Differences in Benthic Macroinvertebrate Communities in Urban and Forested Streams

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Abstract

Macroinvertebrate community metrics can be use as indicators of stream health and biodiversity. A common index of health is EPT richness index, which uses macroinvertebrates that are typically pollution intolerant as in indicator of stream health. Polluted urban streams can be compared to cleaner reference streams that drain forested areas using the EPT index and other metrics. I hypothesized urban streams would have lower species & EPT richness and higher overall dominance than streams draining forested landscapes. The t-test results revealed that species richness and dominance was not significantly different between urban and forested streams. However, EPT richness was significantly lower in urban streams than in forested streams. Our results suggest that EPT richness better distinguishes urban from forested streams than does either of the other tested metrics. The results have implications that further analysis of specific taxa within both streams and other streams with other surrounding predominant land use.

Introduction

- Macroinvertebrate communities are reliable indicator of integrity of aquatic environments (Mandaville, 2002).
- Dominance, or the proportion of a community sample represented by a single species tends to increase with environmental insults (Büchs, 2003).
- The Ephemeroptera, Plecoptera and Trichoptera (EPT) richness index is composed species considered sensitive to pollution.
- High values of EPT richness are associated with better water quality (Mandaville, 2002).
- Healthy streams tend to have high EPT richness and low dominance.
- Forested streams may be expected to have EPT Richness (Harding et. al, 1998; Lenat and Crawford 1994).
- Human-dominated urban streams tend to host lower biological diversity (Moore & Palmer, 2005).
- We hypothesized that urban streams in Vermont would have lower species & EPT richness and higher overall dominance than forested streams.

Materials/Methods

Materials: (1) 500µm rectangular kick sampling nets, (2) Ethanol (3) scrubbing brushes, (4) sample bags, (5) 600 micron mesh sieves, and (6) spoons and forceps.

Methods:

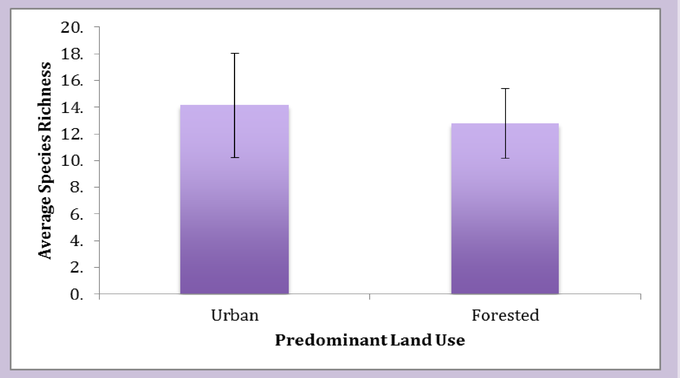
- Kick nets were placed on the stream bed.
- The substrate was disturbed upstream of the net by scrubbing and kicking.
- Large rocks were brought to the net and scrubbed by hand under water.
- Dislodged macroinvertebrates drifted into the downstream net.
- Macroinvertebrates were preserved in (100 %) Ethanol in sampling bags.
- Samples were washed in 600 micron mesh sieves, to drain the ethanol.
- Macroinvertebrates were picked from plastic trays under 2X magnification.
- Identification to lowest practical taxonomic level was performed under dissecting microscopes.
- The urban streams sampled were Centennial Brook, Englesby Brook, Munroe Brook, Potash Brook that and the forested streams sampled were Missisquoi River at North Troy, Mad River, Mill Brook, and Snipe Ireland Brooke.

Analysis

- We used two-sample t-tests assuming equal variance to test for differences between Urban and Forested streams

Results

Figure 1. Average species richness in both urban and forested streams. There was no significant difference between the two averages (*t* test; p = 0.55432, df = 7).



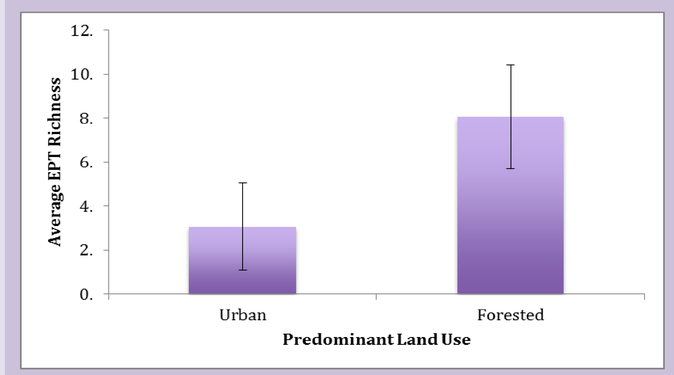
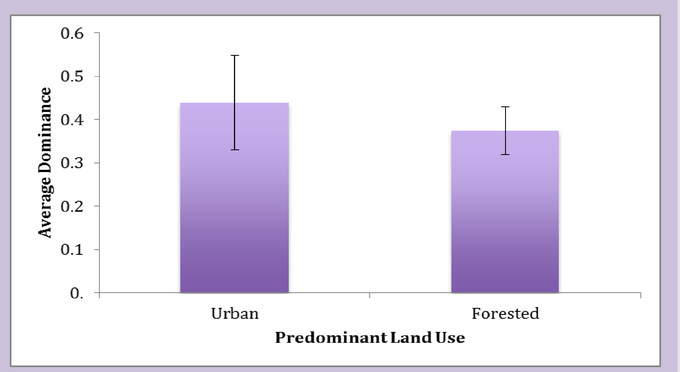


Figure 2. Average EPT richness in urban and forested streams. There significantly more species were found in forested streams than in urban streams (*t* test; p = 0.01173, df=7).

Figure 3. Average dominance in both urban and forested streams. There was no significant difference between the two averages (*t* test; p = 0.283, df=7).



Discussion

- Species richness did not differ significantly between urban and forested streams, and there are a number of possible explanations. First, streams that are classified as urban in this study drain mixed landscapes. Urban streams with riparian forest buffers would have more diversity compared to urban streams without buffers (Moore & Palmer, 2004). Second, agricultural streams were characterized to have an increased taxa richness of tolerant groups compared to forested streams (Lenat & Crawford, 1994). Urban streams that are more polluted than agricultural streams would be expected to have more pollution-tolerant species, increasing the overall richness of the stream. Finally, larger sample sizes may well have revealed an underlying pattern.
- Dominance was measured regardless of the specific dominant taxa; forested streams could be dominated by pollutant intolerant species and thus obscuring differences between urban and forested streams.
- EPT Richness was found to be greater in forested streams. Forested streams with natural vegetation in riparian zones that have been associated with stream hydrology, water quality, and reductions in sedimentation in watersheds (Harding et. al, 1998), characteristics that are generally not found in urban streams, are rich with EPT taxa because they are intolerant to conditions present in urban streams.
- **Future Studies**: I would like to look at specific taxa in each stream to better understand dominance and species richness. Incorporation of agricultural streams into this study as well as sampling during different seasons would expand our knowledge of these habitats.

The Sampling Team

Figure 4. Picture taken by Ken Yamazaki. Samplers Roy Karros, Jakob O'Neal, Sephorah Pierre, and Yasmiim Brandão.

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