ESR 200 Brenneis

**Environmental Research Project**

**Goal:** Students will work in small groups to develop a research question about environmental conditions and/or the biological communities found on the Rock Creek campus. Students will select/develop appropriate methods for addressing this question, collect and analyze data, draw conclusions and communicate findings through a group presentation and an individual lab report.

**Logistics:** Plan for an observational study that can be completed in a two-week period. Ask an interesting question, use appropriate methods and analyze your data carefully – but make sure to keep it reasonable. This should be roughly equivalent to one of our weekly labs, but YOU are in charge of designing it.

- **Week 8.** Students develop a research question and propose a hypothesis for their **observational study** and locate two relevant peer reviewed papers (Introduction)
- **Lab 9.** Students design the sampling methods and material list that will be used, students may begin to collect data (Methods)
- **Lab 10.** Students collect data and begin data analysis. Each student must create their own data tables and graphs. (Results)
- **Lab 11.** Groups will present their research via one group presentations. Individual student lab reports are due.

**Groups:** Please form a group of 3-4 students based on common interests.

**Title:** A good title describes the research question or major findings but is not overly long of technical.

**Introduction:** Begin with an overview of the scientific background for your particular research question. Find and cite at least two peer-reviewed studies that address this general topic. Explain why this is an interesting and relevant study. End your introduction with a clearly stated research question and hypothesis.

> **Research Question:** Ask a question that can be answered by collecting data on the Rock Creek campus (or nearby location), and/or pairing those new data with existing information (i.e. earlier wildlife photos, amphibian monitoring data, species lists, etc.). This is not an experiment, but rather an observational study.
>
> **Hypothesis:** Develop a testable hypothesis, which is your informed predication about the answer to your research question. State it clearly after the research question.

**Methods:** Select methods that we have utilized during ESR 200 labs. You may modify these slightly, but in general, consider the following approaches:

- Mapping: Using geographic information to describe habitats and connectivity
- Microclimate data collection along transects
- Vegetation sampling along in quadrats along transects
- Wildlife cameras: Using wildlife photos to detect patterns in resource use an behavior (previous photos are available)
- Water quality: Using LaMotte test kits and/or YSI-556 meter to test water quality.
- Soil: Using LaMotte test kits to test soil nitrogen, phosphorus, potassium and pH
- Diversity: Identifying plant and/or animal species and describing diversity.

**Results:** Collect quantitative data (numbers) that can be described using some of the techniques used in ESR 200 labs. You may also collect quantitative data (species names, observations). Your results should include a written description of your data as well (a few paragraphs of text).

Your analysis of the data should and/or could include:

- Data tables with numerical data (**required)**
- Calculate descriptive statistics **required** (for example, calculate mean and standard deviation for $n > 3$).
- Graphs: At least one of the following is **required**: Bar graphs showing mean and standard deviation, line graphs or pie chart.
- Other figures: Maps, drawings or photographs (optional)
- Diversity measurements: Species composition, richness, abundance, and calculate Shannon Index. (Optional)

**Discussion:** Interpret your results and draw conclusions.

- Based on the evidence presented in your results section, what conclusion can you draw?
- Was your hypothesis supported by the data?
- What assumptions have you made about your data?
- How might you revise this research project if you were to do it again?
- What further questions do you have?

| Component | **4: Excellent** | **3: Good** | **2: Fair** | **1: Poor** |
|---|---|---|---|---|
| Format | Times New Roman 12 pt font. Double-spaced. 1" margins. Page numbers inserted. Uses IMRD format effectively. Includes descriptive title, section headings and references section. References cited in correct CSE-style, both in text and as full citations. | Uses IMRD format effectively but has some formatting errors. | Uses IMRD format. Some errors. | Does not use IMRD format. Many formatting errors. |
| Writing quality | Each section and each paragraph is well organized. Paragraphs begin with a topic sentences that is followed by supporting details.<br>Contains no grammar or spelling errors.<br>Paper flows well. | Uses paragraph structure effectively. May have some errors or flow issues. | Uses paragraph structure. Does not flow well or contains many errors. | Very hard to follow due to lack of structure and/or grammar and/or spelling errors. |
| Introduction | Background on the topic is provided. Two relevant peer-reviewed articles are cited in text. General description of the study site. Research question is clearly stated. Testable hypothesis is proposed. | Background is provided. Research question and hypothesis stated. | Background and/or research question and/or hypothesis is incomplete. | Background and/or research question and/or hypothesis is missing. |
| Methods | Methods are appropriate for research question. Paragraphs are written in first person, past tense. Sampling methods and materials described clearly. Would allow others to replicate this study. | Methods are clear and appropriate but missing detail. | Methods are appropriate but are not clearly described. | Methods are inappropriate. |
| Results<br>x 2<br><br>*See QL rubric | Results are clearly summarized in paragraph form, with references to tables and figures. Data tables contain raw and accurately calculated summary data. Tables are well-organized and have descriptive captions above them. Graphs are accurate, readable, clearly labeled and have descriptive captions below them. Figures are appropriate for data collected. | Results are summarized correctly. Tables, calculations and graphs are accurate and appropriate. | Results are not summarized correctly and/or some errors in calculations, tables or graphs. | Results are inaccurate or inappropriate. |
| Discussion<br>x 2 | Results are interpreted in a clear and logical way. Clearly states whether your data supports or refutes your hypothesis. Conclusions are thoughtful and based on evidence. Clearly states assumptions and possible error in study. Discusses importance of findings. Poses thoughtful future research questions. | Addresses hypothesis. Conclusions based on evidence. Discusses possible errors and future research. Describes assumptions. | Does not addresses hypothesis or assumptions. +effectively. Fails to discuss possible errors and future research. | Fails to draw conclusions based on evidence. |

**Score:** _____/32 points

# QUANTITATIVE LITERACY VALUE RUBRIC

**Definition**

Quantitative Literacy (QL) – also known as Numeracy or Quantitative Reasoning (QR) – is a "habit of mind," competency, and comfort in working with numerical data. Individuals with strong QL skills possess the ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

*Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (cell one) level performance.*

*for more information, please contact value@aacu.org*

| | Capstone | Milestones | | |
|---|---|---|---|---|
| | 4 | 3 | 2 | 1 |
| **Interpretation**<br>*Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)* | Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. *For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.* | Provides accurate explanations of information presented in mathematical forms. *For instance, accurately explains the trend data shown in a graph.* | Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. *For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.* | Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. *For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.* |
| **Representation**<br>*Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)* | Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding. | Competently converts relevant information into an appropriate and desired mathematical portrayal. | Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate. | Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate. |
| **Calculation** | Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (clearly, concisely, etc.) | Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. | Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem. | Calculations are attempted but are both unsuccessful and are not comprehensive. |
| **Application / Analysis**<br>*Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis* | Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work. | Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work. | Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work. | Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work. |
| **Assumptions**<br>*Ability to make and evaluate important assumptions in estimation, modeling, and data analysis* | Explicitly describes assumptions and provides compelling rationale for why each assumption is appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions. | Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate. | Explicitly describes assumptions. | Attempts to describe assumptions. |
| **Communication**<br>*Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)* | Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality. | Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven. | Uses quantitative information, but does not effectively connect it to the argument or purpose of the work. | Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.) |