GROUP PROJECTS

GOAL: To use your ecological knowledge to collectively generate and test a specific ecological hypothesis, analyze your results, and present your investigation to the class.

OBJECTIVES:

1 – Prepare a project plan. This can be broken down into three steps:
a. Decide on your question(s), experimental system, hypotheses, and experimental design. A statement of these, along with a schematic of your treatments, response variables, and expected results is due the day before lab the sixth week of class (5/4 or 5/6). See the Independent Project Worksheet.
b. Prepare a proposal that describes the context, motivation, questions/hypotheses, and procedures for your project (with literature cited). The proposal is due the day before lab the seventh week of class (5/11 or 5/13). We will give you feedback on this proposal the following week.
2 – Execute the plan.
Carry out your experiment over the course of 2-3 weeks.
3 – Prepare results, tables & figures, and works cited.
Submit summarized/analyzed data, tables and figures, as well as a complete list of literature.
4 – Scientific Presentation.
Present your scientific report orally as a PowerPoint presentation to the class (including an introduction, methods, results and discussion with table(s) & figure(s), and literature cited). This will happen in two stages: a practice talk the last week of classes, and a final presentation during our scheduled finals time (6/8 or 6/10, 1-5 pm)

We expect that each group member will contribute actively to <u>every</u> component of the research project, from coming up with the hypothesis, producing the research plan, collecting and analyzing the data, and presenting the research. You need to work together, not against each other, to do a good job. At the end of the quarter, you will complete peer evaluations, and we may modify individual grades based on how other group members evaluate your effort. <u>By being actively involved and open to others' ideas, you will make it easy for the others in your group to give you a glowing evaluation.</u>

GENERATING YOUR HYPOTHESIS:

- Think about what areas of ecology interest you. Reflect on and discuss ecological concepts, as well as situations or habitats in which you might be able to test hypotheses that relate to those concepts - then look for such situations or habitats. Your hypotheses may fall under the realm of physiological ecology, population ecology, community ecology, or ecosystem ecology, or they may span more than one of those areas.
- Think about patterns in space and/or time (distributions of organisms, differences in rates of processes, etc.). A good place to start can be testing to see if patterns you think you see are statistically significant.
- Then think about mechanisms – what might be the physical, chemical, and biological reasons for the patterns that you see. Understanding mechanisms helps make ecological science more predictive (we can say better how things might change if conditions change). Testing mechanisms often takes doing explicit experiments. This may or may not fall within the realm of possibility for this class. But at the minimum, you should think about what the potential mechanisms might be and what data you might be able to collect to help support or rule out some of those possibilities.
- We will take a field trip to Larrabee Park the fifth week of class (4/27 or 4/29) to give you an opportunity to come up with a research topic.
- We will provide computers for the second half of lab that week to help you with background research.
- *Be sure to think in terms of <u>feasible</u> research*. Thus, anything that will require long-term experiments or the use of difficult techniques or complex instrumentation should be viewed as outside of the realm of possibility.

Check out the handout that lists the equipment that we have available for an idea of what might be feasible. Feel free to ask us for site suggestions.

- When you have settled on a topic, fill out the Independent Project Worksheet, and have it checked by your instructor or TA.
- Visit your proposed field site. In developing a project, take time to explore, observe, and think! If you choose to work somewhere other than Larrabee Park, then you will need to find time outside of class when, as a group, you can go on a field outing to scout out potential field sites and make observations. Try to notice *patterns* that could lead to testable hypotheses. Make preliminary observations to see if your original ideas still make sense. What might be causing those patterns? What kind of data could be taken to help narrow the possible explanations for the patterns? How would you collect that data?
  - Don't wait til next week to do this! Getting a quick start on this effort will greatly increase the likelihood that you will develop a focused, testable hypothesis. And starting immediately will also help prevent last minute frustration and panic during the data collection component of the project.
- Develop a research schematic (DUE 1 pm THE DAY BEFORE LAB in the sixth week of class). When you have finalized your experimental questions and designs, sketch out what this looks like. This assignment must include the following:
  - A statement of your question, system, and hypotheses.
  - A schematic of your experimental design that includes
    - Treatment (independent) variables (those that you think are causing the differences you see).
    - Response variables (those that are the focus of the pattern you are testing).
  - A sketch of how you think your data will look in graphical form, generally either a bar graph or a regression (scatterplot). This is the first step in figuring out what statistics you'll need to do. For all figures, you need to include axis labels, treatments, units, etc. – basically everything so that your figure is interpretable to someone not in your group.

PROJECT PROPOSAL (DUE 1 PM THE DAY BEFORE LAB, WEEK 7):

- Think of your Project Proposal as the Introduction, Methods, and Works Cited sections of a scientific paper.
- See the "Lab Report Guidelines" handout for guidelines on what should be included in the introduction and methods sections, and how to format literature citations.
  - For your introduction, be sure to use citations from the literature (you need at least **five**) to develop the broad context into which your research fits. These references should cover the same basic categories that we developed in the literature assignment for the stream lab:
    - Context and relevance of the study;
    - Background – other research that has addressed similar questions, including at least one reference from each of the various "threads" of scientific ideas that you are tying together in the intro;
    - Work done in the explicit local systems that you plan on studying.
  - In the intro, you should also describe the specific observations you made, your primary questions and the hypotheses you developed.
  - In the methods section, outline the steps you will take to test your hypotheses, including all of the following components: where the study sites are, what comparisons you will make, any experimental design considerations (e.g., controls), what measurements you will do, and how you plan to analyze the results. Be explicit about what your primary independent and response variables are. Be clear about how what you measure and what statistics you use to analyze those measurements will address each hypothesis that you present in the introduction.
  - In contrast to a paper, your proposal needs to describe the methods in future tense (e.g., "We will measure this. We plan to calculate that." Etcetera.)

- You will need to then specify a timeline for your investigation, from initiation to the presentation. These sections together should total approximately four double-spaced pages (2 pp for intro, 2 pp for methods). In addition, turn in a list of equipment that you will need for your project (as an appendix). Literature cited sections and the equipment list don't count toward the 4 pages.

- *Your group will collectively turn in a single written proposal.* This is due in hardcopy form at 1 pm the day before lab in week 7. If you have developed a project prior to the due date, feel free to turn in your written assignment early – it'll give you that much more opportunity to refine the project with our input.
- Prior to beginning your project, we will give you feedback on your proposed hypothesis and methods, check out your group's equipment, and give you any necessary training. Groups that have completed their Proposal earlier can get feedback and check out equipment earlier, and will thus have more time in which they can gather data – a benefit that will increase the likelihood of a successful project.

DATA COLLECTION:

See the syllabus for lab dates dedicated to data collection (generally weeks 6, 7, and 8). If your project will require fieldwork outside of the scheduled lab time (e.g., low tides), be sure your group can commit to that.

DATA ANALYSIS:

- During week 9, laptops will be available for data analysis. Prior to this lab, your group should have discussed the best way to analyze the data, and how you might interpret the results.
  - We will be available for consultation to help you with this process, but we can be most helpful if you have given substantial thought to analysis in advance. We're happy to talk with you about stats any time throughout project development.
- At the end of the Analysis lab (see syllabus for date), you will submit: a spreadsheet with your raw data, summary statistics (means, standard deviations, statistical tests), and a draft of all figures & tables.

RESEARCH PRESENTATION:

Each group will develop a PowerPoint research presentation for the class.

- In the last week of lab, each group will give a practice talk on their project. They will receive feedback from the class, TA and instructor that they will then incorporate into their final presentation.
- During finals week, each group will give their final talk to the class.
- For both the practice talk and the final talk, you will need to turn in an electronic version of your presentation (pdf versions are preferable) one day prior to your presentation date.
- Think of the organization of this presentation as being a lot like that of a research paper:
  1. Big picture context
  2. Motivation for specific hypothesis
  3. Methods
  4. Results and interpretation (figures/tables and what those mean)
  5. Discussion/summary (relate to context & motivation)
  6. Present any alternate interpretations of results or ways to improve your methods
  7. List of references used
  - Unlike a research paper, however, in a talk, it is often useful to break up your project into discrete pieces (each including methods, results, and interpretation) that develop your scientific story gradually. Using the stream lab as an example, you might first give the methods, results and interpretation of the pattern aspect of your study (i.e., differences among streams in the biotic index). The second part of the results/discussion might then look at the mechanism aspect of your study (i.e., what factors might cause the patterns observed). The summary should then tie the different pieces together with 2-3 main "take home" messages. That is, if your audience forgets everything else about your talk, what key scientific insights do you want them to remember? That's what you put in the summary.

- In developing your presentation, keep in mind that your audience will have had little prior knowledge about what you did or why you did it. Make your points clearly.
- Keep your figures/tables from being too complex (i.e. a bar graph with lots of different bars and patterns is hard to interpret, as is a table with too many labels and numbers).
- Each person in the group needs to be involved in giving the research presentation – try to divide the presentation time equally. *Plan to present for 25 minutes, with an additional 5-10 minutes for question/comments.*
- Additional guidelines/suggestions for presenting are located on the course website.

List of equipment available for Group Projects

Plankton nets
D nets
Insect nets (classic butterfly type)
Hydrolabs—measure temp., pH, salinity/conductivity, DO etc. fresh and saltwater
Tri sense meters—measure air temp., humidity, and airspeed
Skymate " " " "
Soil temp. gauges
LI-Cor photo meter
Underwater light meter (electronic)
Assorted glass thermometers
Scales
Stopwatches
Ovens
Combustion furnace
Refrigerator/Freezer
Incubators
Light source with timers (growth experiments?)
Coolers
Ice maker
Binoculars
Hand lenses
Compound and dissecting microscopes
Assorted meter tapes
DBH tapes—for tree diameter
Compass
Rulers
Tally counters
PVC quadrats
Soil corers
Shovels
Increment borers—for tree coring
Filters
Sorting screens/sieves
Rubber boots and waders
Assorted glassware
Aquariums—freshwater/saltwater systems (including the water)
Paper and plastic bags
Soil, fertilizers, and pots
Field guides and other taxonomic keys

If you do not see it on the list, let us know, we will try and find it for you.
Also, check the equipment list at SMATE—www.smate.wwu.edu under resources

_____ Score_____/40

Group Project Proposal Rubric

Introduction (15 pts)

_____ Introduces overall context for experiment
_____ Enough background info. to understand relevance
(i.e. should explain why the research is important)
_____ States the questions to be addressed by research
_____ Briefly describes the study system
_____ States the hypothesis to be tested
_____ Relevant literature citations integrated into text

Materials & Methods (10 pts)

_____ Provides an overall description of what will be done
_____ Describes the study organisms and/or sites
_____ Describes all measurements to be conducted including
- _____ parameters measured
- _____ protocol followed
- _____ equipment used
- _____ # replicates

_____ Describes data analysis procedures to be used
- _____ data averaged
- _____ comparisons & statistical tests described

_____ Experiment can be duplicated based on described methods
_____ Appropriate level of detail

Literature (5 pts)

_____ Correct format of in text citations
_____ All references (minimum of 5) relevant to research
_____ Literature cited section formatted properly

Writing Style & Mechanics (whole document) (5 pts)

_____ Clearly & concisely written
_____ Free of spelling & grammatical errors
_____ Paragraphs have topic sentences
_____ Smooth transitions between paragraphs
_____ Logical & orderly progression of information throughout
_____ Avoids over use of passive voice

General (5 pts)

_____ Project is challenging, but feasible
_____ Evidence of critical thinking (e.g. IDing potential pitfalls)

Group:

Group Project and Presentation Evaluation

		Points
Title • informative • group members' names, address		/2
Introduction • project well motivated • logical flow from 'big picture' relevance to specific hypothesis (funnel effect) • use of supporting literature		/10
Methods • description of study system • experiment design • specific methods • statistical analyses described		/6
Results • tables and figures • description of results: focus on biology, not stats • statistics support the results statements • analyses thorough		/10
Discussion • integration of results • conclusions regarding original hypotheses • use of literature to interpret results • caveats • future directions		/8
Layout and Design • number of slides • amount of text on slides • color scheme • font size • appropriate use of animation		/6
Delivery • length of presentation • good projection • appropriate pace • minimal reliance on notes • speaking to audience (not reading slides) • avoiding nervous twitches • grammar • appropriate use of humor • response to questions		/8
Project scope and execution • Choice of question and system • Novelty • Initiative • Effort involved • Appropriateness of methods • Depth of thinking (level of understanding & integration) • Critical analysis (differentiating among hypotheses) • Synthesis with literature • Level of individual participation in project		/50
	Total	/100

Equipment Request Form

Use this form to request equipment or consumables (chemicals, paper towels, gloves, etc.) for class projects, group projects, or independent research. Please submit this form at least one week in advance of needing the items. If something is likely to need ordering then allow a two week lead time. If it can be purchased locally then the one week lead time is acceptable.

Name: _____ Course Number: 326

Instructor: _____ Date Needed: _____

Email Address: _____

Is building space needed: ☐ Yes ☐ No

If so, what are your needs?

☐ Aquaria table space ☐ Cold Room ☐ Greenhouse

☐ Growth Room ☐ Temperature controlled chamber(s) #_____

Quantity	Item Required	Available (stockroom use only)

Comments:

Group Project Self- and Peer-Evaluation

We would like your **honest** assessment of the contribution each of your group members in conducting your final project. **Your evaluation will remain confidential and will only be viewed by the instructor and TA.** Please fill out the form completely.

1. Your name: _____

2. Group members' names: _____

3. Scope of project: _____

4. Rank <u>each group member's</u> contribution to the group project:

   Use a scale from 0 – 100 to reflect **the percentage of the total effort contributed by each group member**, including yourself. For example, if your group had four members and all four contributed equally to an item on the list below, each person would get a score of 25 (=25%). *Please be honest in your evaluation, you risk nothing in providing an accurate assessment!*

Group Members:	Yourself			
Developing the topic:	_____	_____	_____	_____
Planning the methods:	_____	_____	_____	_____
Writing the proposal:	_____	_____	_____	_____
Gathering the data:	_____	_____	_____	_____
Performing analyses:	_____	_____	_____	_____
Preparing the presentation:	_____	_____	_____	_____

Additional Comments (optional):