

# Estimating the Insect Biomass in Rock Creek

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**Abstract:** The purpose of our experiment is to accurately estimate the biomass of the insects in Rock Creek--particularly the bottom of the creek. We focused on three main macroinvertebrate orders: Stoneflies (*plecoptera*), Mayflies (*ephemeroptera*), and Caddisflies (*trichoptera*). Our results provide important information which can be applied to further research of Rock Creek, including comparing the biomass to previous years to identify any significant shifts and/or improvements in the condition of the stream. In addition, we were able to use this information to calculate an overall biomass and energy estimate within the stream.

## Introduction:

### Overview

•Purpose: to estimate the biomass in Rock Creek.

Relevant Background Information:

- Data on macroinvertebrates within Rock Creek has been recorded since 2013. We applied the data from the most recent sample collected in the Fall of 2016 in our calculations.
- Rock Creek's food web is consistent of the Pacific Northwest region and Temperate Rain Forest Biomes.
- This research is of great ecological and environmental importance. It provides accurate estimations of the biomass and energy within Rock Creek, which can be applied to further important research to promote the health of the entire stream and ecosystem. For example, in Europe and elsewhere, macroinvertebrate community assessment has been used as a tool to manage water usage, evaluate pollution control measures, and improve the performance of bioassessment techniques (Metcalf). This research can support a deeper knowledge of the energy transfer that occurs from the creek to the riparian zones and how the biomass within the creek influences the food web. For example, throughout Temperate Rain Forests, salmon are a keystone species. Everything else in the ecosystem from the trees, to the soil, to other forms of life depend upon salmon. This proves that our research is of definite ecological importance because both juvenile and adult salmon eat macroinvertebrates.
- Specific Research Objective: to estimate the insect biomass in Rock Creek.

## Methods:

### Overview

- The study site was Rock Creek. As an entire class we visited a portion of Rock Creek and split it into multiple sections or "transects". Each group collected relevant information within their transect and then later compiled all of that data together.
- We designed our experiment to be the most efficient and accurate as possible. We began with separating stoneflies, mayflies, and caddisflies. The samples were gathered from various rivers and creeks in the pacific northwest. Once we had about 10-15 of each order we carefully removed the insects from their sample tubes and weighed them together on the scale provided. We decided to calculate their wet mass due to time constraints and scale limitations; Since the scale we had access to was not extremely accurate or sensitive, it was necessary that we weigh the samples of each order together in order for the scale to detect the weight. Then we divided the total mass by the number of insects to find the average wet mass of each macroinvertebrate.
- Mathematical model used to calculate mass:  $Mean = \frac{\Sigma Mass(mg)}{n}$
- From this point, we referred to the data from the most recent sample collected in Rock Creek, which was of Fall 2016. We calculated the total of insects from each order and then divided that number by the area of the sample, which was 46 square feet. This provided us with insect densities for each macroinvertebrate.
- The total mass of each macroinvertebrate was calculated by multiplying the found insect density by the area of the stream (211200 feet squared) and by the average wet mass. After finding a total mass for all the macroinvertebrates combined we corrected the inaccuracy of this number (due to the excess water weight from taking a wet mass) by finding 65% of the total mass, which provided us with a close estimate of what the dry mass of the insects would have been (Sage).
- The next step was to find an energy estimate for Rock Creek. We did this through multiplying the total area of the stream by each macroinvertebrate insect density and then by .0012, which is the average calorie of an insect. After adding these together we found a total calorie energy estimate for Rock Creek.
- In addition, we compared each macroinvertebrate calorie estimation to the food equivalent of Hershey's Candy bars. Since there is 220 food calories in each bar, we divided each by 220. For example, for Stoneflies we divided 336.1 by 220 to get an equivalent of 1.5 bars.
- Our experimental variables were the macroinvertebrate order, the average mass, the insect density, the biomass, and the total calories.

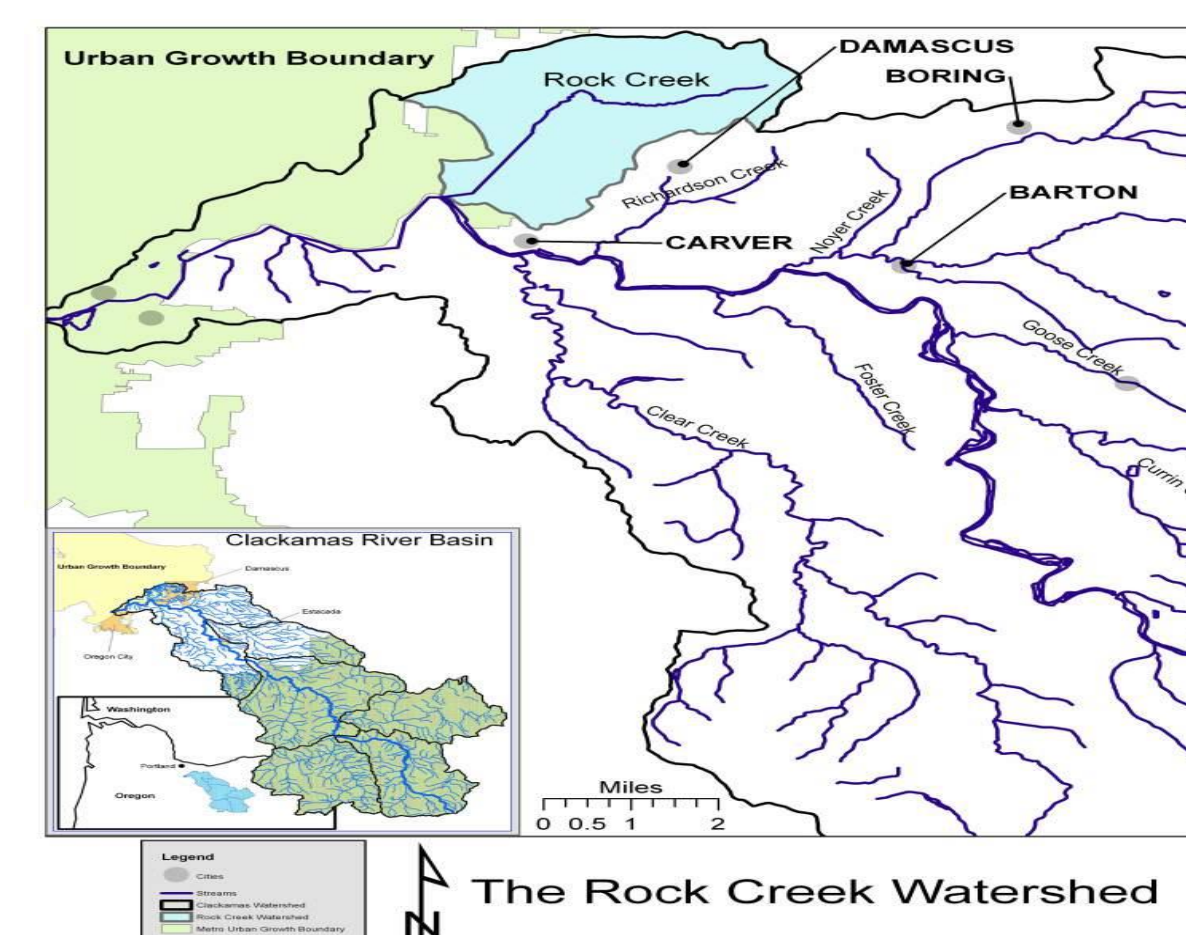


Figure 1: Map of the regional and local stream location

## Results:

Insect	Average Wet Mass (mg)	Insect Density (amount of insects per square foot)
Stonefly	0.010	1.3
Mayfly	0.006	13.3
Caddisfly	0.005	2.4

Figure 2: Table displaying mean averages of macroinvertebrate mass and insect density in Rock Creek.

Insect	Total Mass of Insects in Creek (mg)	Total Calories of Insects in Creek	Food Equivalent: Hershey's Chocolate Bars
Stonefly	2800.5	336.1	1.5 bars
Mayfly	16832.2	3366.4	15.3 bars
Caddisfly	2548.1	611.6	2.8 bars
<b>TOTAL:</b>	<b>22180.8</b>	<b>4314.1</b>	<b>19.6 bars</b>
<b>Adjusted total (due to added water weight)</b>	<b>14417.52</b>		

Figure 3: Table displaying total mass/calories of macroinvertebrates in Rock Creek and a food equivalent..

### Discussion

- The purpose of this study is to estimate the biomass in Rock Creek. Our results provide significant information pertaining to the biomass of macroinvertebrates in the stream. We chose to study three common macroinvertebrate orders: Stonefly (*plecoptera*), Mayfly (*ephemeroptera*), and Caddisfly (*trichoptera*).
- Major findings: The biomass of all three macroinvertebrates in Rock Creek is 22180.8 mg. However, when adjusted to eliminate the inaccuracy due to taking wet measurements (added water weight), we estimate that the biomass is 14417.52 mg. Of the three macroinvertebrates observed, Mayflies are the most frequent throughout the stream and Stoneflies are the least. The energy estimate is 4314.1 calories, which is equal to 19.6 Hershey's Chocolate Bars.
- Limitations of Experiment: Lack of highly accurate/sophisticated equipment, uncooperative weather conditions when gathering data, and wet measurements (which we attempted to recorrect in our calculations).
- Assumptions of Experiment: It is assumed that the weight of the bugs sampled is consistent all throughout the stream at various depths. In addition, it is also assumed that the mass we calculated reflects the mass of every Stonefly, Mayfly, and Caddisfly, even though we acknowledge that variability exists.

### References

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- Metcalf, J. L. Biological water quality assessment of running waters based on macroinvertebrate communities: History and present status in Europe. *Environmental Pollution* **60**, 101–139 (1989).

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