Hypothesis: Watershed land cover can predict measures of water quality in rivers and streams.

Objective

- Capture synoptic snapshots of water quality across the Missisquoi River Watershed during high and low flow conditions.
- Use these data to better understand the variability of water chemistry across a large heterogeneous watershed.

Context

- High-frequency in-situ monitoring stations installed at three locations in the watershed provide high temporal resolution of water quality dynamics. However, high cost per installation prohibits broader deployment.
- Large manual field sampling mobilizations provide better spatial resolution but high cost per sampling event prohibits frequent sampling.
- An optimal system would integrate data from both sampling methods to develop models with high temporal and spatial resolution for minimal cost.

Methods

- Samples were collected from 40 sites during high flow conditions on June 23rd and from 52 sites (including 40 initial locations) during low flow conditions on July 14th (Fig. 1).
- Hungerford Brook and Wade Brook were sampled intensively.
- Other locations were chosen to represent a gradient of land uses.
- Field filtered samples were analyzed for dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) on a Shimadzu TOC-L/TNMA-L.
- Unfiltered samples were tested for specific conductance and pH.
- Total suspended sediment (TSS) was determined by mass per volume filtered.
- Particulate carbon (PC) was estimated as half of loss on ignition (LOI) mass.
- Total carbon (TC) was estimated as sum of PC and DOC.

Results

- Percent agricultural land use is a good predictor of SPC, TDN and TC, but not TSS (Fig. 2 A, B, C, and D).
- Percent forested land cover explains more variation in TC than percent agricultural land use (Fig. 2 D and E).
- All parameters displayed a wide range of concentrations within the Missisquoi watershed.
- For all parameters which show a relationship between land use and water quality the relationship is stronger during high flow conditions than low flow conditions.

Conclusions

- Land cover can be used to predict some measures of water quality.
- The relationships between land cover and concentrations of nutrients and ions are strongest during high flow events.
- Therefore, land use has a significant effect on total loading since the largest volumes of solutes are transported when flows are high.

Future research

- Frozen samples will be analyzed for levels of nitrate, particulate carbon, dissolved and particulate phosphorus.
- Further statistical analysis will assess whether regression models can be refined with additional variables such as watershed area, stream order, or finer scale distinctions between land use classes.
- Variance within and between sub-catchments will be assessed to determine whether Wade Brook and Hungerford Brook can be considered representative examples of forested and agricultural watersheds.

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References

- For Site 1 data, see Table 1, for example. For Site 2 data, see Table 2, for example.