Student Assignment Suggestions and Instructor Rubrics
Permanent Forest Plot Project
Ecological Research as Education Network (EREN)
Primary Authors: Erin Lindquist, Meredith College and Jerald Dosch, Macalester College

I. Example Lab Practical, Quiz, or Assignment Questions:

A. Forest species composition patterns across plots and/or sites (data analysis)

Use the total combined data of multiple plots within one site (if available) or plots from different sites. Use the class' selected questions from the given list (http://erenweb.org/project/carbon-storage-project/permanent-plot-protocol/potential-pfpp-research-questions/), or those generated by your students to direct your data analysis among different plots or sites.

1. Students may contrast any of the following across plots/sites: basal area, biomass, stem densities, size-class frequencies, species richness, or Shannon's or Simpson's Diversity/Dominance Index.

2. Students may explore linear relationships to determine how much of the variation in the biological variables (species richness, stem densities, basal area, biomass, etc.) is explained by variation in any of the environmental variables (topography, climate, or soil variables).

B. Carbon storage analysis and questions

1. How do you use the tree's diameter-at-breast-height (dbh) measurement in the field to determine the amount of carbon stored in that tree?

2. [If students don't calculate biomass and carbon…] Assume that one of the trees in your campus' parking lot accumulated 100 kg of carbon in one year. Considering that the average American emits around 20 tons (1 short ton= 907.185 kg) of carbon a year, calculate the **percentage** of your emitted carbon that this **one** tree fixed or sequestered (captured).

3a. Using Jenkins et al. (2003) equations, how much carbon is stored in your 20 x 20 m permanent plot?
3b: Given the permanent plot you set up is 20 x 20 m, how much carbon would be contained approximately in one hectare (ha; 100 x 100 m or 10000 m^2)?

4a. [If you can re-measure trees at least one year later] Given that the average American emits around 20 tons (1 short ton= 907.185 kg) of carbon a year, calculate the **percentage** of your emitted carbon that the 20 x 20 m plot (or 1 ha) sequestered.
4b. How much forest (hectares) would it take to sequester all of your annual carbon emissions?
4c. There is a net 6.5 Petagrams of carbon emitted into the atmosphere annually from the burning of fossil fuels. How much forest (in hectares) would it take to sequester all of this carbon?
4d. [If your campus has done a greenhouse gas emission inventory. See Clean Air Cool Planet Calculator for directions and campus examples at http://www.cleanair-coolplanet.org/toolkit/inv-home.php].

Example question: The Environmental Resources class at Meredith College did a greenhouse gas inventory for the entire campus and all its students, faculty, and staff in Fall 2009. They found that Meredith and its community of faculty, students, and staff emit 16,003,000 kg C yr^{-1}. How much forest (in hectares) would we need to offset (sequester) this much carbon annually?

II. Oral Presentations

A. Student Assignment: Students can be asked to make a scientific presentation based on their findings. To encourage teamwork, students are encouraged to make presentations in groups (2-4 students) and evaluate individual student efforts and output in a group evaluation form (see Group Work Evaluation form). To help alleviate group work conflicts among students, students are encouraged to set up a working contract amongst themselves and ground rules that they will follow if there is a grievance (see Group Contract and Ground Rules). Presentations should follow standard scientific format and style, and be 10-12 minutes in length leaving 3-5 minutes for questions (15 min total). In addition to the instructor, individual students can evaluate the other groups' presentations on such things as slide format and organization, presentation style and timing, scientific content, and presentation and interpretation of results.

B. Instructor Grading Rubric is attached and can be used for either oral presentations or scientific papers.

III. Written Scientific Paper

A. Student Assignment: Students can be asked to write a scientific paper based on their findings. To encourage teamwork, students are encouraged to write the paper in groups (2-4 students) and evaluate individual student efforts and output in a group evaluation form (see Group Work Evaluation form). To help alleviate group work conflicts among students, students are encouraged to set up a working contract for the group and ground rules that they will follow if there is a grievance (see Group Contract and Ground Rules). Students should be given advice, training, and supplementary resources in scientific writing prior to the assignment. If this is one of the first scientific papers the students write in any of their classes or if time is limited, then instructors can choose for the students to write only specified sections of a scientific paper (e.g. methods and results) or write all the sections but not conduct a literature review.

B. Peer Review: Students gain significant practice in scientific writing when reviewing and critiquing peer writing. Students can review a paper individually or in a group.

Suggested Peer Review Instructions:

Your assignment is to be a good colleague. You will review a paper from one of your peer groups, and offer constructive criticism. Using the form below or on a separate sheet of paper, try to comment on the content, style, format, and logic **of each section** of the paper using the scientific paper guidelines provided. In addition, answer the questions below which address the paper as a whole. Don't worry too much about spelling and grammar– although you are welcome to correct these. Focus on the big picture – are the major components of a scientific paper present such as: Is there sufficient background material?; Are the hypotheses well stated?; Are the methods specific enough that you could redo the experiment?; Are the results well stated and described?; Do the tables and figures show the results in an effective way and are they formatted properly?; Does the discussion not complain too much about all that went wrong, yet gives some interpretation of the results?. It is easy to be overly critical and even mean. Try not to do this. It is much more challenging to identify the good parts. "This sentence sucks" is not nice, nor is it helpful. The sentence may indeed suck, but offer a solution: "This sentence is ambiguous. Can you split it into two sentences and clarify your point?" is helpful and honest.

<u>Additional Peer Review Questions:</u>

- What is missing from any of the sections that you would include?
- What would you expand upon in any of the sections?
- What did you learn from this paper?
- Consider the style of the scientific writing –Does the style change throughout or is it consistent? Why do you like or dislike the style.
- What letter grade would you give this paper? Any other comments?

C. Instructor Grading Rubric is attached and can be used for either oral presentations or scientific papers. For an alternative, thorough method of assessing student scientific writing using Prime Trait Assessment please see Simmons (2009).

References:

Jenkins, J.C., D.C. Chojnacky, L.S. Heath, and R.A. Birdsey. 2003. National-Scale biomass estimators for United States tree species. *Forest Science* 49(1):12-35.

Simmons, J.A. February 2009, posting date. Decomposition and Soil CO2 Emission. *Teaching Issues and Experiments in Ecology*, Vol. 6: Experiment #2 [online]. http://tiee.esa.org/vol/v6/experiment/soil_respiration/abstract.html