# Effects of Restoration on Benthic Energy in Rock Creek

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**Abstract:** Rock Creek is a creek in Clackamas County, Oregon. Three years ago in the summer of 2014, the Rock Creek Restoration Project began to restore stream health. Methods for improving the stream's quality included increasing the amount of woody debri, increasing sinuosity of the stream, and restoring and expanding riparian zones along the stream bank. The stream's health was measured over the course of ten years through the monitoring of insect populations within the stream. Certain types of insects, such as long lived K-adapted species (such as stoneflies) show the the stream is stabilizing and becoming an attractive habitat for less common and tolerant insects.

## Introduction:

### Overview

- The purpose of our research is to understand how stream restoration affects insects population.
- How does stream restoration increase benthic energy in a stream over time?
- Stream restoration is a key part in preserving the natural ecosystems of the Northwest.
- Stream ecology and data analysis are key components in this experiment.
- By looking at the changes in benthic energy of the stream, we can see how energy levels have changed in the years following restoration.

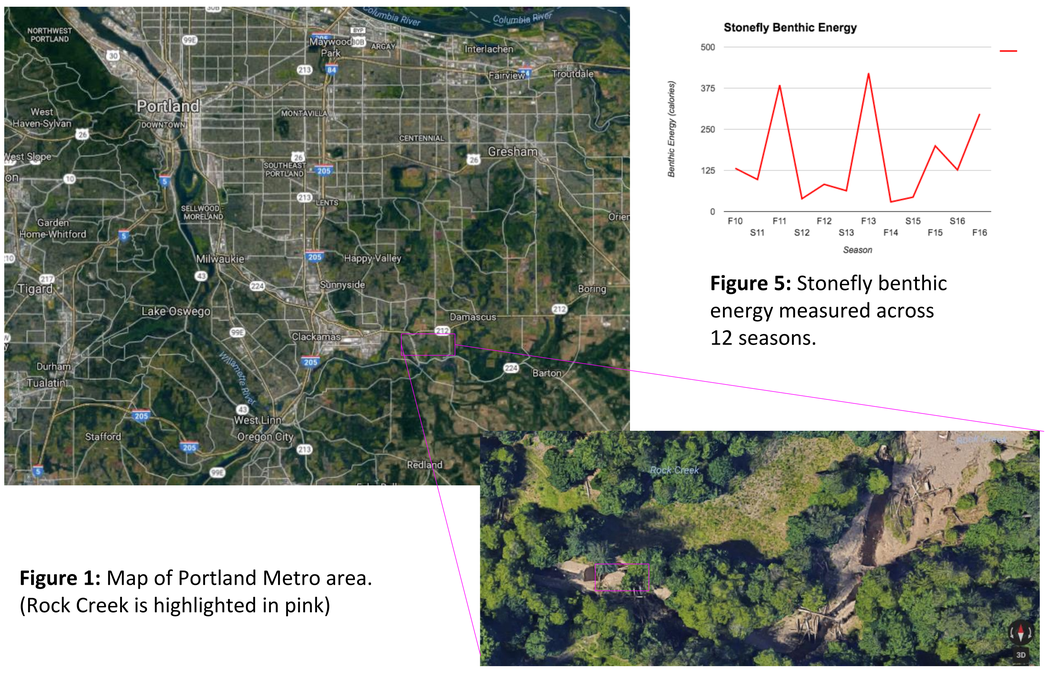


**Figure 1:** Map of Portland Metro area. (Rock Creek is highlighted in pink)

## Methods

- Comparison of data across seven years of research.
- Insect populations are converted into benthic energy (calories) to provide a more uniform unit of estimation across multiple seasons.
- Calorie estimates of insects are taken from *"Diurnal Drift Rates of Aquatic Invertebrates in Second Order Streams"* by PSU's Wellington, Ordway, and Meinhold.

### Assumptions:

- All data is accurate from multiple groups.
- Only restoration has affected insect populations.

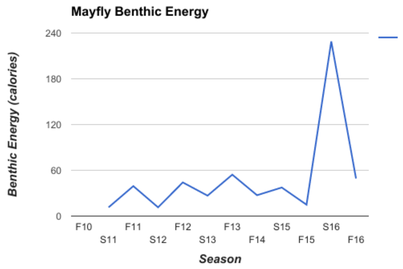


**Figure 3:** Mayfly benthic energy across 12 seasons. (F=fall, S=spring)




**Figure 5:** Stonefly benthic energy measured across 12 seasons.

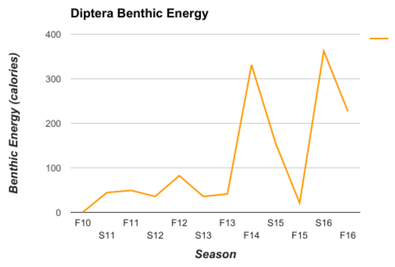


**Figure 4:** Diptera benthic energy across 12 seasons.

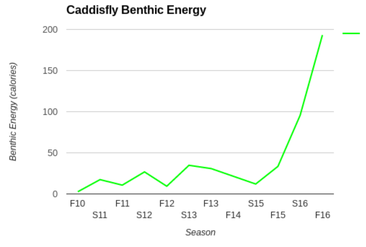


**Figure 6:** Caddisfly benthic energy, note the spike in energy following one year after the restoration in fall 2014

## Results:

### Table: Benthic Energy Levels of Different Orders of Macroinvertebrates

| Season | Mayfly | Stonefly | Caddisfly | Diptera | Other | Cumulative |
|---|---|---|---|---|---|---|
| F10 | 3.3 | 130 | 2.7 | 0.66 | 59 | 200 |
| S11 | 11 | 97 | 17 | 45 | 8.7 | 180 |
| F11 | 39 | 380 | 11 | 49 | 150 | 640 |
| S12 | 12 | 39 | 27 | 36 | 45 | 160 |
| F12 | 44 | 83 | 9.4 | 83 | 31 | 250 |
| S13 | 27 | 63 | 35 | 36 | 49 | 210 |
| F13 | 54 | 420 | 31 | 41 | 180 | 720 |
| F14 | 27 | 29 | 21 | 330 | 87 | 500 |
| S15 | 38 | 44 | 12 | 160 | 31 | 280 |
| F15 | 15 | 200 | 33 | 21 | 35 | 300 |
| S16 | 230 | 130 | 96 | 360 | 100 | 920 |
| F16 | 49 | 230 | 190 | 230 | 170 | 930 |

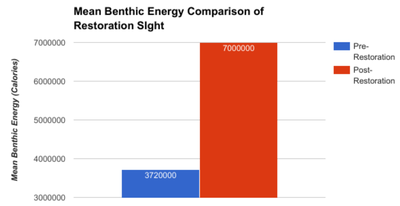


**Figure 9:** A comparison of pre and post benthic energy of the sample area located at the restoration site.
**Food Equivalent:** The amount of benthic energy of the sample area in the equivalent of top ramen. (188 kcal)
**Pre-Restoration:** 19.79 ramen
**Post-Restoration:** 37.23 ramen
**Benthic energy has increased by 88.13% so far.**

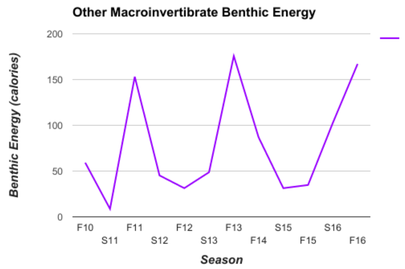


**Figure 7:** Other macroinvertebrates that fall under different orders.

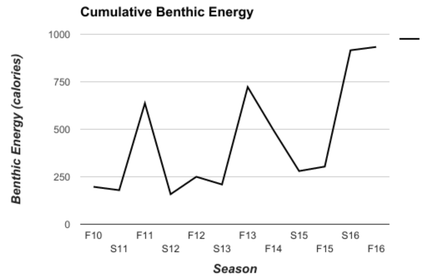


**Figure 8:** Cumulative benthic energy including all orders found within Rock Creek.

### Results

- Stream restoration has improved benthic energy levels in Rock Creek.
- While benthic energy may not rise abruptly, overall benthic energy increased in the years following the restoration.
- While some orders may see dips in benthic energy, this is due to higher populations of K-adapted species in the stream. These insects have higher calorie per insect content, and are often predators.

### Discussion

- Stream restoration has increased benthic energy levels in rock creek.
- This shows that restoration does indeed work to improve macroinvertebrate populations.
- The most impactful limitation of this analysis is that the data does not take into account other factors (floods, man-made disruptions etc.) that impact macroinvertebrate populations.

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