

An aerial photograph of a forest with a stream flowing through it. The stream is dark blue and winds through the green and brown foliage. The text is overlaid on the image.

# Modeling Hg in Lake Ontario

## Data and Knowledge Needs & Gaps

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A map of the Lake Ontario watershed, showing the lake and its surrounding land area. The lake is highlighted in a light blue color, and the surrounding land is shown in a light green color. The map is oriented with the lake's long axis running from northwest to southeast.

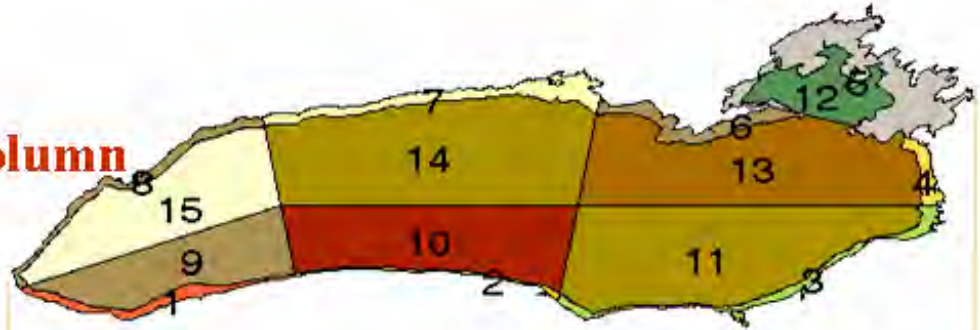
Hg model purpose: forecast outcome of management and regulatory actions on fish Hg levels in Lake Ontario

- Hg emissions and point-source controls
- Land use
- Climate change
- Exotic species

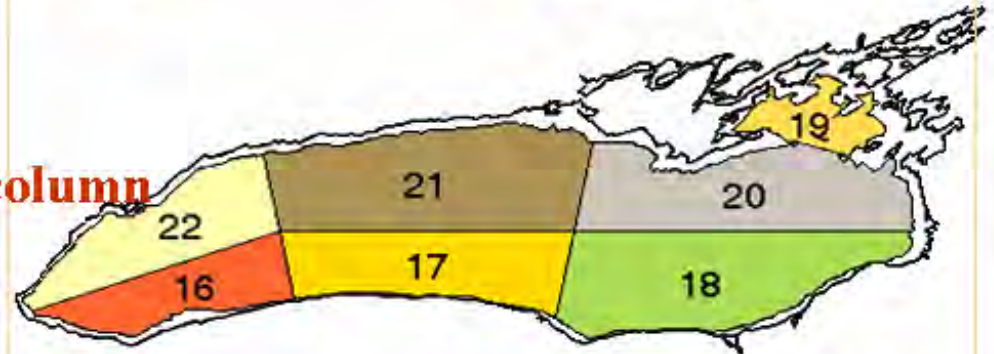
*Need a watershed scale, mechanistic, mass balance approach*

# LOTOX2 Segmentation Scheme - plan view

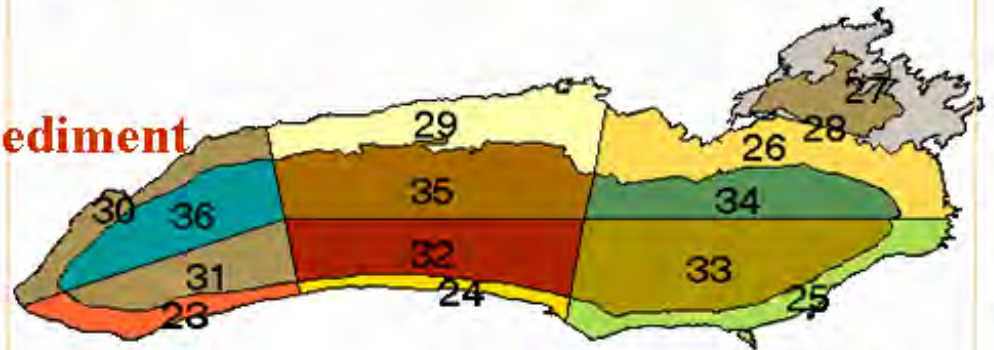
Surface water column



Deep water column



Surface sediment



Projection of water column  
to sediment segments



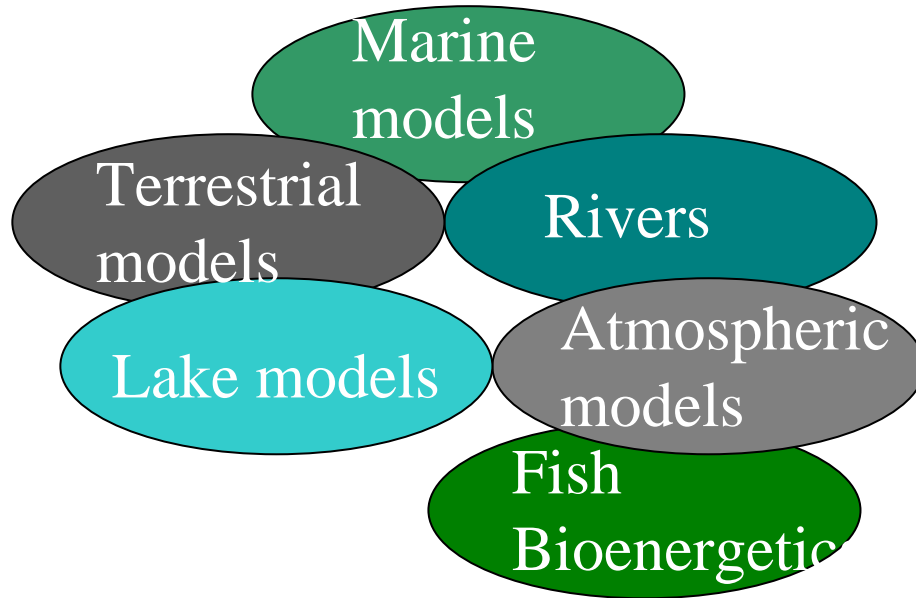
# How far upstream do we have to model Lake Ontario?



# Current capability of Hg mechanistic models

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R&D tool to improve understanding



→ Model development and incorporation of new R&D

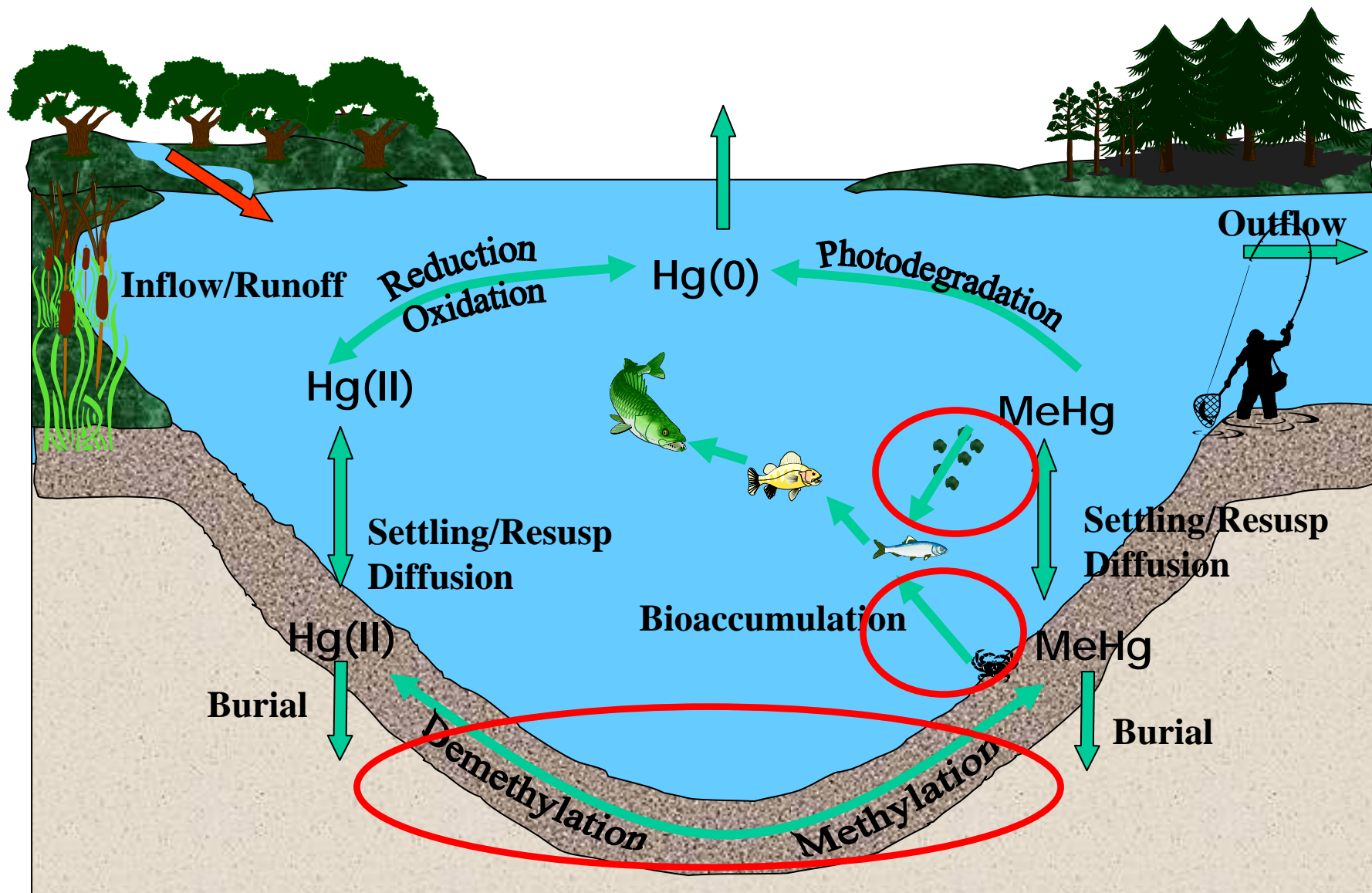
→ Model calibration

→ Model validation

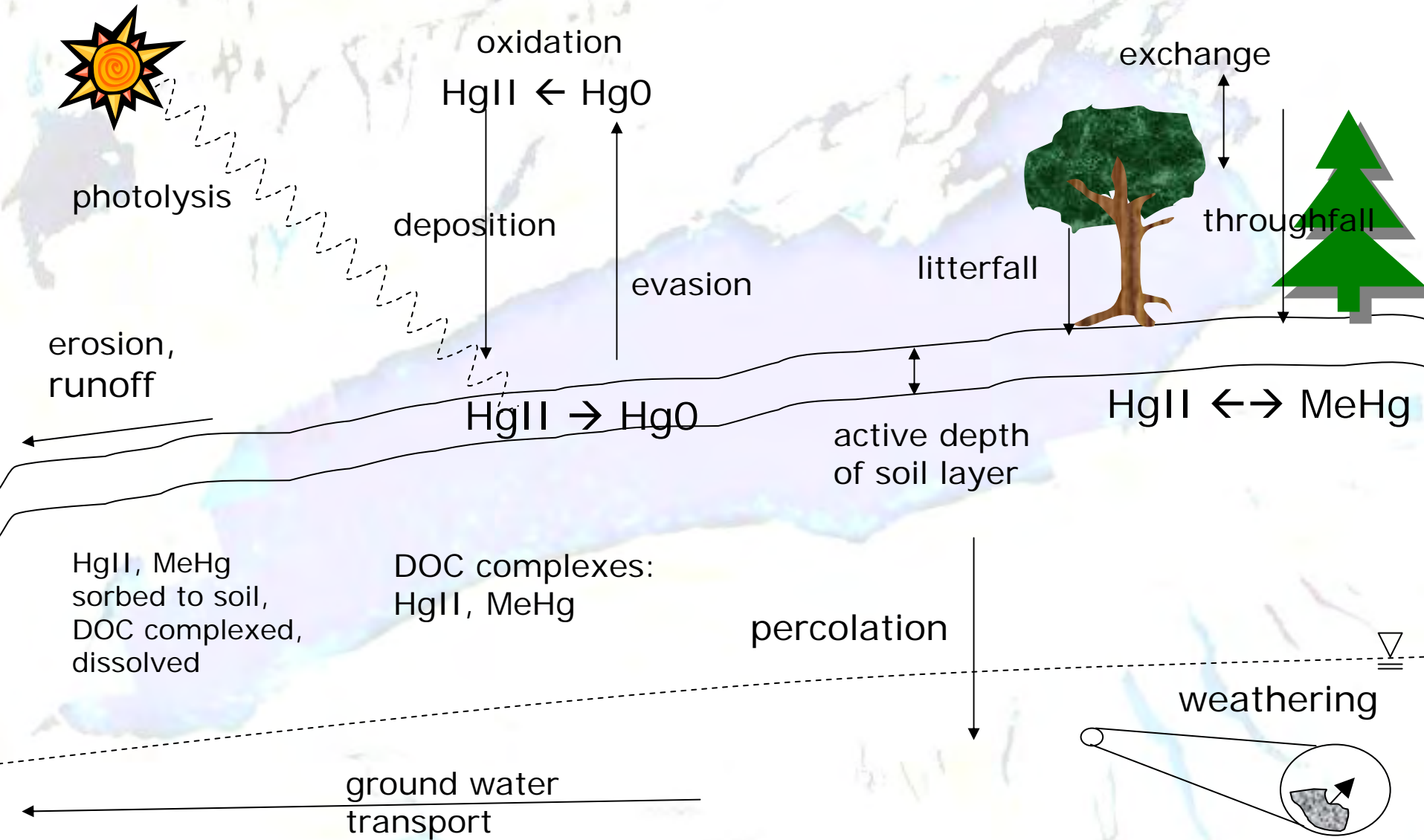
Predictions and mitigation testing



# Key knowledge gaps for aquatic Hg modeling:

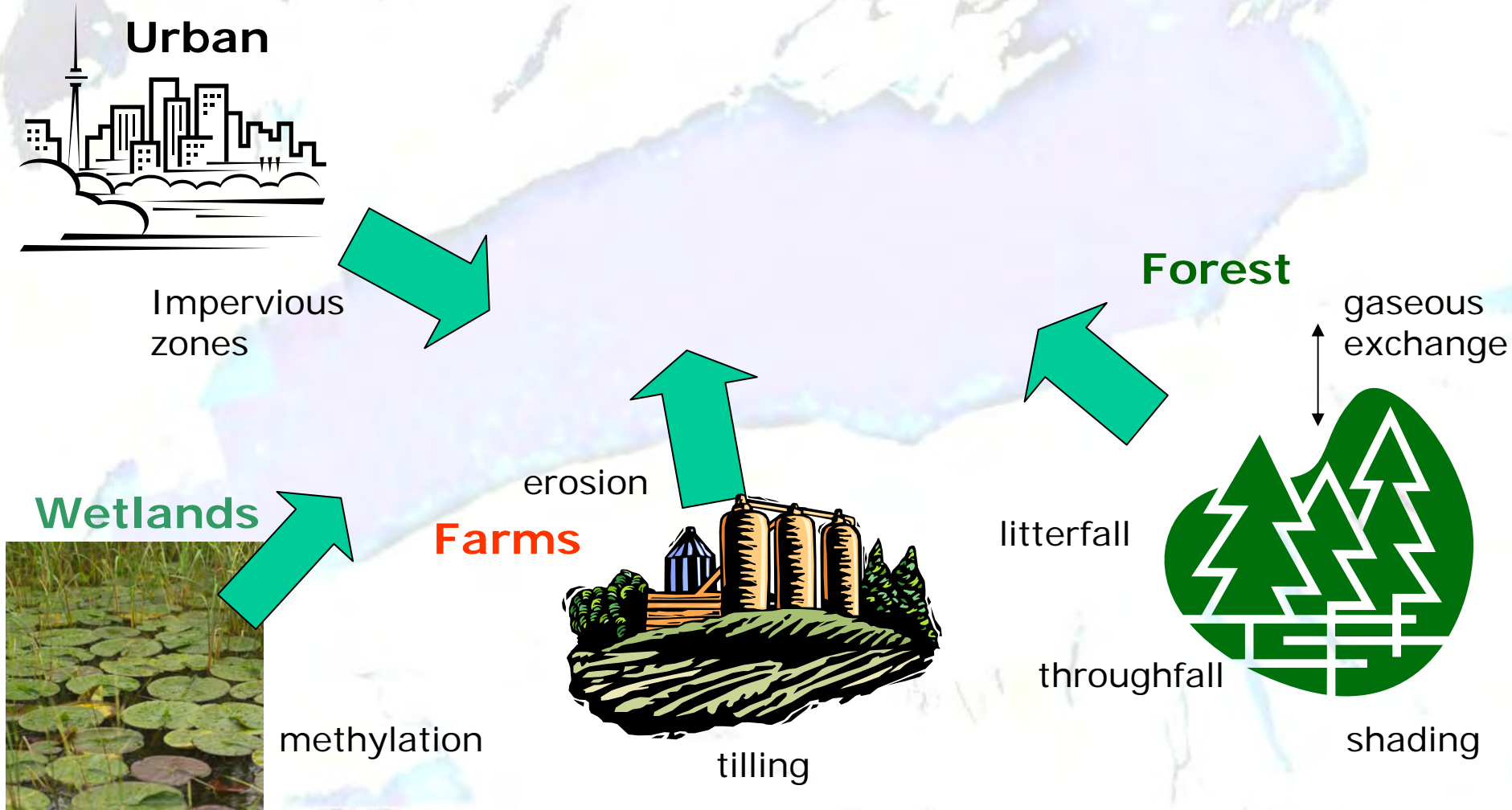


# Mercury Cycle: Watersheds



# Importance of Land-Use

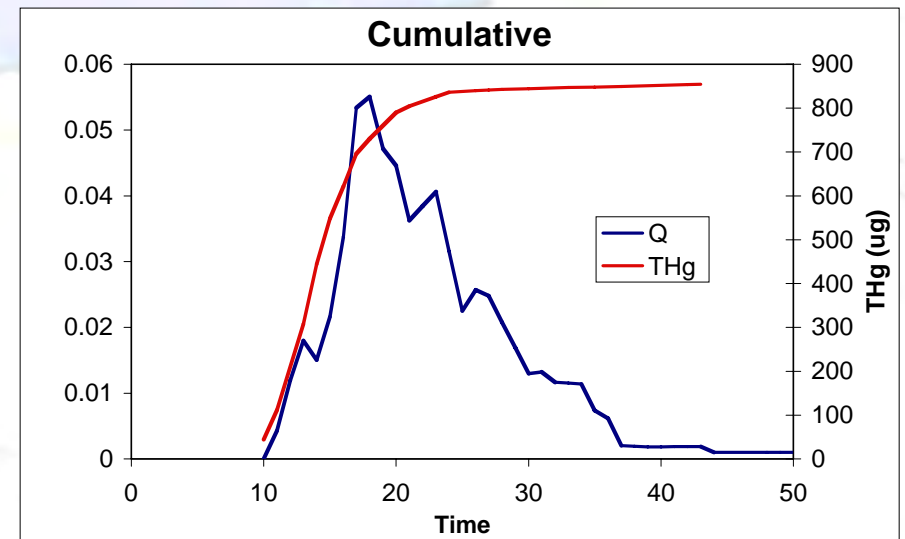
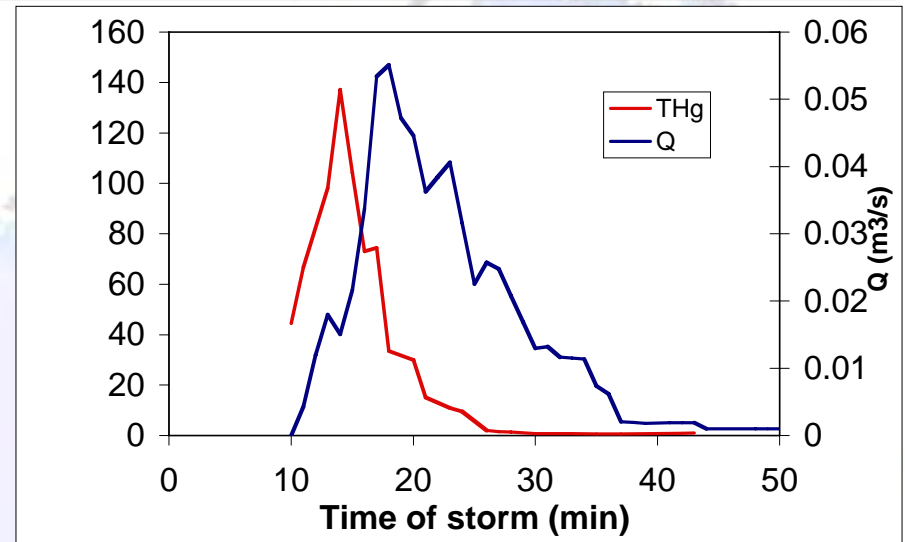
run-off and erosion rates, depth of active soil layer, transformation rates, speciation (%MeHg), DOC, solids



# Controls on Watershed Export

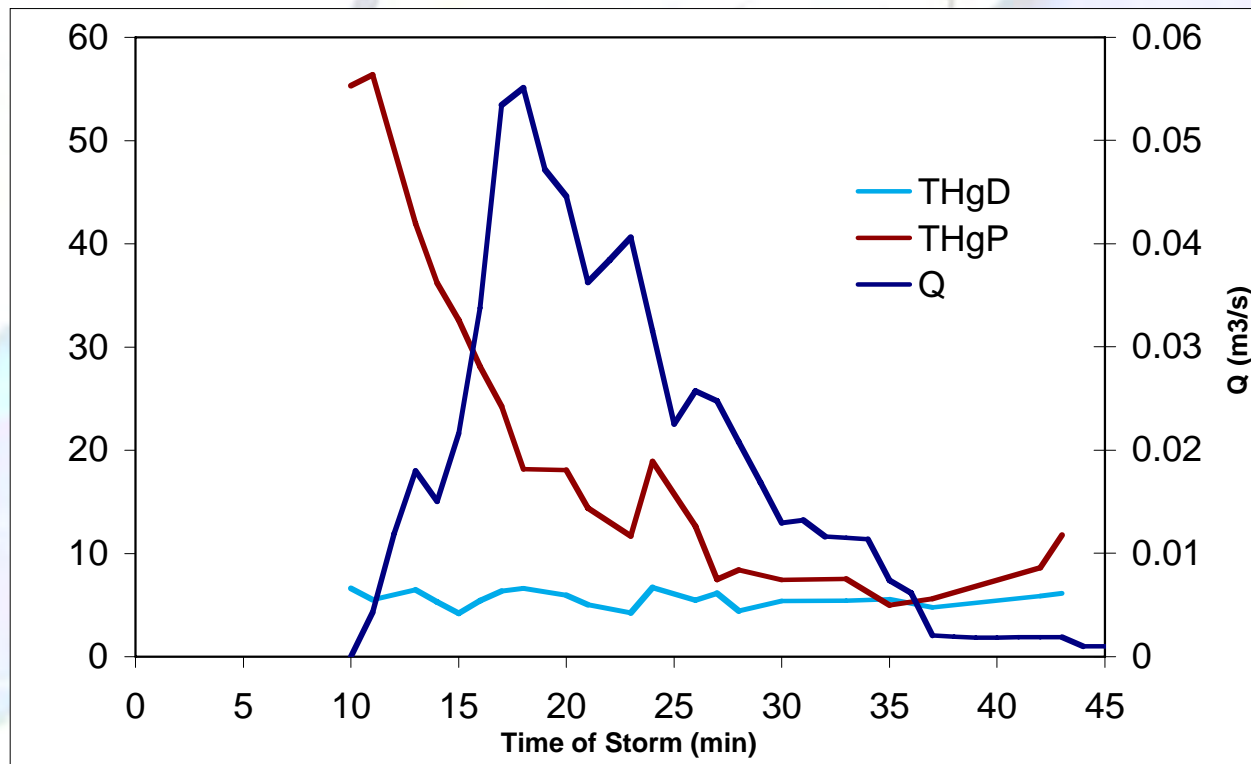


- Export from different land-use types are controlled by different processes.
- Knowledge of controlling processes guides monitoring programs and model development and testing.



Unpublished data, C.  
Eckley and B.  
Branfireun, 2007

# Controls on Watershed Export

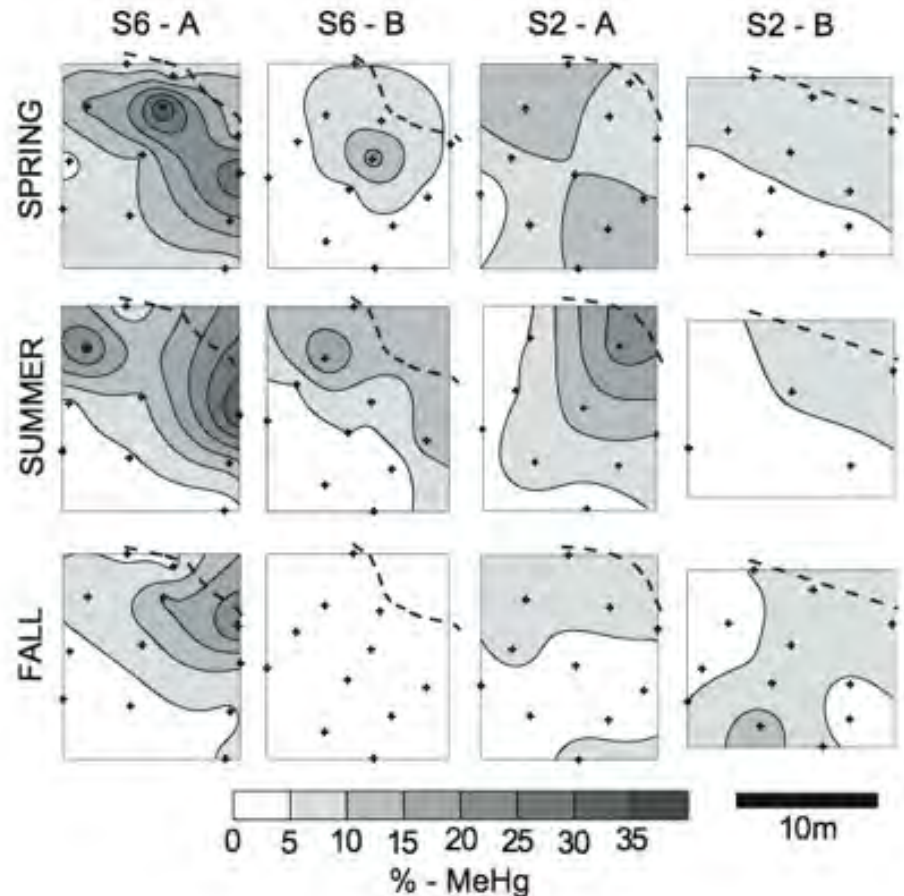


Unpublished data, C. Eckley and B. Branfireun, 2007

# Controls on Mercury Speciation



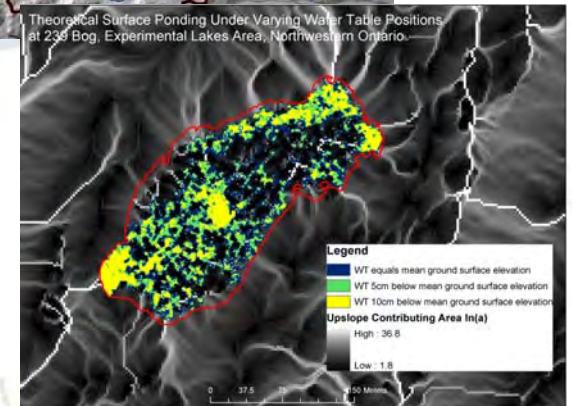
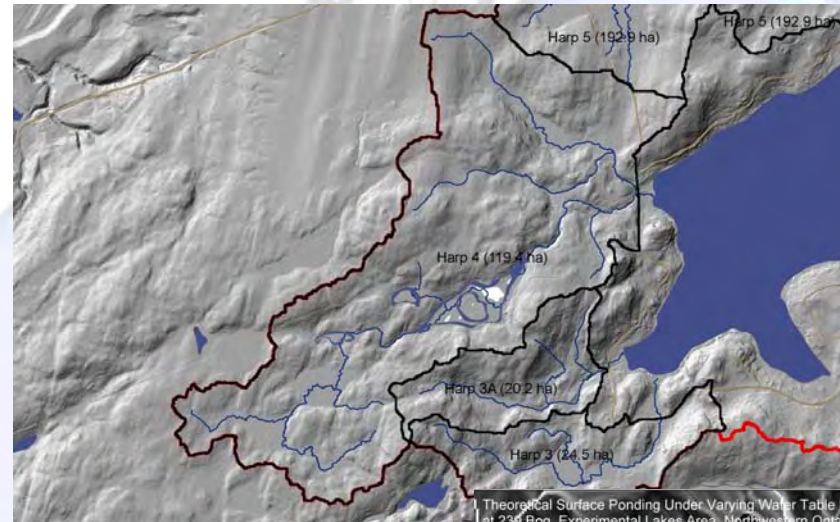
- Production of methylmercury in the watershed contributes to the load to lakes.
- Is highly variable among (sub)watersheds.
- Understanding controlling processes contributes to predictive power.



# Scale



- Landscape characteristics and land-use strongly influence how mercury moves from the watershed to surface waters, and how efficiently methylmercury is produced.
- Fundamental processes can be scaled.



# Knowledge Gaps

- What controls export of Hg from watersheds?
- What controls Hg methylation and demethylation, especially the availability of Hg to methylation?
- Redox processes controlling DGM and evasion.

# Data Needs & Gaps

- HgT and MeHg in:
  - Fish, water, sediments
  - Seston, zooplankton, benthos
- HgT and MeHg Fluxes
  - Deposition
  - Tributary loadings
  - Sedimentation
  - Evasion
  - Outflow
- Ancillary Data
  - TSS, DOC, pH, sulfate, DO, Temp

Modeling

**INTEGRATE!**

Data  
collection

R&D

