How does student activity impact Little Niagara Creek?:

Examining the relationship between streambed disturbance and species diversity in a campus teaching resource

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INTRODUCTION

What Is Disturbance? Rivers and streams experience disturbance when the streambed is disrupted by human or natural events (1).

Why Does Disturbance Matter? Disturbances create important "windows of opportunity" that species can exploit. It can weaken the grasp a successful species and allow newcomers to become established (2).

Intermediate Disturbance Hypothesis (IDH): This predicts that the greatest diversity occurs with the right balance of disturbance and recovery. More or less disturbance will lead to a reduction in diversity (3).

Our Research: Little Niagara Creek is frequently disturbed by UWEC students studying and sampling the stream. We wanted to know how the frequency of that disturbance influenced the diversity of benthic communities inhabiting the streambed.

We predicted we would see the pattern predicted by the IDH, whereby some disturbance would enhance diversity, and too much would decrease it.

METHODS

Five rock trays were placed in Little Niagara Creek in areas of similar depth, flow and substrate.

The trays were shaken in a standardized manner for 1, 2, 3, 4 or 6 times over 24 days and then sampled.

In the lab, all macro-invertebrates collected from trays from were identified and counted.

Richness was determined and the Shannon-Weiner index was used to calculate diversity.

Linear regression examined the diversity- disturbance relationship (Fig. 1).

Pie charts were constructed to analyze trends in community composition and species dominance (Fig. 2)

RESULTS

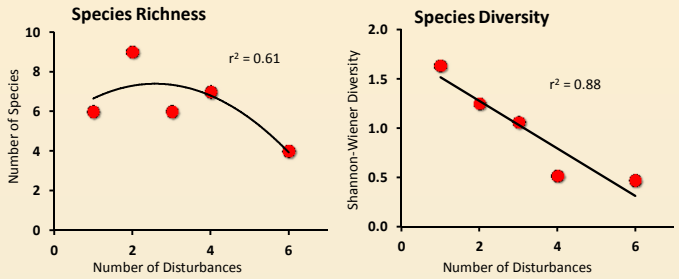

Figure 1: Species richness and Shannon-Wiener diversity for macroinvertebrates collected from rock trays in placed in Little Niagara after being disturbed for 1, 2, 3, 4 or 6 times over a the course of a 24-day period. The relationship for diversity was highly significant ($p < 0.001$).

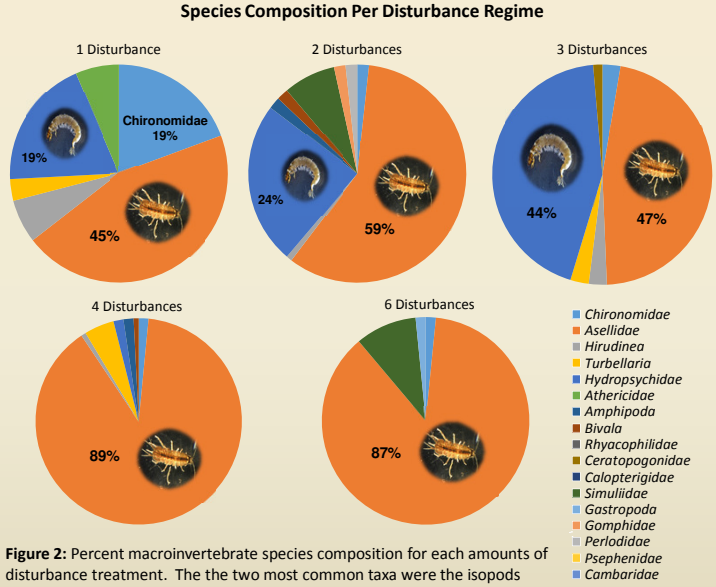

Figure 2: Percent macroinvertebrate species composition for each amounts of disturbance treatment. The the two most common taxa were the isopods (Asellidae) and the net-spinning caddisflies (Hydropsychidae).

Asellidae or Isopods, also known as "aquatic sow bugs"
(https://www.kuleuven-kulak.be/kulakbiocampus/insecten-ongewervelden/vijverfauna/asellidae/Asellus%20aquaticus%201.jpg)

Hydropsychidae or "net-spinning caddisfly larvae"
(http://1.bp.blogspot.com/_J2hQWqXV7rg/TUm3j7lc4cI/AAAAAAAAARM/cCxsWsSpuRE/s1600/Common+Netpinner)

ACKNOWLEDGEMENTS & REFERENCES

Special thanks to Melissa Seidel for helping us shake, rattle and roll the Little Niagara.

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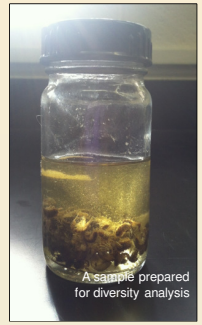
INTERPRETATION OF RESULTS

Species Richness & Diversity (Fig. 1): The number of species present in samples (i.e. the richness) showed a hump-shaped relationship to disturbance, supporting the IDH concept and indicating that two disturbances per 24-day period resulted in the highest species richness. However, when species diversity was examined, we found a steep decline in diversity as the disturbance frequency increased. Diversity incorporates both richness and evenness, and the composition data (Fig. 2) show that evenness was lowest in the communities receiving the highest levels of disturbance.

Species Dominance (Fig. 2): The Asellidae (isopods) dominated all the assemblages and their abundance was highest in the most frequently disturbed treatments. The second most abundant species were the Hydropsychidae (net-spinning caddisfly larvae), which were unable to tolerate high levels of disturbance.



CONCLUSION

Our hypothesis was partially supported because, even though diversity did not follow the expected IDH pattern, richness did. That suggests disturbance affects species evenness (i.e., how closely in number the species are to one another) more severely than richness.

It is also possible that our disturbances were too frequent to produce the entire IDH curve and that what we found was only the far end of the disturbance-diversity relationship. Had we run the experiment for a longer period of a month or more, perhaps a different patterns would have emerged.

Our data suggest that some level of disturbance is beneficial to the benthic communities in Little Niagara Creek, and show that the most species can tolerate moderate levels of disturbance.