The Effect of Stream Order on Water Quality
West Branch of the Westfield River

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Figure 1 shows Steve testing the pH of the West Branch of the Westfield River- a 4th order stream.

Abstract

The West Branch of the Westfield River's watershed (Figure 9) includes various streams with Strahler Stream Orders ranging from first to fourth order shown in Figure 2. The objective of this study was to determine significant relationships between stream orders using various water quality parameters. There were three different sampling sites for each stream order. The sampling sites along the watershed were spaced out in hopes of making our data more representative of the entire watershed. Each sampling site also had four individual data replicates for accuracy, with a few exceptions for the parameters which were tested in the lab. Using the data collected *in situ* and in lab, we created scatter plots to determine correlation between stream order and each variable measured. The scatter plots revealed that there was little relationship between stream order and the parameters we tested. We found no strong correlation between the variables, although CO_2 and turbidity showed the strongest relation to stream order (Figures 3 & 5). .

Hypothesis:

Different stream orders have different quality water.

vs.

There is no difference in water quality.

Study Plan

1. We chose water quality parameters to be tested.
2. Using ArcGIS, we created a map of the watershed showing all streams in the West Branch watershed. See Figure 2.
3. We labeled the stream orders and chose which to test
4. We calibrated electronic testing equipment used.
5. At each of 12 sites, we carried out the temp, DO, pH, and specific conductivity measurements four times by submerging the equipment sensors, and recording the readings.
6. We took a 100mL sample to bring back to test for concentrations of dissolved CO_2, nitrates, and phosphates

Figure 9 shows the Westfield River watershed in southwestern Massachusetts. http://upload.wikimedia.org/wikipedia/commons/thumb/b/b9/Westfieldrivermap.png/375px-Westfieldrivermap.png

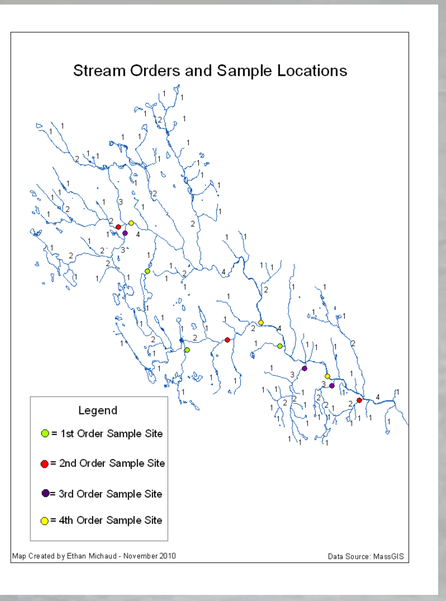

Figure 2 shows the GIS map we used to identify the stream orders in the West Branch watershed. The colored dots show testing locations.

Our Correlations

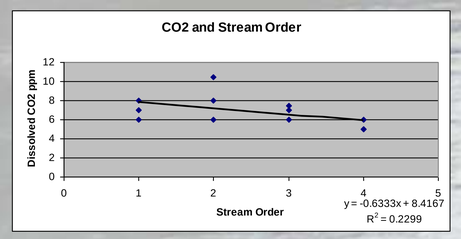

Figure 3 shows the strongest correlation of .2299. It is between CO and stream order

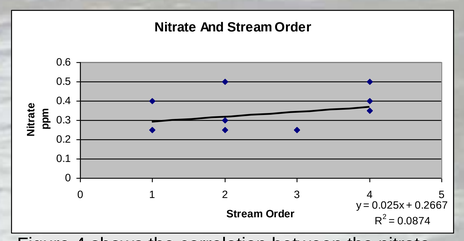

Figure 4 shows the correlation between the nitrate concentration and stream order. The correlation is .0874.

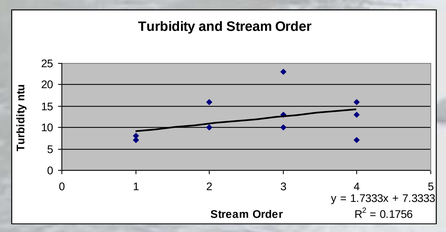

Figure 5 shows the correlation between turbidity and stream order. The correlation is .1756

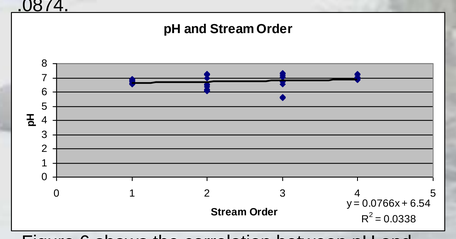

Figure 6 shows the correlation between pH and stream order. The correlation is .0338.

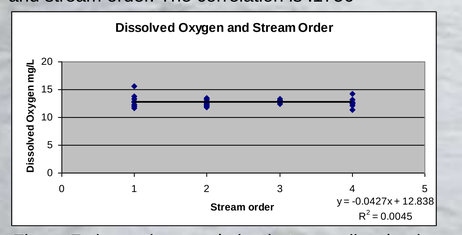

Figure 7 shows the correlation between dissolved oxygen and stream order. The correlation is .0045.

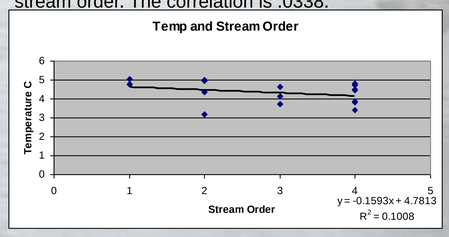

Figure 8 shows the second strongest correlation of .1008. It is between temperature and stream order.

The Strahler Stream Order System

The Strahler Stream Order is a way of identifying streams based on their size. A stream's order refers to the tributaries that flow into it. 1st order streams are the smallest streams because they have no tributaries flowing into them. When two 1st order streams converge, a 2nd order stream is the result. When two 2nd order streams converge, a 3rd order is the result and so on. Headwater is considered any 1st through 3rd order stream. These constitute about 80% of the streams worldwide (Briney) Stream orders are used in the River Continuum Concept which relates how streams of different orders can support different aquatic life (Briney).

Results

After running statistical tests on the data we collected, we were unable to see any significant correlations between water quality and stream order. Streams of the same order often had significant differences in water quality. In some cases, streams of different orders had similar water quality.

The strongest correlations were between stream order and concentrations of CO2, temperature, and turbidity, shown in Figures 3 through 5.FIXXXXX Despite that these showed our strongest correlations, the correllation was not significant. Our strongest correlations still did not reveal a significant relationship between stream order and water quality.

Conclusions

Overall, our data did not indicate any relationship between stream order and water quality. Our hypothesis was not supported. Instead our null hypothesis was supported that water quality and stream order are not related.

Maybe next time

If given more time to sample more streams of each order, there is a chance that we may find trends between some of the variables tested.

The fact that we only sampled three streams of each stream order limits the conclusions we can make from the data. If, say, one hundred streams of each order were sampled, the conclusions one could make would be more accurate.