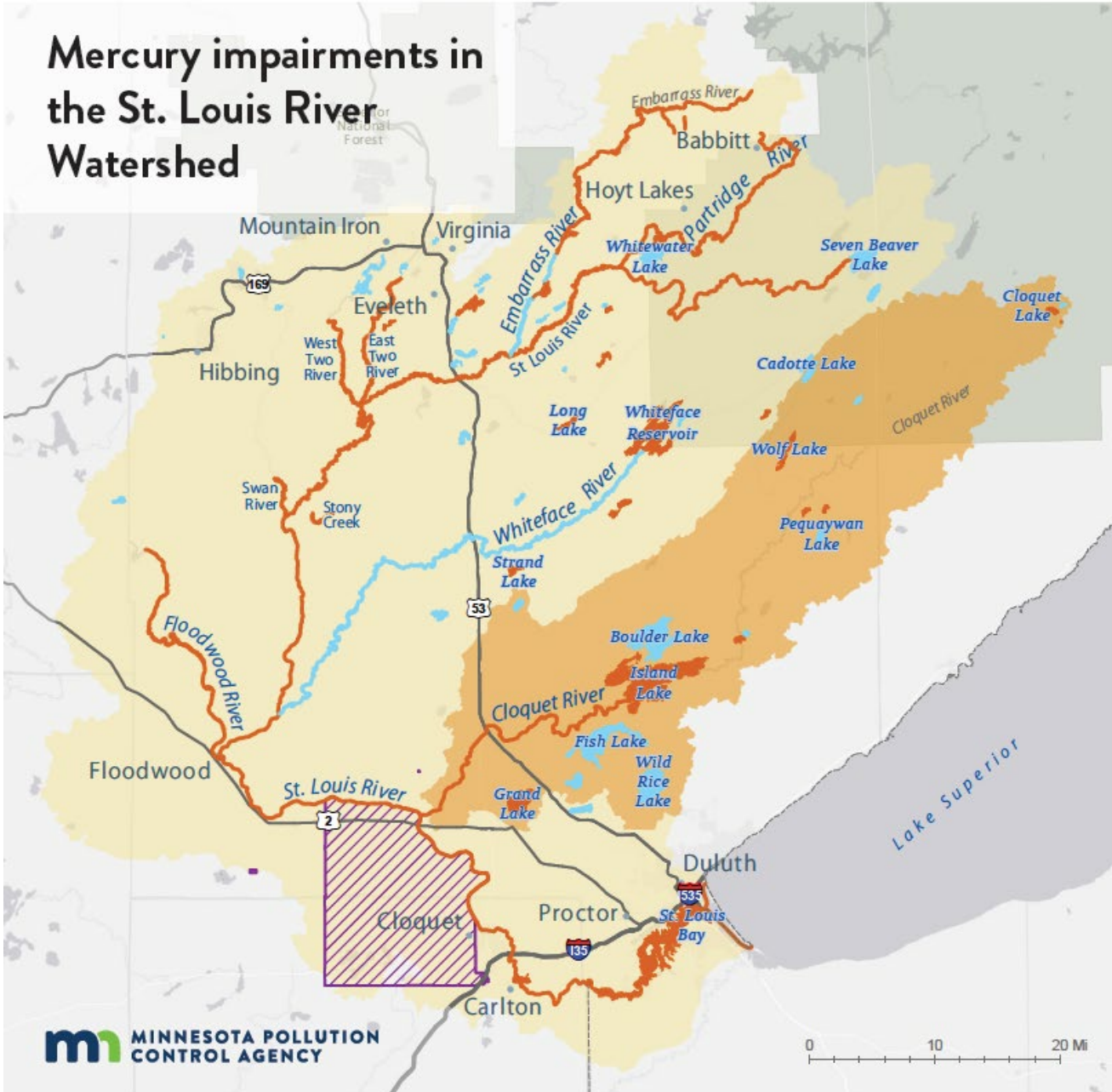
Reduction of watershed and atmospheric mercury sources

Improve human and environmental health

Mercury methylation



Mercury impairments in the St. Louis River Watershed



- Mercury impairments**
- TMDL needed
 - TMDL approved
- Watersheds**
- Cloquet River
 - St. Louis River
- Fond du Lac Reservation
- Superior National Forest
- Minnesota Boundary



Impairment Type	Streams	Lakes
Water column Hg	N = 18	N = 4
Fish tissue Hg	N = 25	N = 28
Total = 75	N = 43	N = 32

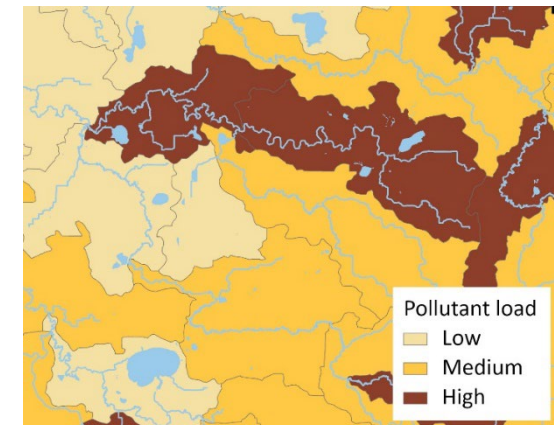
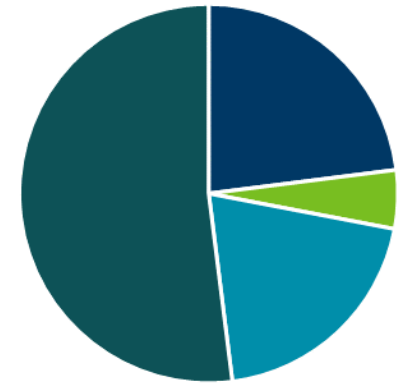


TMDL project goals

- Description of mercury sources
- Allowable amounts and reductions to meet standards
- Recommend management practices to meet aquatic consumption designated use

$$\text{TMDL} = \text{LA} + \text{WLA} + \text{MOS}$$

Implementation strategies



Summary of work to date

- Research, data collection and analysis (~2000—present) to inform TMDL approach
- Project charter (fall 2021 / [fall 2022](#))
- Technical advisory team (TAT): government partners (tribal, federal, state) and scientists; provide technical, scientific, and policy expertise
- Contract with consultant (Tetra Tech) for modeling
- Public forums
- TMDL approach (in progress): MPCA staff, TAT, Tetra Tech, public



Public forums

Feb 2023	<p>Why mercury matters (Dr. Cole Pueringer)</p> <hr/> <p>How mercury works in the environment (Dr. Sarah Janssen)</p> <hr/> <p>Small group discussions:</p> <ul style="list-style-type: none">Watershed and impairmentsHg and MeHg in the environmentData and tools to understand MeHg for this TMDL
Jun 2023	<p>Mercury sources in the SLRW</p> <hr/> <p>TAT comments</p> <hr/> <p>Small group discussions: mercury sources in the watershed</p>
Jul11–Aug11	Online public input opportunity



<https://www.pca.state.mn.us/business-with-us/st-louis-river-watershed-mercury-tmdl>



Stay connected

Sign up for updates on the St. Louis River Watershed mercury TMDL.

jane.doe@example.com


Subscribe

For more information






-  [Project charter for the St. Louis River Watershed Mercury TMDL \(wq-iw10-16a\)](#)
- [Document-sharing site for St. Louis River mercury TMDL project](#) 

Document sharing site

Link from
project
website



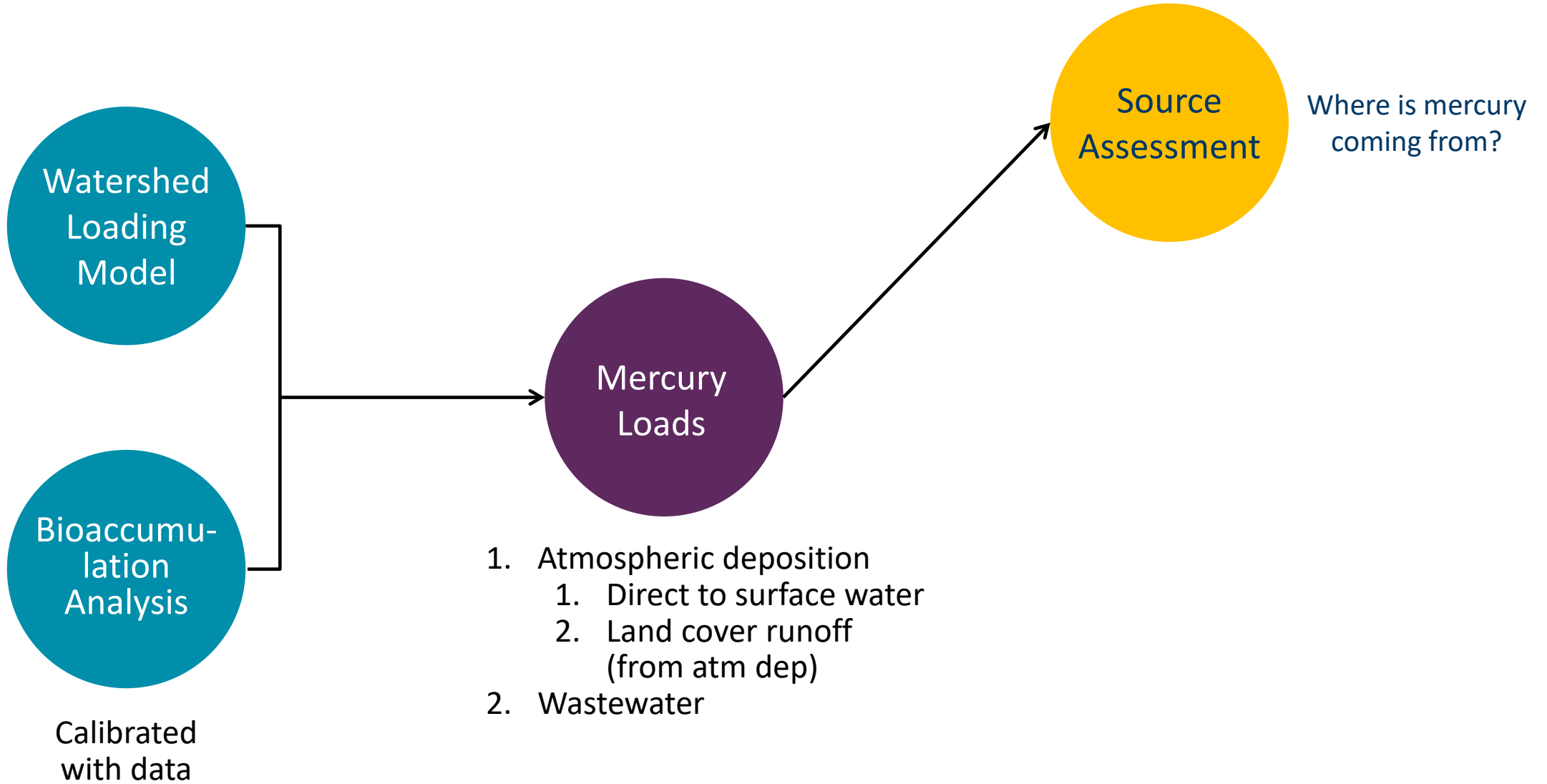
SLR TMDL project

-  Public Forum 1_2023-02-07
Modified: Jul 28, 2023
-  Public Forum 2_2023-06-06
Modified: 12:30 PM
-  Technical Advisory Team Information
Modified: Aug 24, 2023
-  CitationList_SLRW_HgTMDL_June2023.pdf
Uploaded: Jun 14, 2023
414.84 KB
-  Frequently Asked Questions, St. Louis River Watershed Mercury TMDL.pdf
Uploaded: Jul 11, 2023
339.87 KB

Modeling

TMDL
Analysis

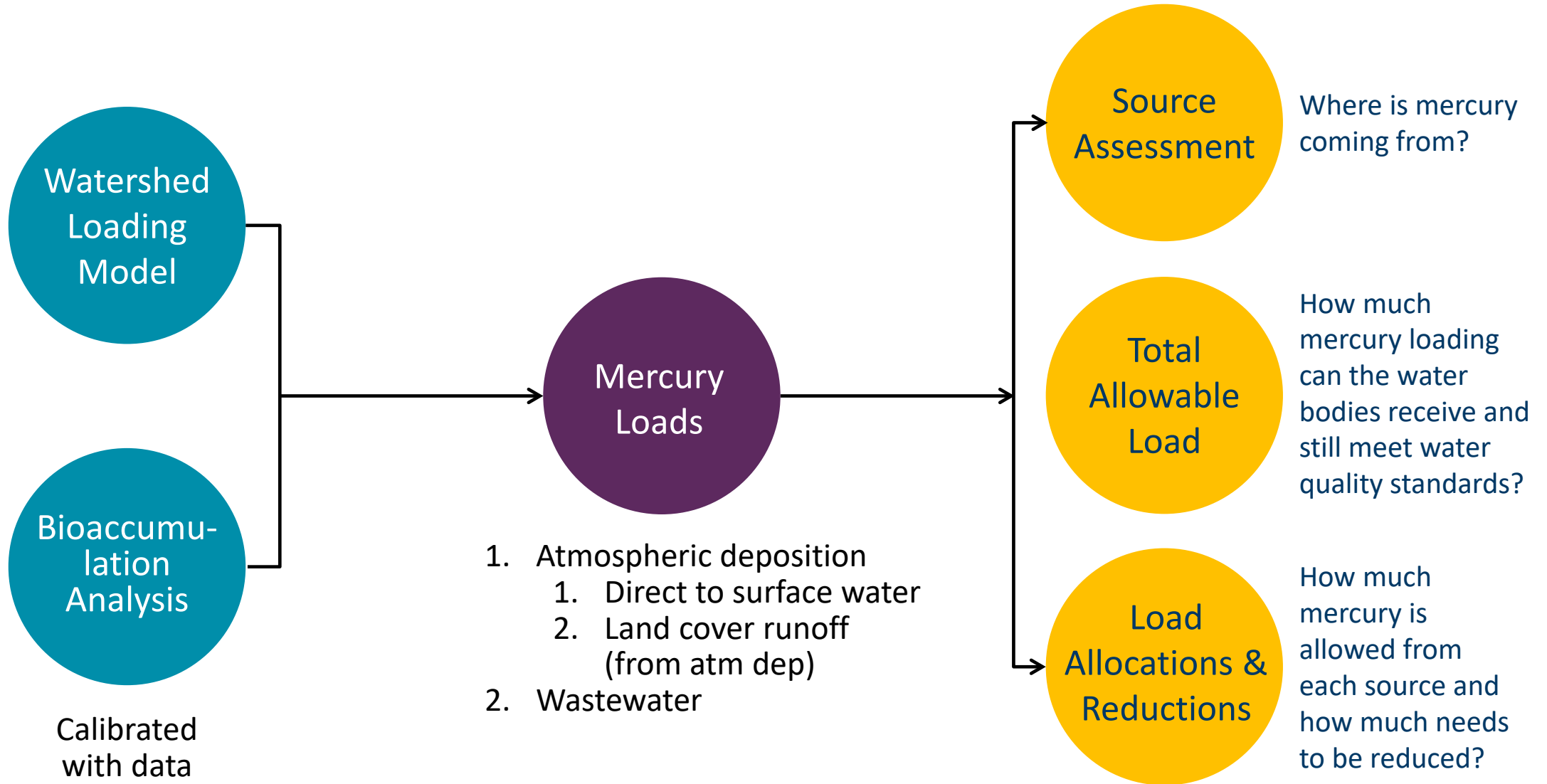
Report



Modeling

TMDL
Analysis

Report



Timeline (approximate)

2023	Public forum #1 (February)
	Mercury source load calculations (draft) for watershed
	Public forum #2 (June)
	Mercury source load calculations (draft) for estuary
	Draft TMDL calculations
2024	Meetings with industry, environmental groups
	Public forum #3
	TMDL calculations
	Implementation strategies
	Fond du Lac community meeting
	Public forum #4
2025– 2026	Report writing and review
	Public notice
	EPA approval



Mercury sources

Transformation and transport of mercury

*Photo Credit:
Randen Pederson*

St. Louis River Watershed

- Large watershed >9000 km² and largest tributary to Lake Superior
- Land cover dominated by deciduous forest and peatlands
- Fond du Lac Reservation borders St. Louis River
- Largest freshwater estuary on US side Lake Superior
- Mesabi Iron Range in northern part of the watershed



Photo Credit: Randen Pederson

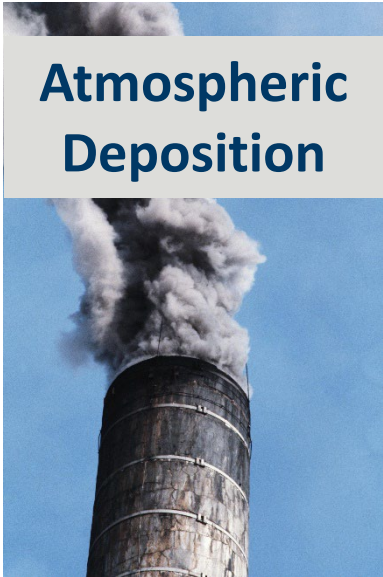
Transformations and transport of mercury sources

- Where is mercury likely to become methylmercury?
- How do the relative loads of total mercury and methylmercury vary across the watershed?



Primary Mercury Sources

**Atmospheric
Deposition**



*direct to
surface waters*



**Land Cover
Runoff**



*via watershed
runoff*

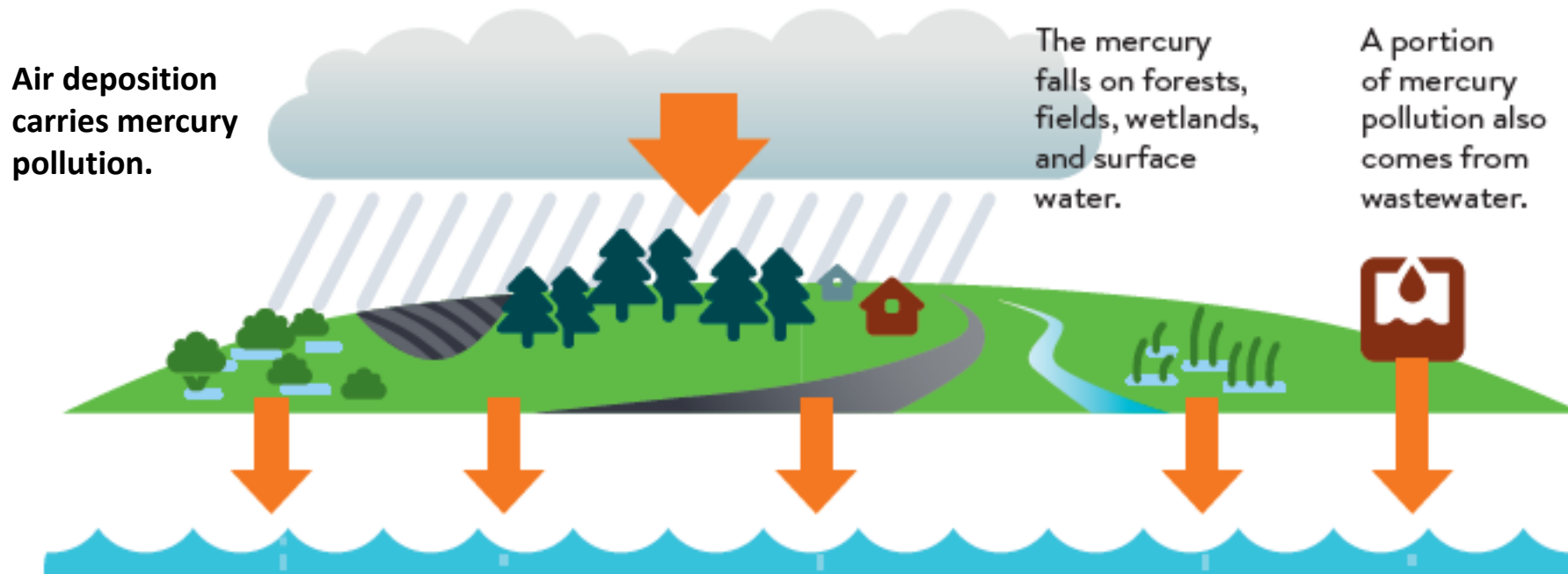


Wastewater

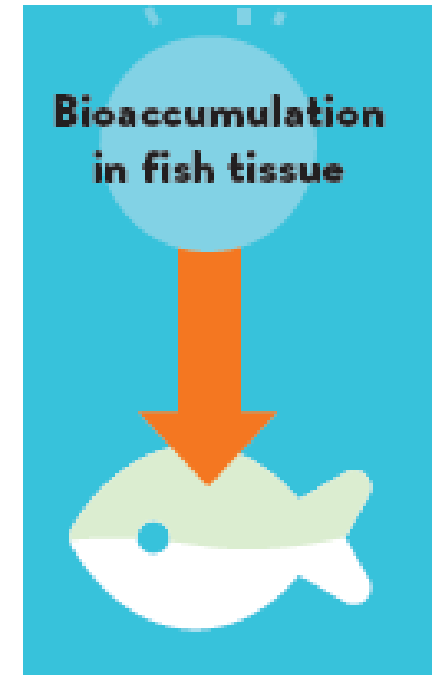


Technical approach

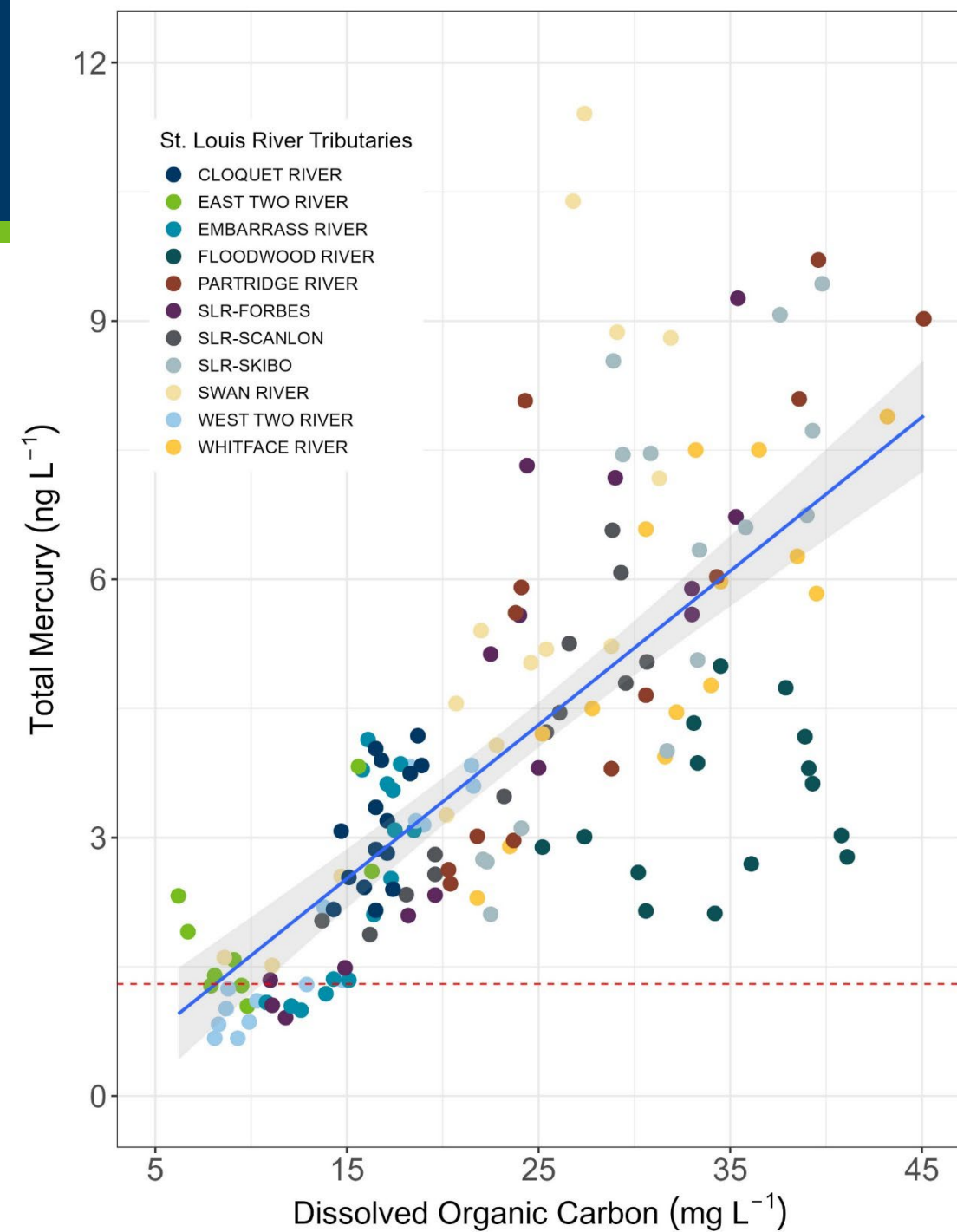
Watershed model



Bioaccumulation analysis



Modeling Mercury Transport with Dissolved Organic Carbon



Subwatersheds

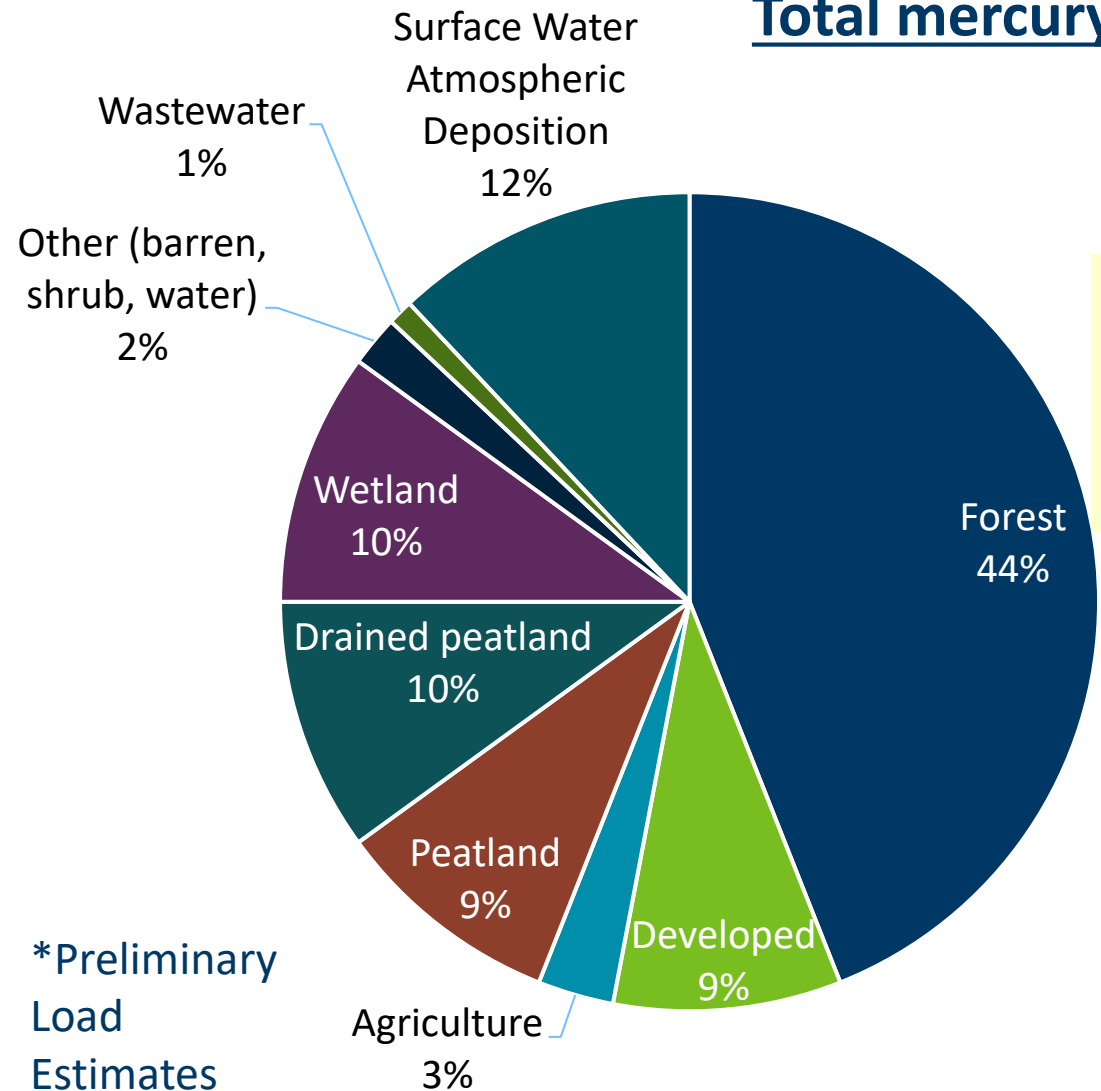
- 15 subwatersheds based on hydrology
- Subwatersheds vary in area, dominant land cover types, and the number of wastewater sources
- Spatial scale for source assessment and TMDLs



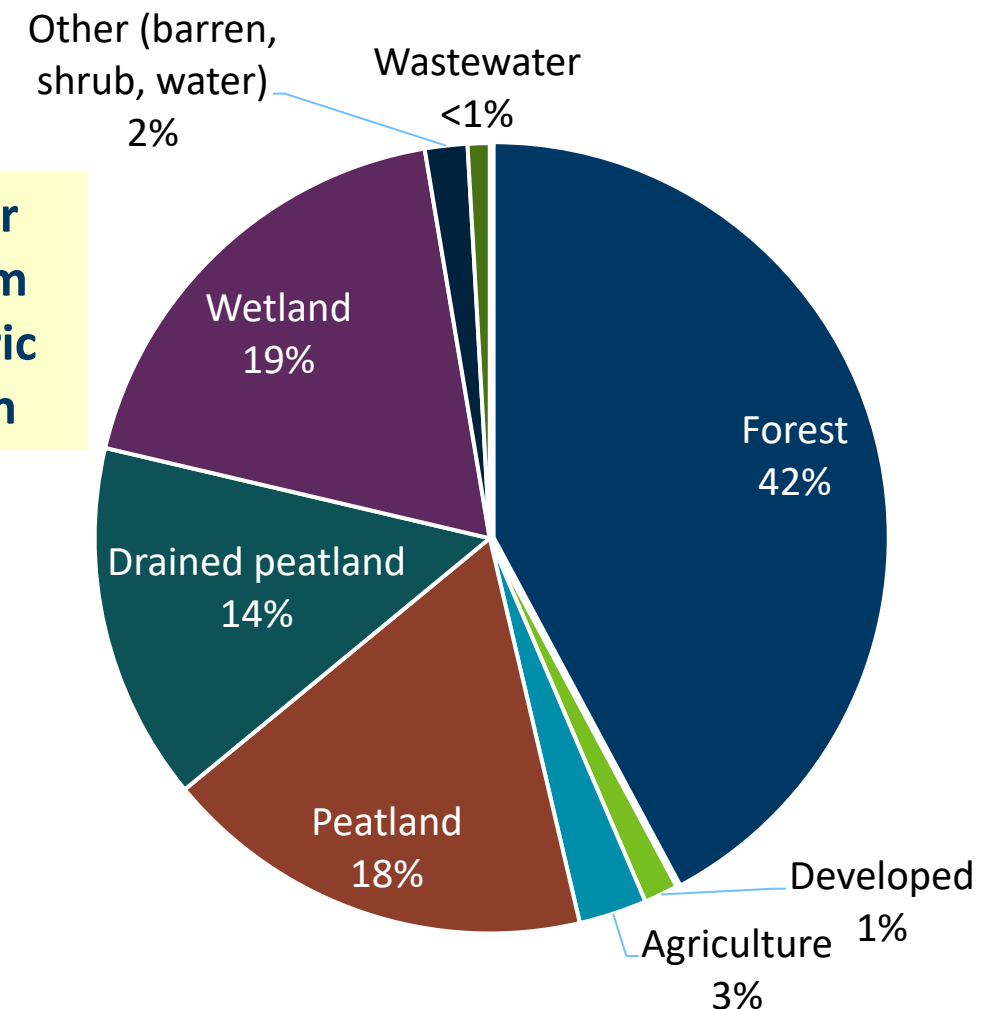
Total mercury vs. methylmercury average annual load

Total mercury

Methylmercury



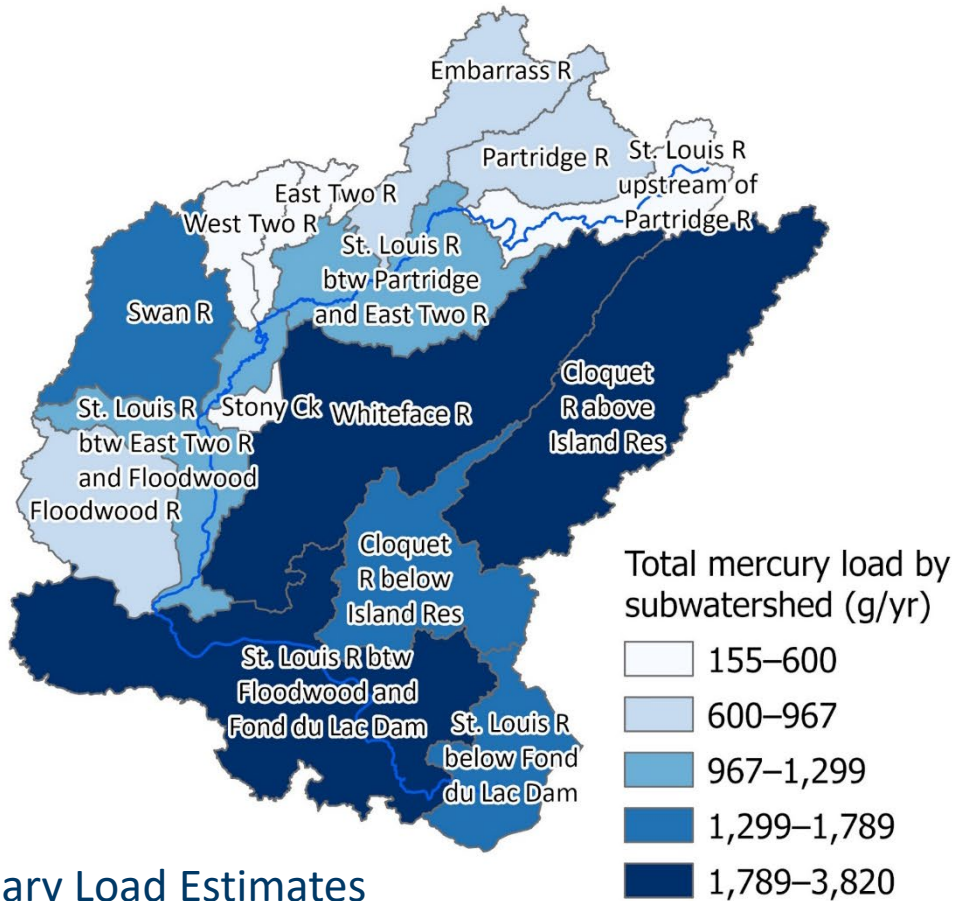
Land cover runoff from atmospheric deposition



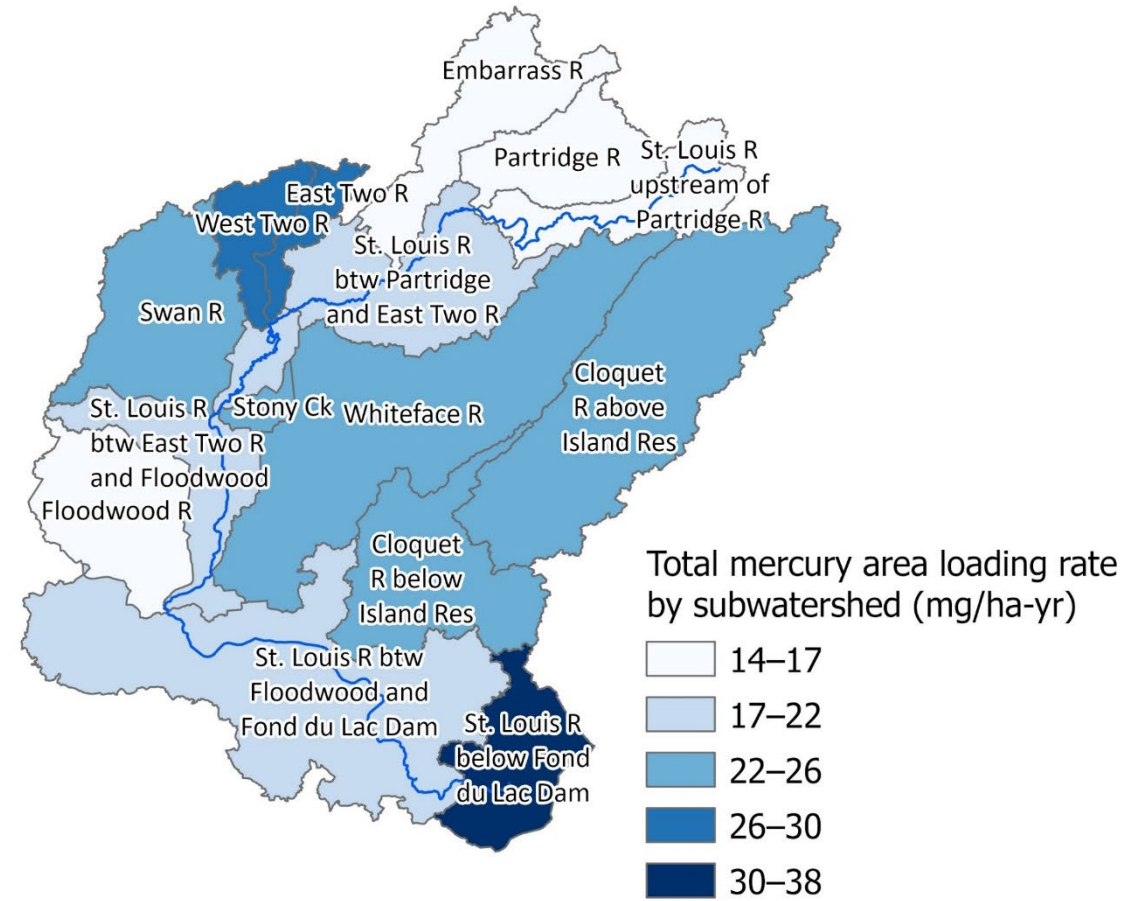
*Preliminary Load Estimates

What is the geographic variation of total mercury loads?

Total Mercury Annual Loads (g/yr)



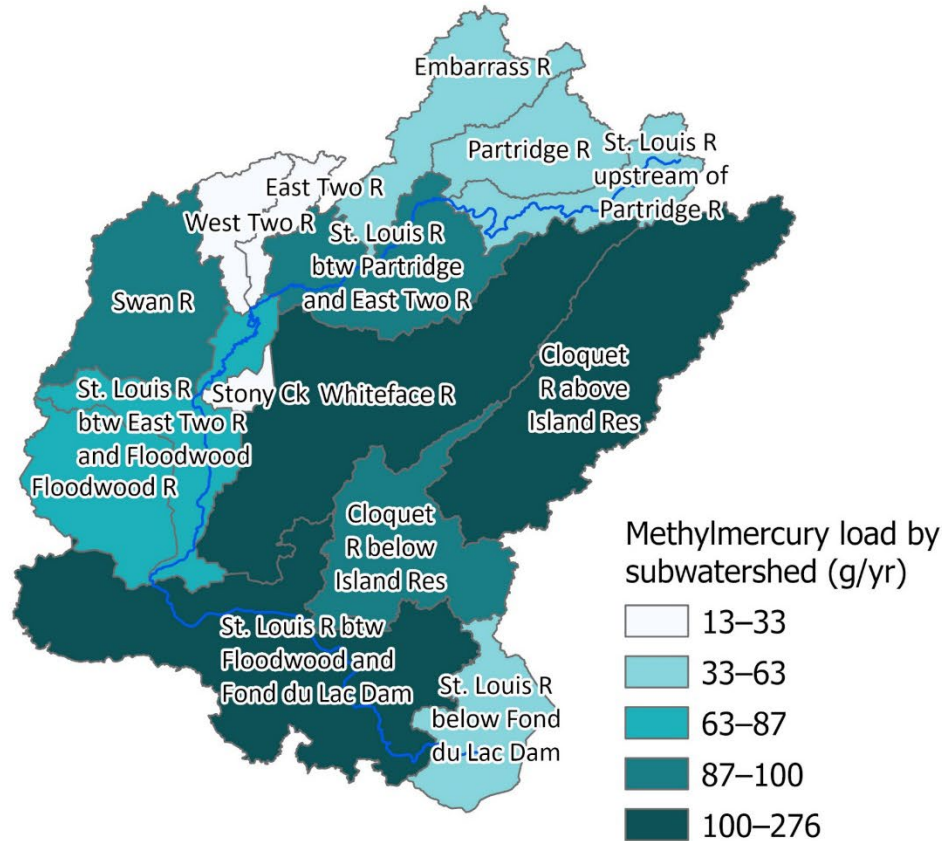
Total Mercury Annual Area Loading Rates (mg/ha-yr)



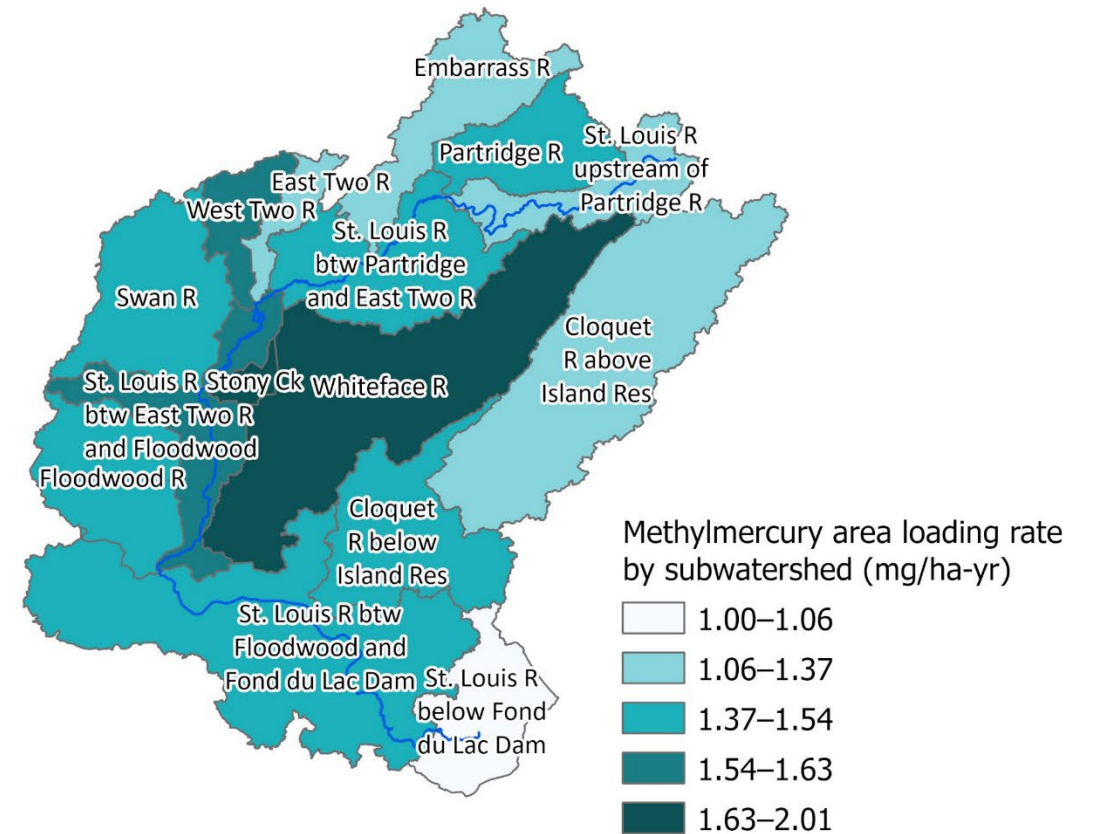
*Preliminary Load Estimates

What is the geographic variation of methylmercury loads?

Methylmercury Annual Loads (g/yr)



Methylmercury Annual Area Loading Rates (mg/ha-yr)



*Preliminary Load Estimates

St. Louis River Watershed TMDLs

- Atmospheric mercury deposition is processed differently by land cover type
- Most of the land cover is forests and wetlands/peatlands/drained peatlands; most of the mercury comes from these areas
- Developed land cover has a high rate of total mercury loading on an areal basis
- Drained peatlands and other wetlands have high rates of methylmercury loading on an areal basis

Other watershed-based mercury TMDLs

- Applying what we learn in this TMDL project to future TMDLs

Advances in mercury science

- Rates of dry deposition and wet deposition
- Reductions in MN and US emissions
- Contribution from local sources is higher than previously assumed

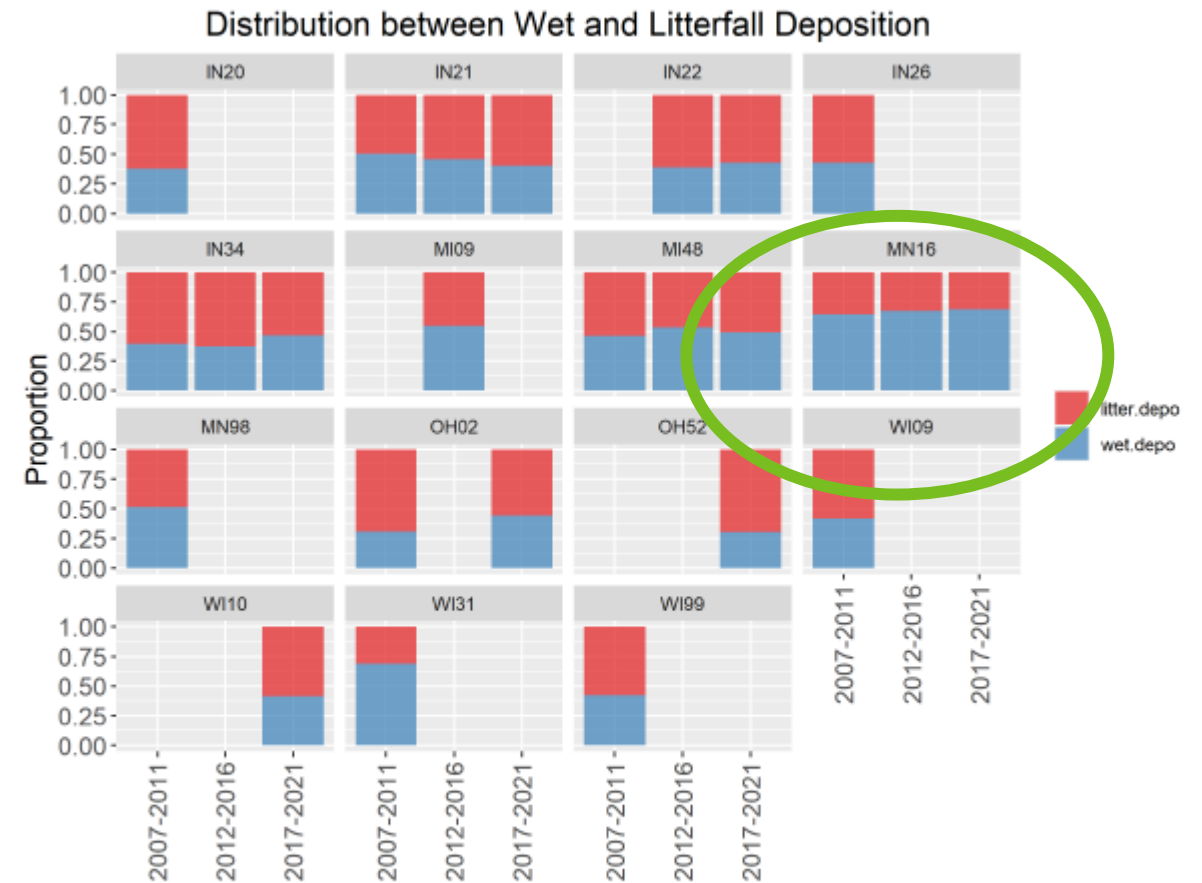


Figure from Dickens 2023.
Mercury Deposition in the
Great Lakes Region

Figure 13. Distribution of total deposition between wet deposition and litterfall dry deposition at monitoring locations with both measurements.

Contact Information



jennifer.brentrup@state.mn.us

andrea.plevan@state.mn.us