Lauren.Koenig@unh.edu

Response of metabolism and fluvial carbon flux to anomalous low flows in New Hampshire streams

L.E. Koenig[1], L.E. Snyder[1], JD. Potter[1], and W.H. McDowell[1]

[1]Department of Natural Resources and the Environment, University of New Hampshire

Background

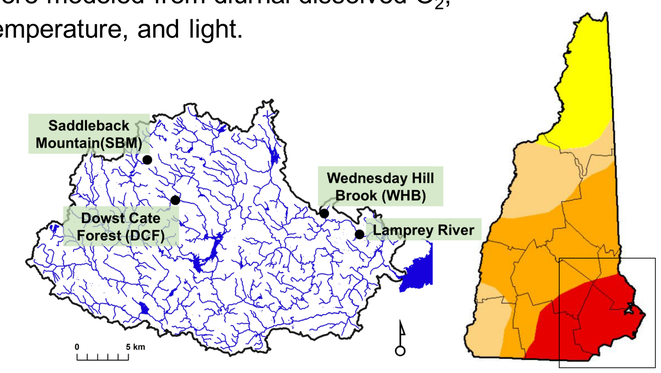
- The northeastern United States is experiencing greater precipitation extremes:
- Longer, drier summers and extended droughts are becoming more common, and are punctuated by heavy precipitation events
- River networks metabolize terrestrial carbon loads.
- What is the effect of extended dry periods on the metabolic regime of northern temperate streams and rivers?

Research Question

How do low flows constrain rates of primary production (GPP), respiration (ER), and dissolved organic carbon fluxes?

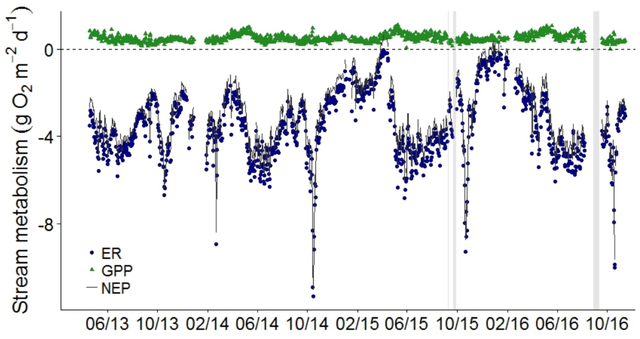
Methods

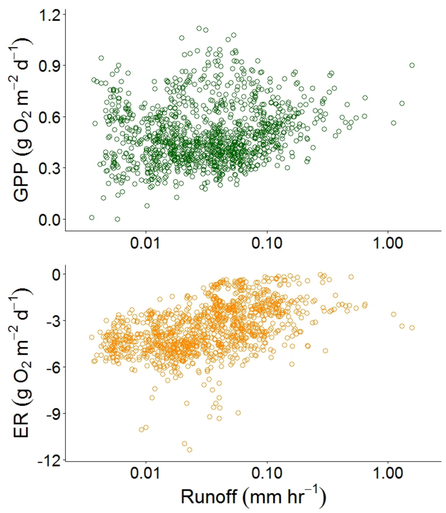
- Study sites: 3 headwater streams and a 6th-order river within the Lamprey River watershed, southeast NH.
- In-situ measurements of discharge, dissolved O_2, and fluorescent dissolved organic matter (FDOM) were collected (2013 – 2016).
- Prolonged seasonal drought observed in summer 2015, and summer/fall 2016.
- Stream metabolic rates: GPP, ER, and reaeration were modeled from diurnal dissolved O_2, temperature, and light.



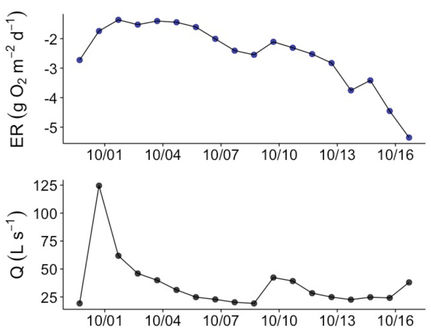
Stream metabolism

1. Annual seasonality in stream GPP, ER
Annual stream metabolism shown for one site (Dowst Cate Forest). NEP was most negative at low-intermediate flows, and days with positive NEP were rare.

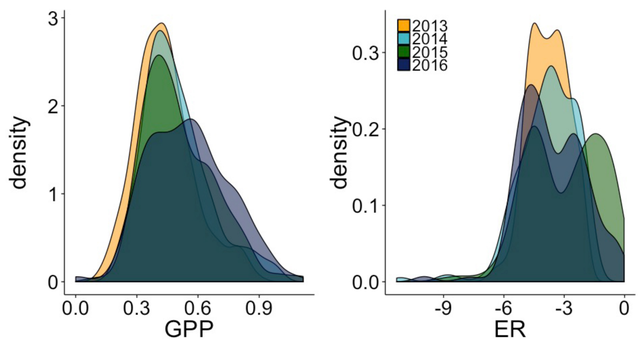




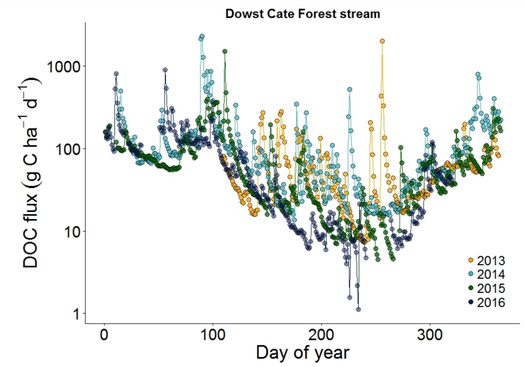
2. Respiration rates are initially suppressed following storms
ER recovers (1-7 days) following storms

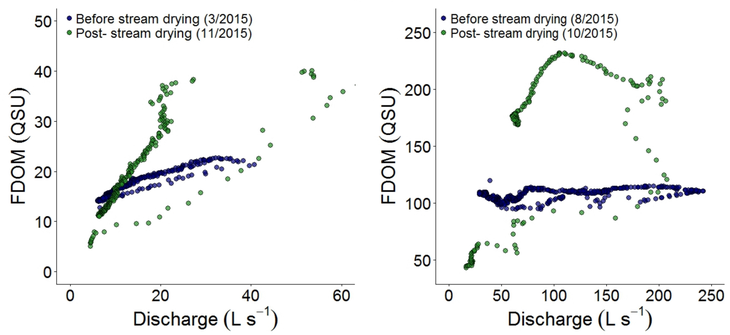


3. Drought did not dramatically alter metabolic regime
Spring GPP maxima were slightly higher during the 2016 low-snow year (annual distribution shown for Dowst Cate Forest, right).



Dissolved carbon export





4. Dissolved carbon export declines with low flow; Concentration-discharge relationships shift following stream drying
Low flow seasons lead to higher dissolved carbon export per unit discharge, as shown for two sites (SBM, left; DCF, right)

Conclusions

- Stream metabolism has a characteristic annual regime: GPP maxima in spring and ER maxima during fall
- However, anomalous low flows in 2015 and 2016 do not appear to have dramatically altered the magnitude of metabolic rates in the Lamprey River watershed
- Storms following dry periods yielded higher carbon export per unit discharge, possibly due to DOC accumulation in soil solution

Acknowledgements

Support for this research was provided by the National Science Foundation and the NH EPSCoR Ecosystems and Society project.