Using Specific Electrical Conductance to Compare Rainfall Runoff in NH Urban and Rural Catchments

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Goal of Study

To better understand source water variation during storm events across New Hampshire watersheds and to understand how urban catchments function differently than rural/forested catchments.

Research Questions

1. Can we use EC sensors for proper end-member mixing analysis across different land uses?

2. Is EC an appropriate tracer of new water for all watersheds?

3. Is there a “normal” percent of new water for NH?

4. What watershed characteristics cause differences in percent new water?

Methods

FIELD

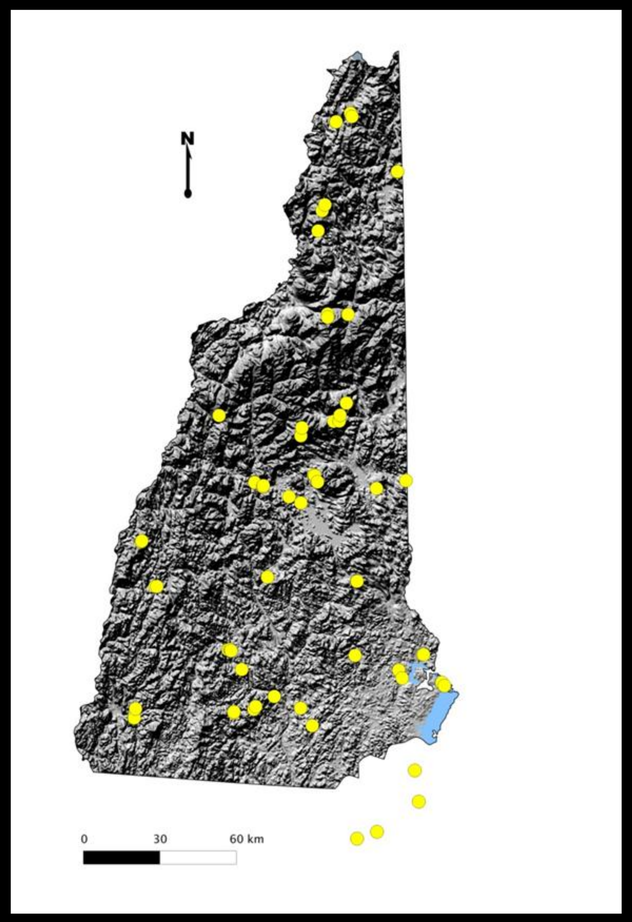
- We are collaborating with partners to deploy data loggers at partner-selected sites. Loggers set to collect data every 3 minutes or finer during the summer and every 15 minutes during the winter.
- Partners submit data to Plymouth State monthly.
- EC rain measurements made at Plymouth, Berlin, and Keene, NH.

DATA ANALYSIS

- Two end-member mixing (Pinder and Jones, 1969)

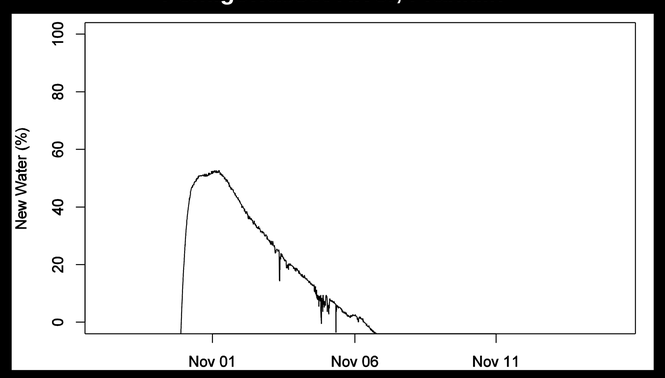
$$X = \frac{C_t - C_o}{C_n - C_o}$$

X = new water fraction of streamflow
C = specific EC (µS/cm)
Subscripts t, o and n indicate total, old and new water, respectively

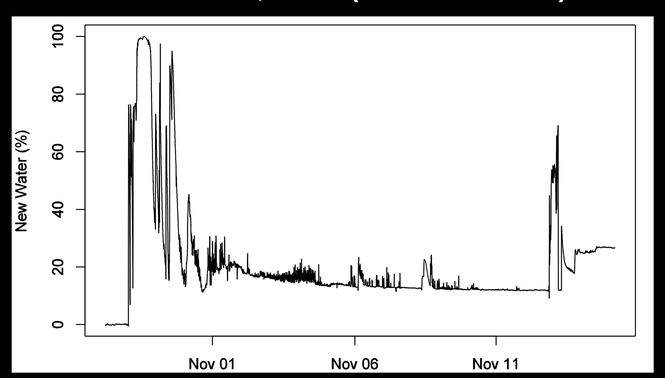


Preliminary Data: Hurricane Sandy 10-29-12

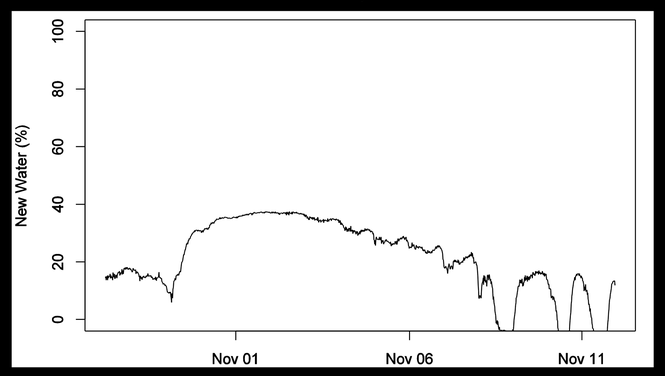
Pemigewasset River, Franklin



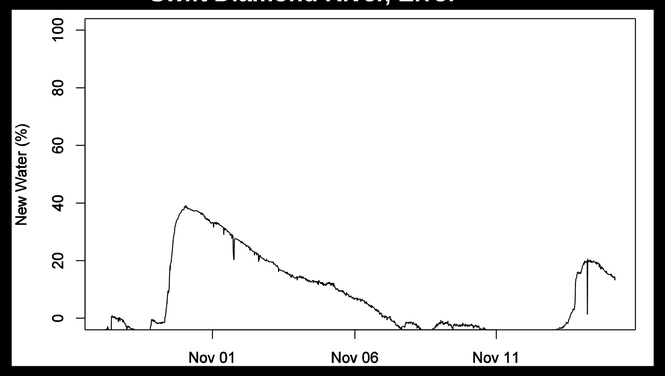
Beaver Brook, Keene (Stormwater drain)



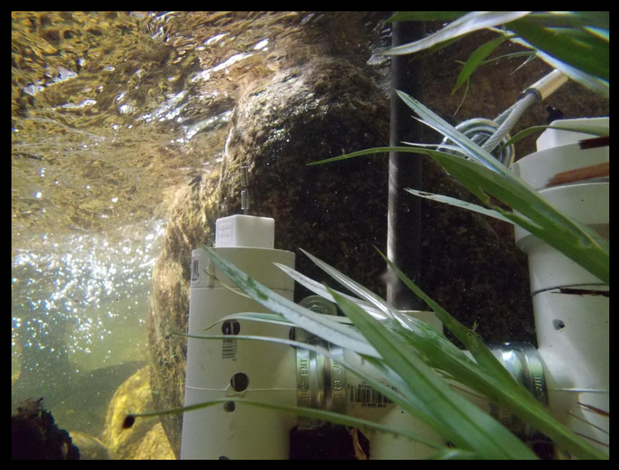
Contoocook River, Henniker



Swift Diamond River, Errol



The graphs above show the percent new water that entered each stream during the October 29 to Nov 1 event. These sites vary greatly in land use. Keene’s storm drain is very urbanized while the Swift Diamond is in nearly 100 percent forest cover. The Contoocook and Pemigewasset sites are less urbanized than the Keene site. Percent new water was approximately 40 percent at all sites except for Keene, which reached 100 percent. We hypothesized that the earlier and higher new water peaks are a result of infiltration excess runoff.



Thoughts and Next Steps

- This is a preliminary data analysis of differences in hydrology across NH watersheds. Much more thorough analysis is forthcoming.

- These separation graphs are important in understanding hydrologic storm responses across the state and how storms effect ecosystems. This information may also help to better understand non-point source pollutant transport.

- We will be extracting watershed attributes to better characterize stream basin characteristics such as drainage area, land cover, and basin morphology.

- We are currently establishing a network of partners to record precipitation EC. This will help to better define the EC of “new” water inputs to NH watersheds.

Acknowledgements

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References

Pinder GF and Jones JF. 1969. Determination of the groundwater component of peak discharge from the chemistry of total runoff. Water Resources Research. 5: 438-445.