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Predictions of the Effect of Wetland-type Soil on Water Chemistry in the Lake Sunapee Watershed, NH

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Predictions of the Effect of Wetland-type Soil on Water Chemistry in the Lake Sunapee Watershed, NH

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Motivation

Inorganic mercury (Hg) is ubiquitous in the environment (atmospheric sources). Under certain conditions Hg can be converted to its organic form, methylmercury (MeHg), which is a neurotoxin and bioaccumulates. Wetlands (hydric soils) are considered a site of this methylation process.

Question

Does (1) Total area of wetlands in a watershed, (2) Percentage of wetland soils in a watershed or (3) The proximity of wetland soils to the sampling site matter most in predicting associated stream water characteristics (here: DOC, sulfate and temperature)?

Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Effect</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Organic Carbon (DOC)</td>
<td>Possible increasing/decreasing effect on bioavailability</td>
<td>• High [ ]: co-transport; metal uptake with DOC for microbes&lt;br&gt;• Low [ ]: lower bioavailability</td>
</tr>
<tr>
<td>Sulfate (SO$_4$-2)</td>
<td>Hg $\rightarrow$ Methyl Hg</td>
<td>• Stimulate methylating bacteria</td>
</tr>
<tr>
<td>Temperature</td>
<td>Possible increasing/decreasing effect on Hg methylation</td>
<td>• Cold: optimal for some bacteria&lt;br&gt;• Warm: may increase metabolism</td>
</tr>
</tbody>
</table>

Acknowledgements

I would like to acknowledge the time that Amanda Elliot spent in making, and working with Holly Ewing and me to develop the methods and models. A thank you to Holly Ewing, Dave Richardson, Nick Baer, Christina Maki, Alyeska Fiorillo, and the Lake Sunapee Protective Association for all contributing to the water chemistry dataset.

References


Chen, CY, RS Stemberger, B Klaue, JD Blum, PC Pickhardt, and CL Folt. 2000. Accumulation of heavy metals in food web components across a coastal to forest gradient: Influences of trophic level and ecosystem characteristics (here: DOC, sulfate and temperature)?

Methods

Layers: (1) original soil files from Natural Resources Conservation Service, (2) modified version from Bethel Steele, (3) delineation by Amanda Elliot

Analyzing: (4) clipping down to “hydrics,” (5) determine total area, percent, distance for each watershed, (6) considering upstream watersheds, (7) correlations and trends with water characteristics (summer data only)

The area of hydric within each watershed and percent of each watershed that is hydric (90% or more saturated). The graph does not include the outlet sampling sites of Lake Sunapee and Little Lake Sunapee. Pike Brook has the highest total area of hydric soil in it while Eagle Rock Creek has the highest land cover percentage in saturated soils.

Correlations to previous classifications

• Classification of hydric soils area is significantly correlated (p<0.0001) with the previously used classifications: wetlands, Histosols, and wet soil area
• Percent of the watershed hydric soils is not significantly correlated with percent wet soils or Histosols, but is with wetlands
• Distance measurements (sampling site to hydric area) appears to be irrelevant

Correlations to water characteristics

• Temperature correlates with the area within the watershed in hydric (90% or more saturated).
• DOC and SO$_4$-2 correlate (p=0.0361) with Histosols (p=0.0101)
• DOC and SO$_4$-2 correlate (p<0.0001, p=0.0201) with percent of the the watershed Histosols

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