Insect Communities: Ellensburg Upstream vs Downstream Sites

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Introduction

In cities, urban stream syndrome affects natural creeks/rivers by degrading water quality, increasing peak flow and decreasing the diversity of aquatic insect and fish communities. Urban streams are also often buried to support infrastructure. Stream burial could alter food resources used by aquatic insect communities, but the effects of burial on insects is largely unknown. I measured total suspended sediments (TSS), fine benthic organic matter (FBOM), chlorophyll (Chla), phosphorus (P), and the insect communities themselves. TSS, FBOM and Chla are metrics of insect food resources and P is a primary predictor of Chla.

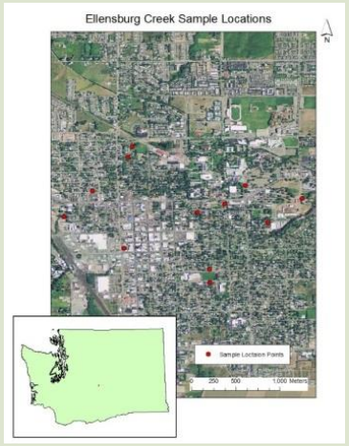


Figure 1: Sample Site Location Map

Predictions

I sampled 2 locations on each of the three creeks that flow through Ellensburg, and each sample location had a site upstream and downstream of a buried stream segment. When streams are buried, they no longer support photosynthesis, which is a main contributor of TSS and FBOM. Therefore, I predict that there will be a significant difference between the upstream sites and the downstream sites, with upstream sites in better condition than downstream.

Methods

- TSS: a 1 liter sample was collected at each site and filtered to collect a sample. The filters were put into pans and dried. Next they were weighed then put in a furnace. From there they were re-wetted, dried and weighed again to measure mass lost on ignition which represents organic matter content. (See Figure 3)
- FBOM: collected off of the bottom of the creeks by suspension. Theses samples were filtered and processed same way as TSS. (See figure 3)
- Chla: samples were scraped from rock surfaces with a wire brush and rinsed into a small cup. Subsamples were filtered and frozen. Chlorophyll was extracted in a hot bath with ethanol, and measured on a spectrophotometer. (see figure 2)
- Phosphorus: stream water samples were filtered into small bottles and then frozen. Dissolved phosphorus concentration was measured using colorimetric methods on a spectrophotometer along with a calibrated standard curve.

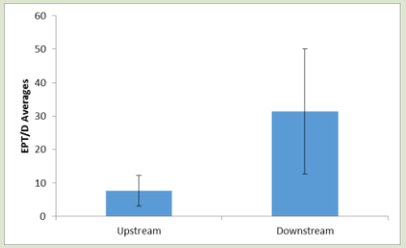
Figure 2: Chla testing: before hot bath

Methods Cont.

- Insect communities were collected using a Hess Sampler (see figure 3 – large picture). Each sample was put into a whirl bag with ethanol for preservation and processed in the lab using the sugar float method to remove insects from detritus. Insects were identified by order and/or family (Caddisfly, Mayfly, Stonefly, Midge, Riffle Beetle and other) to calculate the EPT index where a higher value indicates higher environmental quality. EPT is calculated as: Caddisflies + Stoneflies + Mayflies / Diptera (Midge)
- I tested for differences using paired T-Tests on each upstream and its paired downstream site

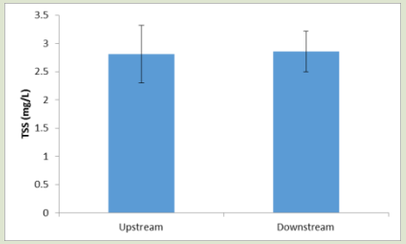
Figure 3: Hess sampler & TSS/FBOM

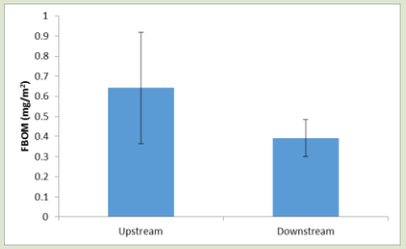
Results



EPT/D averages of the insect communities, comparing upstream to downstream sites
p = 0.31

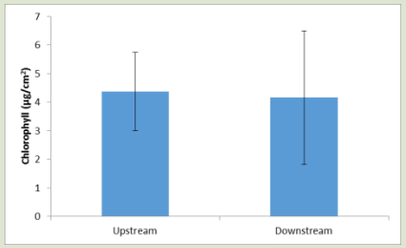
TSS averages from upstream downstream sites
p = 0.50





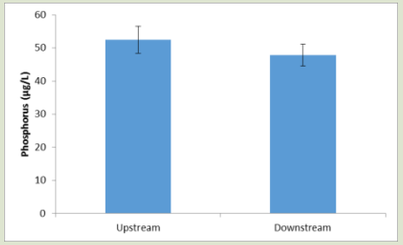
FBOM averages between upstream and downstream sites.
p = 0.47

Results Cont.



Chla averages of upstream and downstream sites
p = 0.92

P averages of upstream and downstream sites
p = 0.049



Conclusion

I found no significant difference in chlorophyll a, FBOM, or TSS between the upstream and downstream sites. This suggests that stream burial does not affect these key insect food resources. However, I found higher phosphorus concentrations upstream of a buried stream segment compared to downstream implying net phosphorus uptake in the buried reach. I also didn't find a difference in EPT/D between upstream and downstream sites, indicating no difference in environmental quality among site. Overall, these results suggest that the overarching environmental effect on urbanization on streams is a more important control on food resources and insect communities than the effect of burial

Next Steps

The next step for this research is to measure NH4+ (ammonium) concentrations to see if there is a significant difference from stream burial. Also, identifying insects at a more specific taxonomic level could reveal more refined differences between the communities upstream and downstream of buried stream segments.

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