Methods

Flow rate measurement: Every 4-6 weeks from February to June 2010, we determined the flow rate of each stream using slug tests (Fig. 3).

- A conservative tracer bromide (Br) slug was introduced into the stream and samples were taken 30 m downstream every 1-2 minutes for 2 hours (Figs. 4 and 5).
- Water samples were filtered and run on an Astoria Pacific autoanalyzer to determine Br concentrations.
- A flow rate was calculated in L/sec based on the initial Br concentration, the average Br concentration of downstream samples, and the time for the Br slug to pass downstream.

Hypothesis

Nitrogen removal assessment: We added Nitrate-N to our Br slug to several times to compare its behavior to the conservative tracer.

- Sampling, filtering, and analysis occurred as described above.
- Nitrate removal was determined by comparing N:Br ratios in the initial slug and downstream samples. An ending ratio of N:Br less than the initial ratio indicated N removal.

Approach

We used GIS tools to identify transient headwater streams and conducted slug-nitrate and bromide tests to determine flow rates and assess N removal.

Site Selection

We used the Digital Elevation Model data in the GIS ArcHydro program to identify vernal stream locations based on the topography of the Wood-Pawcatuck Watershed in southwestern RI. Four forested, vernal stream study sites were selected in Arcadia Management Area (terming ASE4 and ASE2), Crawley Preserve (CP1), and Fisherville Brook Wildlife Refuge (FB1) (Fig. 2).

Results

- Three out of the four test slugs demonstrated substantial Nitrate-N removal.

Discussion

- The streams with high N removal tended to have several locations where pooling occurred (Fig. 8).
- Lateral scour pools, plunge pools, and impoundment pools were common at the sites. Pooling leads to longer retention time, which allows more time for N to be transformed.
- Sphagnum was present in-stream and around the banks of the sites that showed N removal (Fig. 9).
- In a study comparing the seasonal dynamics of N in two Sphagnum moss species, Berwyn Williams et al. suggested that sphaugnum has high nitrate removal capacity (Williams et al., 1999).
- Organic matter was present in sites that showed N removal (Fig. 10).

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References