8. TESTING SEDIMENT HYPOTHESES

40 Points

The objective of this exercise is for you to develop you own hypotheses or research questions relating stream bed texture to stream hydraulic or geometric characteristics, and then to test those hypotheses or attempt answer those research questions using our field data from the Tomorrow River. The results of these tests will be incorporated into a PowerPoint presentation. Again, communication of our experimental results is a critical component to the scientific method, and public presentations are one common way of communicating those results to the wider scientific community.

YOU SHOULD BE ABLE TO:

- Develop hypotheses or research questions relating stream bed texture to stream hydraulic or geometric characteristics;
- Test these hypotheses or attempt to answer these research questions using our field data; and,
- Assemble the combined test results of individual team members into a well-organized, consistently formatted and professional-looking scientific oral presentation.

PROCEDURE

Research can start with a question we would like to answer regarding the landscape, or research can start with a hypothesis (a statement we think is true) regarding the landscape that we would like to test. Either way, the question or the hypothesis should be simple and it should be focused. Broad general questions or unfocused hypotheses have too many unknowns for us to address in a single research project. An example of a simple, focused hypothesis is: stream depth is negatively correlated with stream width. Although the strength of this relationship may be affected by stream bed texture, stream bank vegetation, exposed bedrock, and a variety of other factors, none of these factors is included in the hypothesis. If we wanted to investigate the impact of these additional factors on the relationship between stream width and depth, we would need to create a follow-up hypothesis after addressing the truth of our first hypothesis.

Here is an example of an unfocused research question: What is the relationship between stream channel geometry and aquatic habitats? This question is unfocused because we can measure many geometric characteristics of stream channels. Will we investigate the relationship between wetted perimeter and habitat, or the relationship between hydraulic radius and habitat, or the relationship between stream width and habitat? The second way in which the question is unfocused comes from the definition of “aquatic habitat.” What does “aquatic habitat” refer to? Does this refer to spawning sites for trout, or reproductive sites for mayflies, or sites suitable for lily pad growth?

In addition to developing a simple, focused research hypothesis or question, the hypothesis or question needs to be one we can address using the data we collected. Here is a simple, focused research question: Does stream discharge increase as distance downstream increases? Although this is a good research question, we cannot answer this question using our field data because our transects are too close together. Our experimental design is inappropriate for answering this question.

Task 1: develop a hypothesis to test or a research question to answer that uses our sediment data

Each individual needs to develop one hypothesis or research question relating stream bed texture to stream channel geometry or stream hydraulics. Each hypothesis or research question must be one that our field data can provide an answer to. Each team member needs to test a different hypothesis; you may not have two people on the same team testing the same hypothesis or attempting to answer the same question. As a result, you must confer with your team members about the hypotheses you intend to test or the questions you hope to answer. If you can agree on some common theme for your hypotheses, that will result in a more coherent presentation. Get your hypotheses and/or research questions approved before proceeding.

Task 2: test your hypothesis or answer your question in Excel using our field data

Once approved, each individual must test their hypothesis or answer their research question by creating scatter plots, line graphs, bar charts or tables of summary statistics such as averages and correlation coefficients in Excel. You might want to refer back to Lab 5 – Testing Hydraulic Hypotheses for help with the Excel work.

Each of you must test your hypothesis or attempt to answer your research question **in two different ways**. For example, if you are testing whether a relationship exists between hydraulic radius and bed texture, two different ways of testing this would be first, to correlate hydraulic radius to the 84th percentile (ϕ_{84} or d_{84}) and second, to correlate hydraulic radius to the degree of sorting. Or, if you were testing the relationship between velocity and bed texture, you could do this first, by correlating the overall transect values for velocity and ϕ_{84} or d_{84}, and second, by correlating the individual velocity readings with the associated ϕ_{84} or d_{84} for the individual samples. Creating a scatter plot of velocity and the ϕ_{84} or d_{84}, and then calculating a correlation coefficient to accompany the scatter plot does not constitute two different tests. The correlation coefficient is just an added detail to accompany the scatter plot. Once you have thought of the two ways in which you intend to test your hypothesis or answer your question, get those ideas approved before proceeding.

Task 3: write a brief outline summarizing what your Excel charts show with regards to your hypothesis or research question

Each individual needs to create a bulleted list or outline stating what their Excel charts/graphs/tables show with regards to their hypothesis or research question. Your outline must include a statement as to whether the charts support or refute your hypothesis, or what the charts/tables suggest the answer to your question is. This outline should be created in PowerPoint.

Task 4: design a consistent-looking PowerPoint presentation

Your team needs to create a PowerPoint presentation that incorporates the Excel tests each individual did and the individual outlines that summarize what the individual Excel work shows. You need to format all this information to create a consistent looking set of slides. To this end, you must detail all the visual aspects of each slide.

- Determine which font face(s) and sizes to use for different types of content (e.g. figure captions, headings, bulleted lists, references, etc.). Remember that all the content on each slide must be legible from the back of the room.
- Select a theme or color scheme for the entire presentation. This includes background colors, font colors, and colors on charts (e.g. for points on a scatter plot or for lines on a graph). The theme may also include colors/symbols that will be used as bullet points (if you use something other than a traditional bullet).
- Determine the spacing and indentations for bulleted lists.
- Decide on an appropriate size and format for all Excel charts – how much of a slide will charts occupy, and how will you title/label your charts.

- Determine the chart formatting prior to leaving lab. It is not necessary to have all your charts in finished format prior to leaving lab, but it is necessary to determine how you will format your charts so you can work on the presentation over the course of the next week.
- Create a minimum of two slides prior to leaving lab: A Title slide, an Introduction slide that lists the hypotheses or research questions. The file you create with these three slides will become the team's master PowerPoint file. Each team member will eventually add slides relevant to their hypothesis to the master file.

Task 5: add slides that address your specific hypothesis or research question to the team's PowerPoint presentation

Each individual needs to create set of slides for their hypothesis or research question that include the following information:

- A statement of the hypothesis or research question – this should be the first thing presented in each individual's set of slides.
- Your Excel charts or statistics and the outline of what the charts or statistics show regarding your hypothesis or research question.

Each individual is responsible for insuring their slides follow the format agreed upon (Task 4).

Task 6: add your slides to the team's master PowerPoint file

I want one PowerPoint presentation from each team, not three or four different presentations. Please indicate on each slide which member of the team did the work for that slide by including initials in the bottom right corner of each slide.
A conclusion regarding your hypothesis or research question. Base your conclusion on the combination of your Excel work, the degree of confidence you have in our field data, and what the literature you cited said.
A reference list that is formatted according to the Geography/Geoscience Reference List and Citation Guide.

GRADING RUBRIC

	Excellent (9-10 points)	Good (7-8 points)	Satisfactory (5-6 points)	Unsatisfactory (3-4 points)	Failing (0 points)
Individual Question/Hypo-thesis (4 pts)	Hypothesis/research question is stated clearly and concisely;	Hypothesis/research question is stated;	Hypothesis/research question not completely clear; too terse or wordy;	Hypothesis/research question is unclear;	Hypothesis/research question is not stated;
	Hypothesis/question readily testable/ answerable with our field data.	Hypothesis/question testable/answerable with our field data.	Some difficulty testing/ answering hypothesis/ question with our field data.	Major difficulties testing/answering hypothesis/question with our field data.	Hypothesis/ question inappropriate for our field data.
Individual Excel charts/graphs and statistics (12 points)	Excel charts/ statistics totally appropriate for hypothesis tested;	Excel charts/ statistics appropriate for hypothesis tested;	Excel charts/statistics not totally appropriate; better ways exist to analyze data;	Excel charts/ statistics are inappropriate for hypothesis tested;	Excel work missing;
	Charts/tables clearly and appropriately labeled;	Charts/tables are labeled;	Charts/tables missing some labeling;	Charts not labeled or incorrectly labeled;	
	Charts well-designed and look good (easy to under-stand; effective use of color; appropriate sizing of chart elements, etc.).	Charts are reasonably well designed and look good.	Charts are not very well designed and are only marginally attractive.	Charts are poorly designed and are unattractive.	
Outline associated with Individual Excel work (12 points)	Accurate, clear, concise description of Excel work; statistics interpreted correctly; all important points are discussed	Description of Excel work accurate; minor mistakes interpreting data or omissions don't detract from conclusion	Inaccuracies in description of Excel work, some significant mistakes interpreting data; misses important points	Description of Excel work is inaccurate; work is incorrectly interpreted; major points missing	Excel work is not described or interpreted
	Decision regarding hypothesis is clearly stated and is supported by Excel work	Decision regarding hypothesis is stated and is supported by Excel work	Hypothesis decision not stated clearly and/or not completely supported by statistics	Decision not stated or stated but statement not supported by statistics	No decision
	No grammatical or spelling errors; content completely and easily comprehended	Minor grammatical and spelling errors; content comprehensible	Significant grammatical or spelling errors; observer needs to work at comprehending content	Numerous grammatical and spelling errors; content difficult to understand	Major grammatical errors; content incomprehensible
Visual consistency of presentation (Design elements: color, font face and size, text spacing, position and organization of elements) (12 points) (team work)	Slide design is attractive and invites observers to attend to slide content; completely legible from the back of a room;	Slide design is mostly attractive; minor issues don't distract observers from slide content; slides are mostly legible from the back of a room;	Issues with slide design (e.g. color coordination, organization) distracts observers from slide content; some difficulty reading from the back of a room;	Slides poorly designed; poor color or other layout choices distract from information on slides; difficult to read from the back of a room;	Lousy slide design; no coordination to slide design; nearly impossible to read from back of a room;
	Overall design of slides) is consistently applied across all slides;	Minor inconsistencies in application of design to all slides; slightly detracts from overall visual impact;	Moderate inconsistencies in application of design to slides; detracts from overall visual impact	Major inconsistencies in application of design to all slides	No consistency in formatting
	All Excel charts and tables consistently formatted, labeled, sized and positioned	Minor inconsistencies in Excel chart/table formatting, labeling and sizing; doesn't distract much from overall presentation	Moderate inconsistencies in Excel chart/table formatting, labeling and sizing; distracts from overall presentation	Major inconsistencies in Excel chart/table formatting, labeling and sizing; very distracting	No consistency in any of the Excel charts/tables