BIOL 392 Allan & Castillo 2009 Ch. 4 Assignment
Water Chemistry, D_{50}, and Thalweg

Objectives: The objectives of this activity are to determine your ability to…

1. Apply the material from Allan & Castillo 2009 to a realistic stream scenario;
2. Support an argument using 3 pieces of evidence; and
3. Solve a stream assessment problem.

Instructions: You must write in complete and clearly worded sentences/paragraphs and demonstrate that you have critically thought about your responses rather than quickly scratched down ideas.

You <u>MUST</u> work in your stream assessment teams to begin or continue practicing your teamwork skills for your stream assessments! Be COVID-19 safe!

Format: The font style and size must be readable; paragraphs must be single-spaced. There are not any page number requirements.

Submission: Upload your Word or Excel document using the Assignments link. Name your Word or Excel file using the following format. Only one team member needs to submit the assignment.

Single Author File Name Format
FirstName_BIOL392_Week_4

Two Author File Name Format
FirstName_FirstName_BIOL393_Week_4

Three Author File Name Format
FirstName_FirstName_FirstName_BIOL393_Week_4

Grading: This assignment will be graded based on student's ability to 1) follow instructions; 2) provide a clearly organized argument; 3) support the argument with evidence; and 4) compare the discharge between two sites.

Ability to Follow Instructions

Score	Description
0.0	*Many mistakes (>5)*
1.0	*Some mistakes (3 or 4)*
1.5	*Few Mistakes (1 or 2)*
2.0	*No Mistakes, perfection*

Clarity and Organization

Score	Description
0	*Little organization and lots of confusion*
1-2	*Some organization and manageable clarity*
3-4	*Clear answer and mostly organized argument*
5	*Clearly organized argument*

The Argument Supported with Evidence

Score	Description
0	*No evidence is provided, just a statement*
1-2	*The argument is provided but without clear evidence that is linked to the argument.*
3-4	*The argument is provided, but only using 1 piece of evidence or almost supported fully.*
5	*Perfection*

Part 1: Patterns in Stream Water Chemistry

A team of stream ecologists wants to understand the relationship among several water chemistry variables between two seasons. They collected water chemistry in brown bottles at 10 sites in both the Spring and Summer of 2019 (Figure 1). An analytical chemist quantified 15 molecules or compounds in each of the water samples. The stream ecologists ran a principal component analysis (PCA) to determine the spatial pattern of the sites based on their water chemistry (Figure 2). The ecologists need you to explain the reason for the chemical pattern between the sites AND seasons. Use three pieces of evidence from Chapter 4 in Allan and Castillo (2009) to construct your argument AND support your explanation (12 Points)!

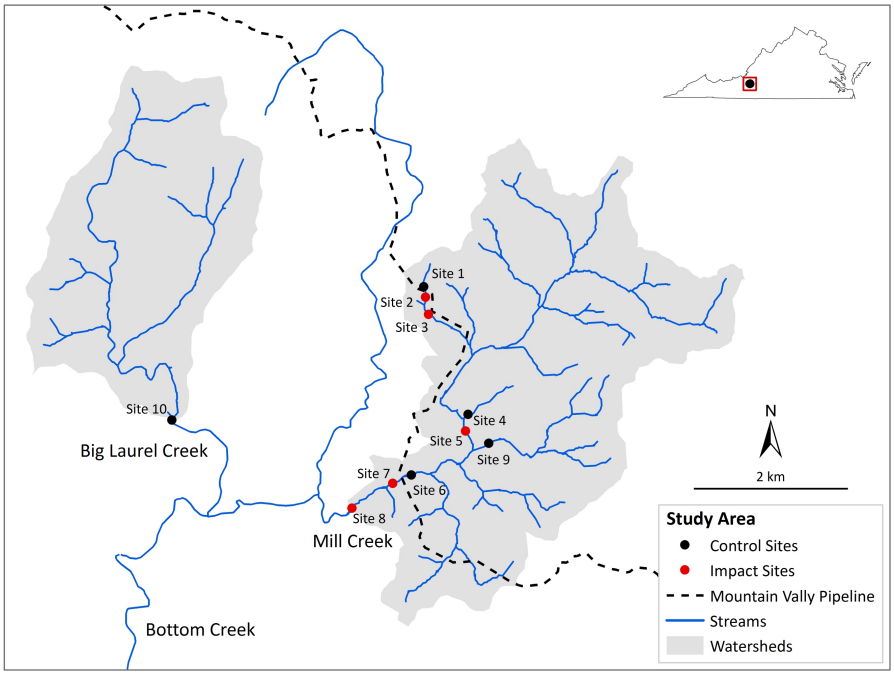

Figure 1. Map showing the location of the 10 sampled sites.

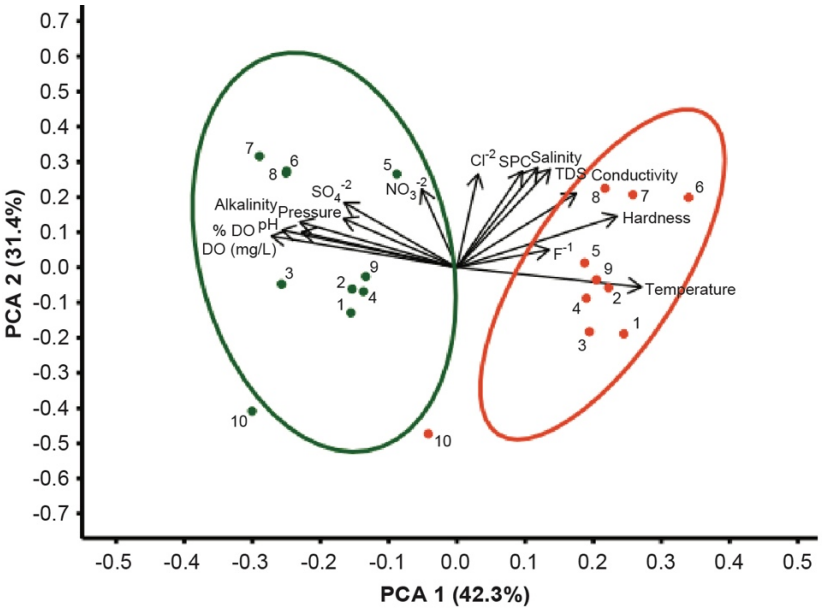

Figure 2. Principles component analysis for water chemistry at ten sites in the Mill Creek and Big Laural Creek watershed, Roanoke County, Virginia for the Spring 2019 (—●—) and Summer 2019 (—●—) sampling season.

Part 1: The Principle component analysis (PCA) shows water chemistry at two sites between two seasons. The primary difference between these two seasons is temperature. One occurs during spring, and the other during summer. Temperature plays a big role in affecting water chemistry. Seasons can also affect water chemistry due to the amount of rain failing in a particular season. Rain and runoff from rain can affect water chemistry by altering levels. This is discussed in Chapter 4, "increases in flow due to rain events typically dilute streamwater although it is not a simple relationship." (Livingstone 1963) The PCA shows chemical variables that are most similar to each other. The ones that are grouped closely are more closely related. The two sample sites have no similarities. Another difference that can be found among the seasons is the breakdown of plant material in the later season. Chapter 4 states, "the dissolved oxygen of importance are oxygen and CO2…photosynthetic activity in highly productive settings can elevate oxygen…" This could be some explanation for dissolved oxygen showing up more in the spring rather than in the summer.

Part 2: Comparing the D_{50}, Depth, and Channel Units as a Summary Table

The team of stream ecologist performed the "Wolman Pebble Count" for the sample reach in Mill Creek and the Tributary. They also measured the depth and categorized the channel units along Thalweg profile. They entered their data into a nice Excel spreadsheet (see D2L Week 5 Assignment – Data). Using their data and the Wolman Pebble Size Analyzer (also in D2L), calculate the D_{50} for the two stream reaches. Further, calculate the average depth and percentages of riffle, glides, and pools along the Thalweg profile. Show your detailed work for full credit (either hand written calculation or using the Excel functions). Create a summary table to organize the data. **The D_{50}, average depth, and percentages per stream reach must be in one clearly organized table** (8 Points).

D50 Mill Creek	**D50** Tributary to Mill Creek	Average Depth Mill Creek (mm)	Average Depth Trib of Mill Creek (mm)	Percentage Mill Creek	Percentage Tributary of Mill Creek	CoV Mill Creek	CoV-Tributary of Mill Creek
11.3	16	Riffle- 239.4 Glide-279.9 Pool- 395	Riffle- 100 Glide-134.56 Pool- 265.21	Riffle- 32% Glide- 47% Pool- 21%	Riffle- 33% Glide- 23% Pool- 24%	Riffle- 0.61 Glide- 0.22 Pool- 0.18	Riffle-0.27 Glide- 0.22 Pool- 0.31

Work: I used the Excel pebble analysis to enter the data to get the D50 for both sites.

Grading Rubric for Correctly Solving the D_{50} and Channel Unit Problem

Score	Description
0-0.5	*Incorrect and little to no work shown.*
1-1.5	*Incorrect but with some math errors.*
2-2.5	*Incorrect but with correct steps to solving the problem.*
3-3.5	*Correct with work shown, some aspects of the math are missing.*
4	*Correct, clearly demonstrated how to solve the problem, perfection.*

Table Clarity and Organization

Score	Description
0-1	*Little organization and lots of confusion, data summarized in multiple tables*
1.5-2.0	*Some organization and manageable clarity*
2.5-3.0	*Clear answer and mostly organized table*
4	*Clearly organized table*

Part 3: Coefficient of Variation (2 Bonus Points or 20% of This Assignment)

Calculate the coefficient of variation (CoV) for the riffle, glide, and pool depths. Show your detailed work for full credit AND include the CoV in your table for Part 2.

$$CoV = \sigma/\mu$$

σ = standard deviation
μ = mean

Work: I did my work in Excel. I used the functions to create the standard devation calculation: =stdev(…) Once I calculated standard deviation I placed the number in a cell in Excel and divided it by the average.

STDevGlide	STDev Pool	STDev Riffle	
29.8828411	79.392793	27.66992953	
0.22207819	0.311088096	0.276699295	