The Effects of Contrasting Land Cover on Macroinvertebrate Prevalence and Diversity in the Russian River Watershed

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Introduction

Human land use impacts freshwater ecosystems by introducing contaminants into macroinvertebrate habitats. Macroinvertebrates are indicator species, meaning that they can reveal the overall health of the surrounding ecosystem (Ogbeibu and Oribhabor, 2002). We tested to see how land cover impacts macroinvertebrate prevalence and diversity at two Northern California creeks. We sampled from Pieta Creek located in rural Mendocino County, and the more urbanized Copeland Creek at Sonoma State University. We expected to find greater abundance and diversity of macroinvertebrates at Pieta Creek, where surrounding land cover is largely forested. Collecting macroinvertebrates from both creeks, we recorded the species diversity and overall sample population. In our analysis, we incorporated water quality data from members of another Science 120 group to identify other factors that could impact macroinvertebrate communities. As such, our findings can help us better understand the specific conditions that contribute to a healthy freshwater ecosystem.

Materials & Methods

We collected macroinvertebrate samples from both Copeland Creek and Pieta Creek using a D-Net. From three points along each body of water, we dragged the D-Net across the width of the creek. After collecting macroinvertebrates, we transferred our samples from the D-Net to a frisbee filled with water. Using pipettes we extracted the macroinvertebrates from the frisbee into test tubes filled with alcohol. Finally, we counted and identified each of the different macroinvertebrates from each point located at the two creeks (Stark, 1993).

Figure 1: Satellite view of Pieta Creek where macroinvertebrates were sampled.

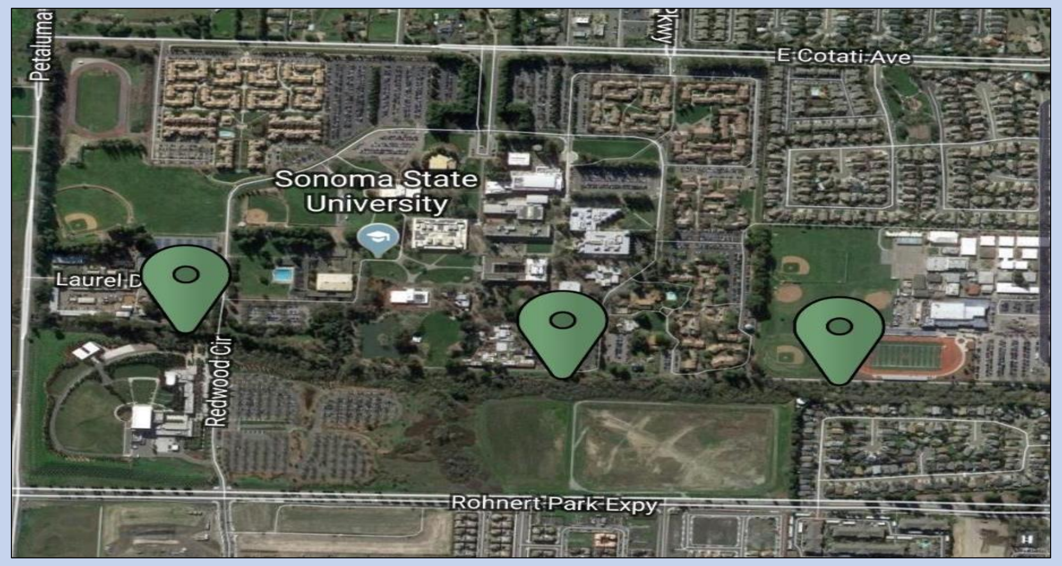


Figure 2: Satellite view and location markers along Copeland Creek where macroinvertebrates were sampled.

Figure 3: Collecting macroinvertebrate samples at Pieta Creek.

Figure 4: Collecting macroinvertebrates in Copeland Creek utilizing a D-Net.

Figure 5: Transporting equipment to Copeland Creek to begin macroinvertebrate sampling.

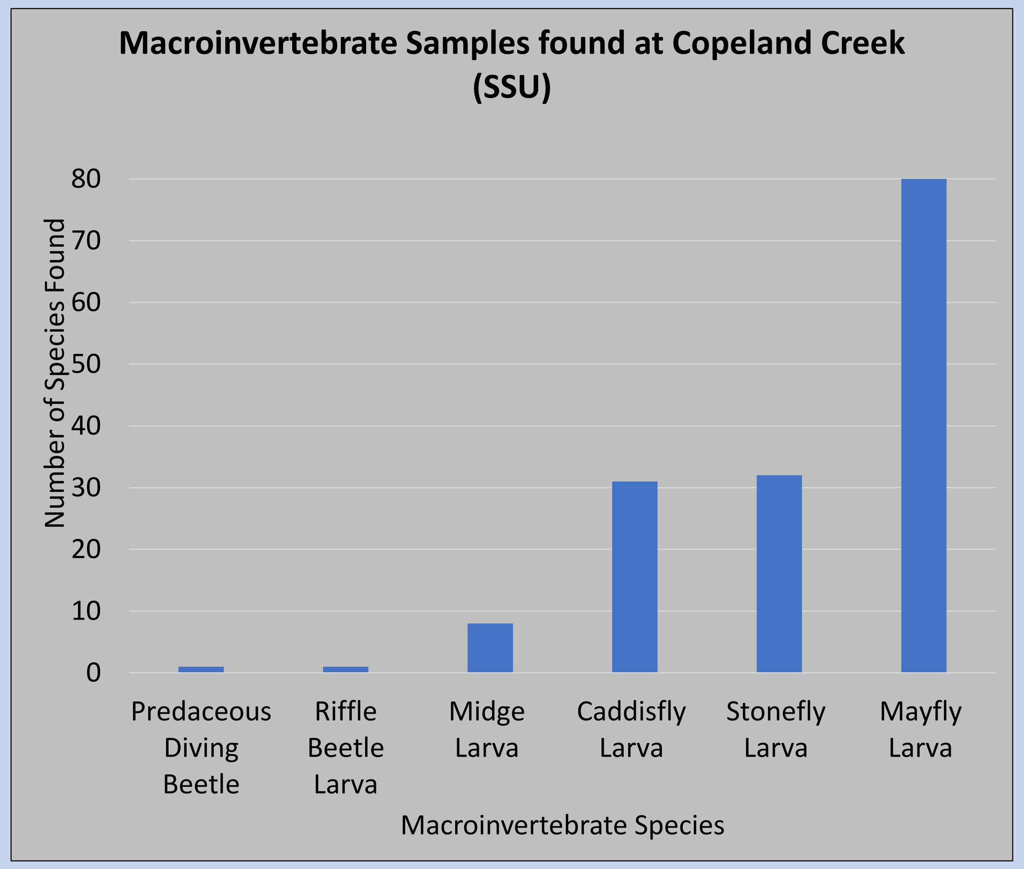
Figure 6: Identifying and sorting macroinvertebrate samples.

Acknowledgements

We would like to express our gratitude towards Dr. Nathan Rank and Dr. Robin Glas for their guidance and assistance.

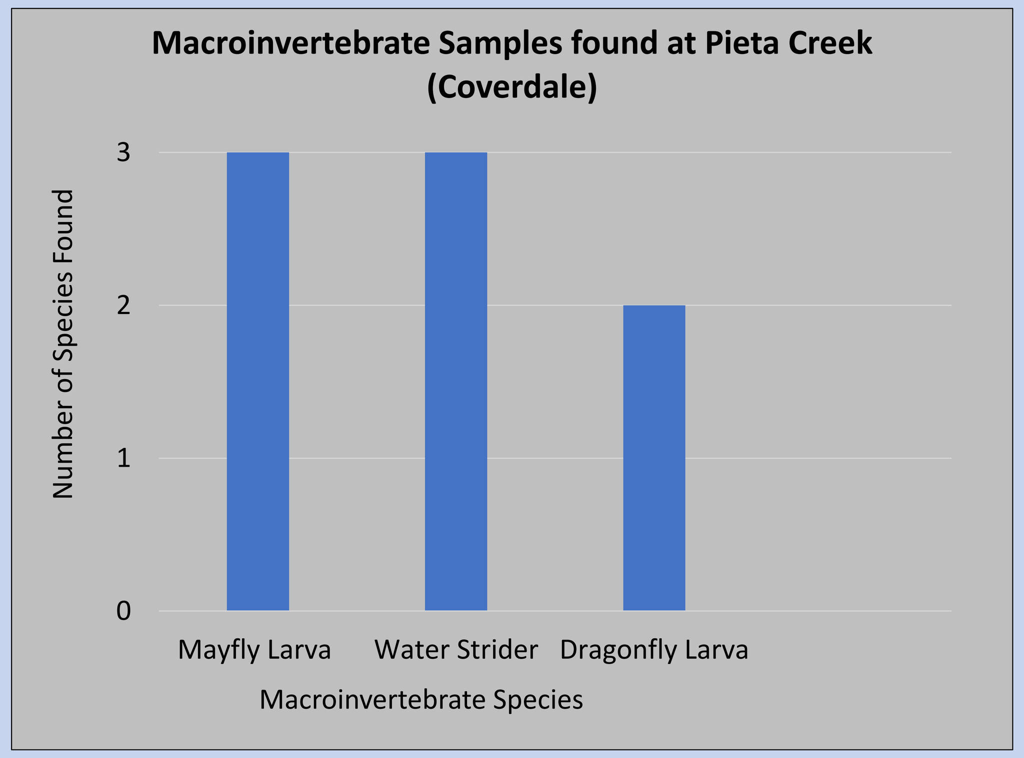
Results

Figures 7 and 8: At Copeland Creek we found six different species of macroinvertebrates as well as a large sample population of several species.



Macroinvertebrate Species	Number of Species Found
Predaceous Diving Beetle	1
Riffle Beetle Larva	1
Midge Larva	8
Caddisfly Larva	31
Stonefly Larva	32
Mayfly Larva	80
Total	153

Figures 9 and 10: At Pieta Creek we found three different species of macroinvertebrates with a small sample population.



Macroinvertebrate Species	Number of Species Found
Mayfly Larva	3
Water Strider	3
Dragonfly Larva	2
Total	8

- We found a negative correlation between Water Quality Index scores and macroinvertebrate sample populations.
- The Water Quality Index score of Pieta Creek suggested healthier stream conditions than Copeland Creek.
- Copeland Creek possessed a greater abundance and species diversity of macroinvertebrates than Pieta Creek.

Figure 11: Microscopic view of Stonefly Larvae.

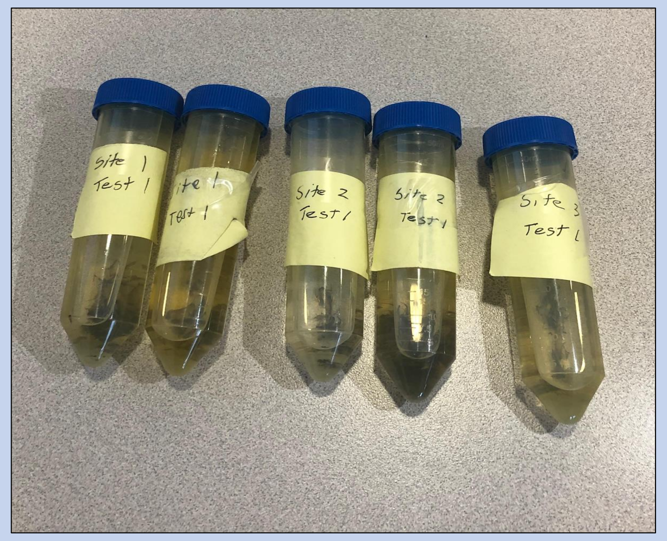


Figure 12: Early stage macroinvertebrate samples from Copeland Creek.

Figure 13: Microscopic view of Riffle Beetle Larva.

Copeland Creek	Location 1	Location 2	Location 3
Phosphate (mg/L)	0.4	0.2	0.2
Nitrate (mg/L)	0.9	0.6	0.4
Total Dissolved Solids ppmx10	19.245	17.175	16.205
Temperature (˚C)	16.1	16.2	15.4
pH	8.26	8.08	8.03
Dissolved Oxygen (mg/L)	8.7	8.5	8.5
Biochemical Oxygen Demand (mg/L)	-0.1	0.7	0.2
Fecal Coliform (mpn/100ml)x10^3	24.1	24.192	24.2
Turbidity	2.02	2.05	3.17

Figure 14: Water Quality Index for Copeland Creek.

Pieta Creek	Location 1	Location 2	Location 3
Phosphate (mg/L)	0	0	0
Nitrate (mg/L)	0	0	0
Total Dissolved Solids ppmx10	9.1	10.03	10.145
Temperature (˚C)	12.9	12.8	12.7
pH	8.4	8.35	8.23
Dissolved Oxygen (mg/L)	8.3	8.2	8.5
Biochemical Oxygen Demand (mg/L)	0.4	0.4	0.4
Fecal Coliform (mpn/100ml)x10^3	24.1	24.192	24.2
Turbidity	29	12	5

Figure 15: Water Quality Index for Pieta Creek.

Figure 16: Organized samples of macroinvertebrates collected.

Discussion

In finding a negative correlation between the Water Quality Index and macroinvertebrate sample populations, it can be concluded that these sample populations are likely regulated by a multitude of factors other than explicitly water quality. This is due to multiple studies coming to the conclusion that there is a positive correlation between water quality and macroinvertebrate populations, which is a result that is antithetical to our findings (Ogbeibu and Oribhabor, 2002). With our findings disagreeing with the well established precedent, but our calculations and data being accurate, it can be concluded that the factors likely responsible for the discrepancy were not tested for. Since macroinvertebrates are indicator species which demonstrate a positive correlation of sample population size and ecosystem health, it is important to understand what controls those population sizes. As such, perhaps it would be beneficial to conduct a larger study that accounted for other factors such as stream velocity and light exposure in tandem with water quality that could allow us to understand exactly what contributes towards the sample populations size of macroinvertebrates and the health of the ecosystem as a whole.

References

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- Stark, J. D. (1993). Performance of the Macroinvertebrate Community Index: effects of sampling method, sample replication, water depth, current velocity, and substratum on index values. *New Zealand journal of marine and freshwater research*, *27*(4), 463-478.