**ENVS 163L – Plant Disease Ecology Laboratory**

**Spring 2015**

**Friday 12:30-3:30 in 229 Nat Sci 2**

Professor: Gregory S. Gilbert, 439 ISB, 459-5002, ggilbert@ucsc.edu

TA: Juniper Harrower, 413 Nat Sci 2, jharrower@ucsc.edu

Materials required: Bound lab notebook, preferably quadrille ruled

Suggested materials: Hand lens, camera

The purpose of this lab is to help you learn to conduct research in plant disease ecology. We will be working on the UCSC Campus Natural Reserve on the general issue of how important butt- and heart-rot diseases are in the forest, and their potential contribution to forest dynamics. We will be building on research conducted by a class working in tropical rainforest; we will generate comparable data, using cutting-edge sonic tomography technology, for a temperate-tropical comparison. Although the specific techniques and protocols have been developed, and the overarching questions outlined, the form of specific questions will be developed as part of the class. Importantly, the answers are not known. This is primary research; you are the first group of researchers to have access to this kind of technology and to be able to ask these questions in a temperate forest.

We will work overall as a group, but with sub-groups designated to focus on particular aspects of the work. We will divid into groups responsible for different aspects of literature review and data analysis. Each group will focus on one real research question over the course of the entire quarter. The answer is not known. You will need to find, read, and synthesize the literature relevant to your question, carefully refine the question to be addressed, and work both independently and as part of the group to define and carry out the studies necessary to answer your question.

Fully engaged participation in the project throughout the quarter will lead to co-author on a resulting manuscript. Less than full engagement will lead to acknowledgement for helping with the research in the resulting manuscript. Determination of “full engagement” will be based on timeliness, thoroughness, and quality of all required work for the class as well as positive contributions as part of the group in field and lab work. Final determination of authorship is at the discretion of the professor and TA.

Overarching questions (others possible):

1. What proportion of trees on the UCSC Forest Ecology Research Plot having internal decay (heart- and butt-rot)?
2. What is the relationship between tree size (or age) and decay?
3. How do species vary in susceptibility to decay?
4. Is the probability of decay associated with the abundance of the tree species?
5. What fungi are associated with heart- and butt-rot?

The techniques we will be using are new – a Picus 3 Sonic Tomograph – but the question of the importance of heart- and butt-rot in California forests is not new. You will need to become familiar with what is already known and available in the literature about decay, and work with your group to develop a comprehensive review of the literature. You will need to learn the specific techniques and methodologies necessary to carry out the research (we will provide that training). You will need to organize the data, and conduct analyses on it.

In addition to the tomography work, each student is required to generate a clean culture of a fungus isolated from a diseased tree, and to prepare detailed labelled drawings (macroscopic to microscopic) of the fungus.

Each student is required to keep an independent laboratory notebook of all aspects of this research project.

As a class we will prepare a research poster to present at the ENVS undergraduate research symposium in early June.

Each student is required to:

 5 pts. Written quiz on Lab General Methods Handout and Picus 3 manual (10 Apr).

15 pts. Turn in an annotated bibliography of at least 3 peer-reviewed papers related to the research topic. This includes the full citation and abstract, plus an original paragraph that discusses what aspects the paper would be useful for a lab project. One of those papers must be Gilbert et al. 2010. Beyond the Tropics. *J. Vegetation Science*  (Gilbert et al. is Due 10 Apr; others due 17 Apr. Post to eCommons discussion forum before lab. Paste in text, rather than as attachment. Attach pdf of papers you read (not Gilbert et al.)

20 pts. Keep a detailed, dated, research notebook (clear, consistent, complete entries for all aspects of work in this lab) You can paste in printed material or photos. The lab notebook is for a future reviewer to be able to follow exactly what was done in development of this research (Reviewed 24 April and 29 May)

10 pts. Prepare a semi-permanent slide and clearly labeled drawings of fungus showing reproductive structures, including spores & spore-producing structure (no later than 8 May)

10 pts. Pure culture of a fungus isolated from diseased tree tissue or fungal reproductive structure (Due 29 May)

20 pts. Graphs, analysis, and appropriate accompanying text for group portion of overall project. Handed in as a group, together with group-based evaluation of the contributions of each group member. The maximum score out of 20 will be set for the group based on quality of work; group assessment of individual contributions can reduce points from that level for slackers (Due 29 May).

10 pts. Final group poster for ENVS research symposium (1 June?): everyone gets the same points here)

10 pts. Enthusiastic, positive, responsible, consistent participation in all aspects of field, lab, writing, editing, analysis, and other contributions to the research endeavor.

**Written quiz** (5 pts.)

Read the Lab General Methods Handout and PiCUS 3 manual and PiCUS Q72 manual (sections 1,2,3,5). Be prepared for a written quiz at the start of lab 10 Apr. Everything in the Lab General Methods handout is fair game. For the Picus 3, focus on the overall procedure and how the tomography actually works.

**Annotated bibliography** (15 points)

This lab requires that you find, read, and understand scientific literature related to potential research systems. For three relevant papers of your choosing, submit an annotated bibliography that includes (1) the full citation of the paper, (2) the abstract of the paper (as written by the authors), and (3) a paragraph or so of your own original writing that highlights and discusses what from that paper is useful to the lab project. Each group will identify the literature to be reviewed, and then divide the literature for detailed reviews among group members, so that each member reviews different papers.. These descriptions will be made available to the full class, and will be used to inform the research proposal and final report.

**Lab Notebook Requirements** (20 points)

Keep a dedicated lab notebook with detailed notes for all that you do in this lab.

1. Should be a bound notebook – I like the marbled quadrille-rules ones, but you can choose what style works for you.
2. Date every single page.
3. Keep track of when you do what, and how you did it.
4. Your lab notebook should be readable and interpretable by someone else five years from now. The notebook is not really for you, it is for other researchers.
5. Paste in data, graphs, and analyses that you generate outside the notebook.
6. Use the notebook as a place for thinking – keep notes about papers you read, hypotheses you come up with, outlines of possible studies, sketches of things you see, etc. You should paste in the annotated reviews you do.
7. When you complete an analysis, paste it in your journal, and write out what you think it means right away.

**Fungal slide and drawings** (10 points)

For a fungus you isolate from a diseased tree, or a fungal reproductive structure from a diseased tree, make a good-quality semi-permanent slide that show important reproductive structures (spores, the structures that produce the spores, etc.). When the fungus has macroscopic structures (like a basidioma on the tree) you must also include detailed drawings of the macroscopic structures. Make clearly labeled, identifiable drawings of what you see through the microscope, stereoscope, and just visually.

**Clean culture** (10 points)

For a fungus isolated from a decayed tree, produce a clean (single fungus) culture.

**Group analysis and writing** (20 points)

As a group, produce the graphs, analysis, and appropriate accompanying text for group portion of overall project. Hand in this material as a group, together with a group-based evaluation of the contributions of each group member. Maximum score out of 20 will be determined based on quality of submitted work. A group assessment of individual contributions will be used to adjust individual scores as necessary (to adjust for the slacker effect).

**Final group poster for ENVS research symposium** (10 points)

As a group, you will collectively design and produce a poster on the project to present at the Environmental Studies undergraduate research symposium. Everyone is expected to participate in the design, analysis, and interpretation. Everyone in the group will get the same number of points for this component - however, the separate participation grade (10 points) is based on active, constructive, timely participation in all aspects of the group project.

**Participation** (10 points) Enthusiastic, positive, responsible, consistent participation in all aspects of field, lab, writing, editing, analysis, and other contributions to the research endeavor. We will include self and sub-group evaluations of participation to contribut to overall evaluations by the instructor and TA.