DISSOLVED CARBON EVOLUTION ALONG A PACIFIC MARITIME HEADWATER STREAM NETWORK

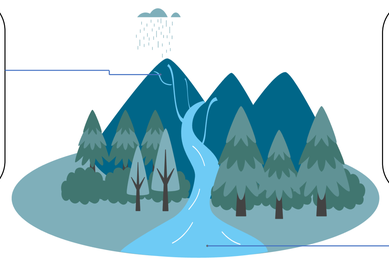
Brian Wang [a], Mark Johnson [a]
[a] UBC Ecohydrology, Institute for Resources, Environment and Sustainability, Vancouver, BC

THE UNIVERSITY OF BRITISH COLUMBIA
Institute for Resources, Environment and Sustainability
Faculty of Science

forWater
NSERC Network for Forested Drinking Water Source Protection Technologies

Background

Headwater streams emit 36-52% of transported dissolved carbon [1]
Occupy 96% of the global stream network [2]

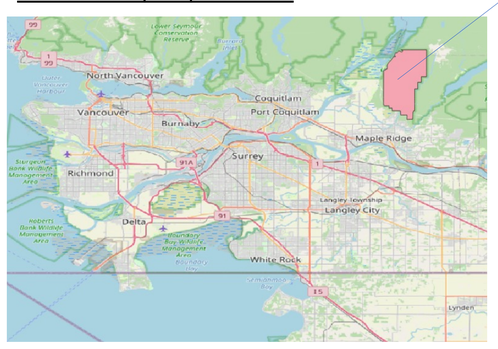


Globally, 3.9 petagrams of carbon (C) are outgassed from inland water [1]
(comparable to the terrestrial C sink [3])

	Transported Dissolved Carbon			
	Organic Carbon (DOC)		Inorganic Carbon (DIC)	
Composition	Allochthonous (high molecular weight)	Autochthonous (low molecular weight)	Dissolved gasses	Mainly Carbonates
Transformation	~ Constant	DOC_{labile} ↓ $CO_{2\,(aq)}$	$CO_{2\,(aq)}$ ↓ $CO_{2\,(air)}$	$CO_{2\,(aq)} = H_2CO_3 \rightleftharpoons HCO_3^- \rightleftharpoons CO_3^{-2}$
Driver	Photodegradation + Biodegradation		Water-Atmos. Exchange	Δ pH

Research Site

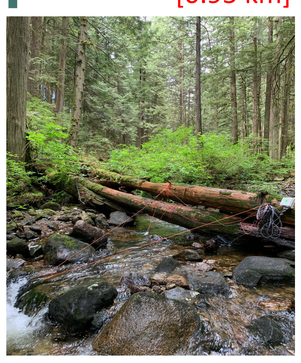
Vancouver, BC, Canada

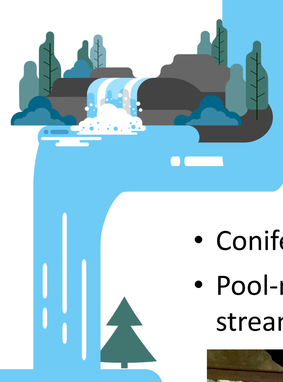


Blaney Creek Observatory [0 km]
Lake-fed; Drainage area: 7.88 km^2

[0.25 km]

[0.95 km]





- Coniferous dominant
- Pool-rifle w/ cobbled stream bed

Downstream Station [3.3km]
Drainage area: 9.3km^2

The *North American Pacific Coastal Temperate Rainforest* – a dissolved carbon hotspot due to the high volume of rain (2022 WY– 1912.5mm) combined with steep elevation gradient draining the productive rainforest landscape

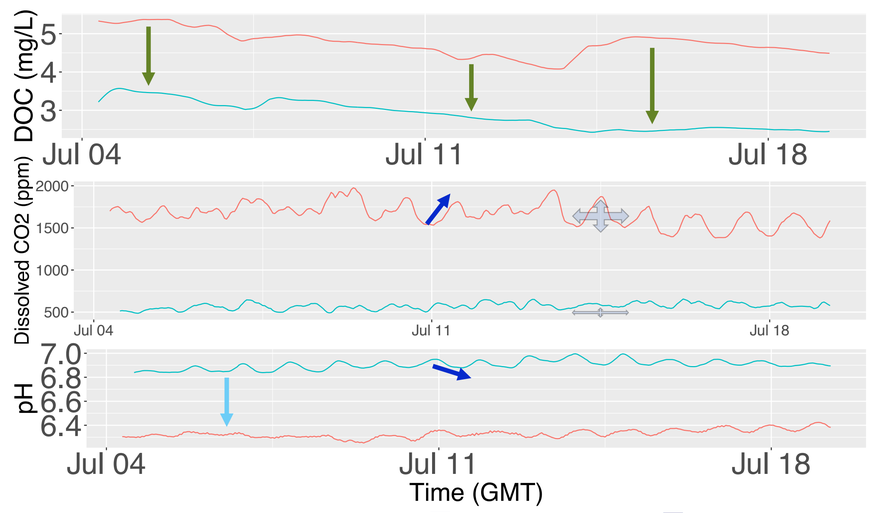
Research Problem & Approach

***Overall RQ**: How do DOC composition (humic & labile) and dissolved CO_2 change over the stream network?*

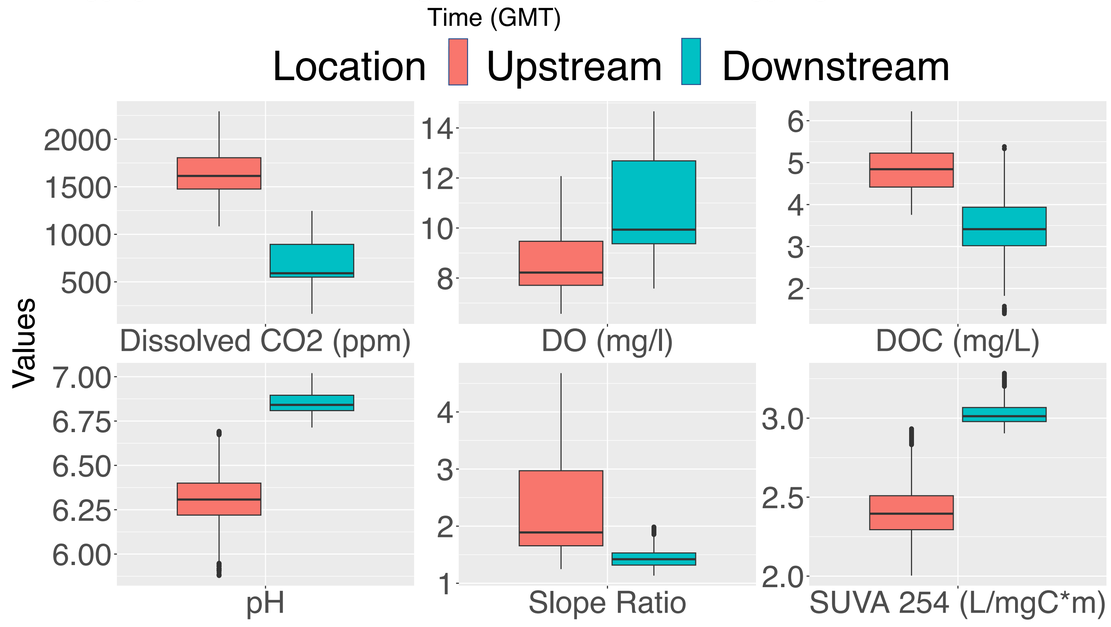
Method: Measuring DOC, $CO_{2\,(aq)}$, water quality (i.e., pH) and micro-climate measurements over 3km of headwater stream reach from December 2021 to present

Preliminary Results

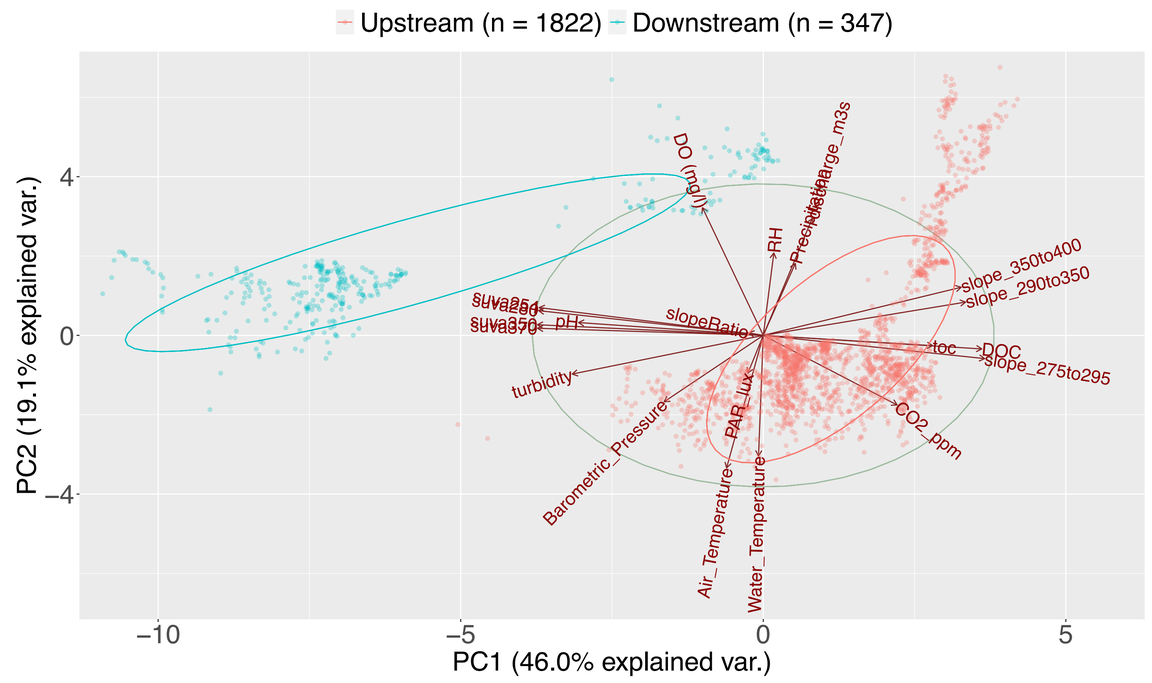
1. How do the upstream & downstream sites differ?



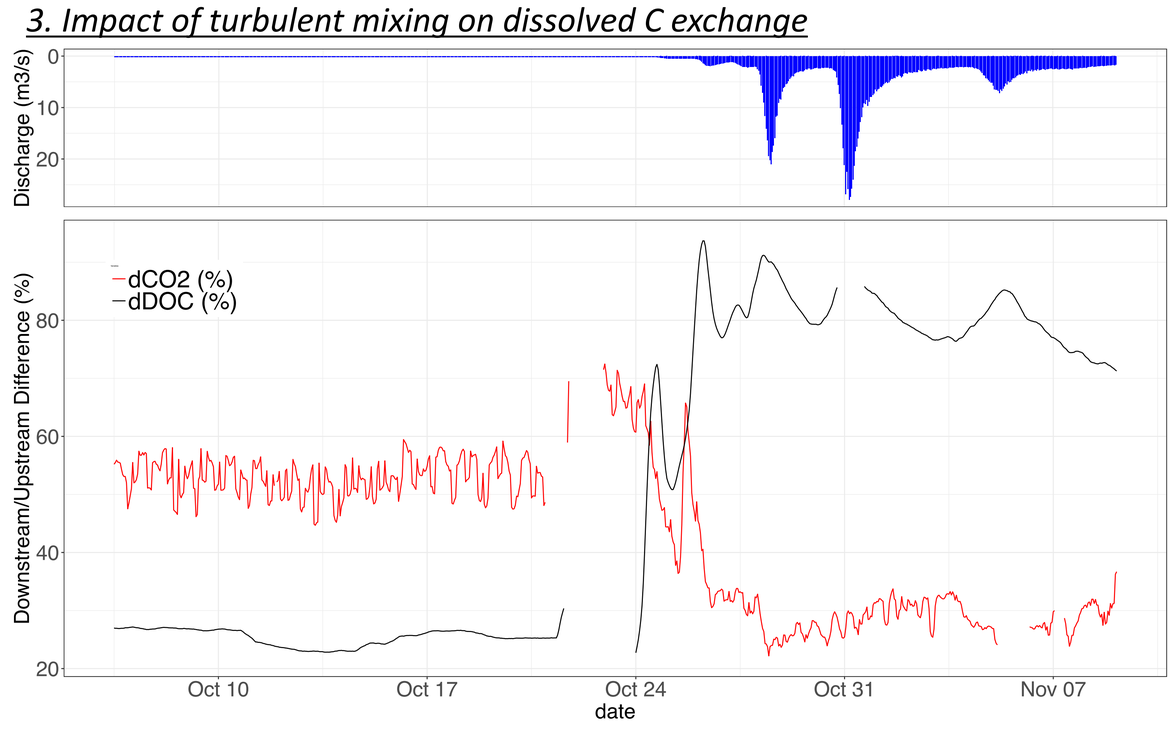
Observed coupling:
- DOC
- $CO_{2\,(aq)}$ ~ pH
- pH ~ decomposition
- Diurnal cycle



2. Principle component analysis on dissolved C composition



3. Impact of turbulent mixing on dissolved C exchange



5. Preliminary Conclusions

1. **Distinct dissolved gasses** (i.e., CO_2 & DO) **and DOC characteristics** observed over the 3km stream reach
2. Dissolved carbon exchange driven by stream morphology is **amplified by discharge**

Contact, References and Acknowledgements