

Importance of the hydrological change on the dynamics of dissolved organic carbon and nitrogen at the Arbutus Lake watershed in the Adirondack Mountains of NY State

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Background

The dynamics of dissolved organic matter (DOM) in terrestrial and aquatic ecosystems is linked with hydrology, microbial activity, elemental cycles including toxic metals (e.g., Al and Hg), the formation of disinfection by-products.

Objectives:

- 1) Evaluate how changes in climatic factors (e.g., temperature and precipitation) are affecting the concentrations in the Arbutus Watershed in the Adirondack Mountains of New York.
- 2) Quantify the fluxes of DOC and DON with particular focus on evaluating the role of within-lake processes by the comparing results between the inlet and outlet sites from 2000 to 2009.

Climatic factors

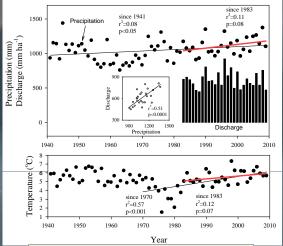


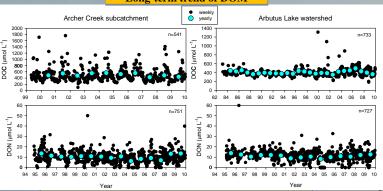
Fig. 1. The change of temperature and precipitation.

- Significant increases of temperature and precipitation.
- Did the increase of climatic factors affect the change of DOC and DON? See Figure 2

Acknowledgement

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Long-term trend of DOM



- Fig. 2 Long-term changes of DOC and DON concentrations at the inlet and outlet showed no significant changes
- There were, however, some seasonal patterns of DOC and DON concentrations at both the lake inlet and outlet

Seasonality of DOM

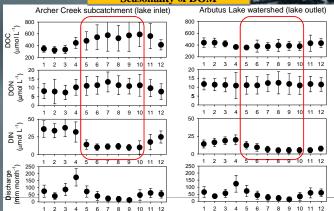


Fig. 3. Monthly pattern of concentrations of DOC, DON, and DIN for 10 years.

- Strong seasonality of DOC, DON, and DIN at the inlet was observed and likely related to terrestrial production in terms of DOM export and DIN uptake.
- DIN decreases during growing season at both the inlet and outlet. DOC and DON concentrations increase during the growing season only in the inlet.

Archer Creek Subcatchment -135 ha with podzolic soils 134.5*104 m3 Arbutus Lake outlet

-American beech and sugar maple Arbutus Lake watershed (352 ha) -Lake: 50 ha, 8 m depth(max)

Oligo-Mesotrophic Residence time: 0.6 year

Change at the Inlet subcatchment

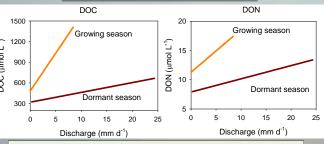


Fig. 4. Relationship between discharge vs. DOC, DON, and DIN concentration exported from the inlet subcatchment for 10 years.

During the growing season there were stronger relationships between discharge and DOC and DON concentrations than during the dormant

Within-lake process

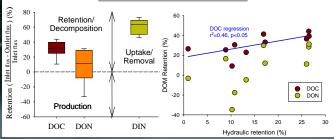


Fig. 5. Retention of DOC, DON and DIN in the lake (left) and relationship between DOM and hydraulic retention (right).

- In the lake, there was a net loss of DOC but DON concentrations increased.
- The decrease of DIN is likely related to algal uptake, and this algal production could have contributed to the increased DON concentrations.

Summary

- There were no long-term significant change of DOC and DON
- DOC was consumed within the lake.
- 3. However, DON production increased in the lake and this was likely due to algal production as evidenced by DIN utilization.
- 4. Hydrological relationships affect the dynamics of both DOC and DON.