

## ESP 280: Research and Analytical Methods Fall 2005

**Instructor:** Sharon M. D'Orsie, ScD., CIH, CSP-106 Bailey Hall, Phone: 780-5552  
smdorsie@usm.maine.edu

Emergencies: home is 839-2733; cell is 653-7690

**Office Hours:** Tuesday and Thursday 10:00-11:30 am 106 Bailey Hall

**Lecture:** Tuesday 1-3:40 pm in 242 JMC (first class in Bailey 213)

**Lab:** TH 1-4 PM in 242 JMC

242 availability: key card; Scheduled access

Mondays 8-3 PM (Dr. Moore has a class here 4-7 PM)

Tuesdays 8-4 PM

Thursdays 8-6 PM

Other times: probably okay, but not "reserved"

**Text:** Ford, E. David. 2000. Scientific Method for Ecological Research.  
Cambridge University Press.

**Course description:** This course is designed to introduce you to the ways environmental scientists conduct research, including such topics as conducting a literature review, forming a hypothesis, setting up an experimental design, gathering samples and analyzing those samples, writing a formal research paper, and designing a formal research presentation.

**Objectives of the course:** at the completion of the course, the learner will be able to:

- Conduct a literature review to determine the "state of the art" on an environmental research topic
- Form a testable hypothesis
- Write an environmental sampling plan
- Gather and analyze data
- Prepare a formal research paper
- Present a formal research presentation suitable for Spring "Thinking Matters"
- Learn the fundamentals of project budgeting

**Problem-based cohort learning:** Solving environmental problems, as you know, requires integration of expertise in many disciplines, including social, economic and political sciences, as well as the natural sciences. As an ESP student you may be destined for a variety of environmental careers. This course will give you some background and experience in natural and social science approaches to identifying, analyzing and solving environmental problems. Until we have some understanding of the procedures and limitations of environmental research, we cannot fully appreciate or solve the environmental problems we face. In many classes you get to sit back and listen to some designated authority give you all that s/he thinks you need to know on a particular topic—not in this class! Real-world environmental problems are messy (not cleanly spelled out by books), and we often do not know the question, let alone the answer. Even if we do understand the question, there may be no precedent to tell us what to expect or current techniques to help us find the answer.

Therefore, the instructor's role in this class is to serve as an advisor, to guide you through the problem you choose to explore.

Emphasis is on experimental design, data collection, and analysis. The class is "front end loaded" meaning that you'll work more hours the beginning of the term than the end of the term. There are no examinations, but there are other work product deadlines.

Four of the nine of you enrolled in this class have selected a tentative research area in your prior class, 203W, Environmental Communication (radon, drinking water, asthma in Maine.) <The way that we like to guide students through their environmental studies is to have each one select an environmental area of interest that provides a theme for subsequent study. However, we have many deviations from this ideal!>

During the first class period we will discuss our individual research interests, and form three research teams of three people each. It is intended at the first class period, that each team define an environmental problem to investigate that, as much as possible, reflects the combined interests of the individuals. Ideally, each team should contain one person who has completed a course in statistics, and one person who lives in Gorham.

In the first weeks, the instructor will work with each team to guide a hypotheses selection that allows the team to COLLECT DATA during the course of the class.

Whatever your research interest, you must be able to COLLECT DATA starting September 20<sup>th</sup>.

Any and all students are invited to work with me on a research topic involving health and air pollution, relative to Gorham. <If, however, any group has a desire to pursue another topic, then, I will be happy to work with you on that choice. Be aware, when you take ESP 401 W, Environmental Assessment, the faculty would like for you to continue with your chosen environmental theme (and examine the environmental impact of human decisions.)> I am prepared to have all three teams working with me on data collection relative to air pollution and human health because this area is my expertise; however, you may work with other faculty on issues of soil, water, and planning and policy.

Activities:

1. Hypotheses; time and expense logging
2. Sampling plan: collect data until Thanksgiving
  - a. Best shot (lots of Dr. D. help)
  - b. Second half of term: a look at alternative methods
3. Literature search and rationale
4. Data presentation and analysis
5. Results and Discussion
  - Work product: one poster-board presentation per team
  - Work product: one paper per team

Work Schedule: See following page

September 6: Orientation and “big picture”: Class goals, class schedule, group formation and work division, APA style, pass key and lab availability, time logging (bound notebook) and evaluation; give “alert” to have met with other faculty before class next Tuesday.

Team jobs (rotating)

- Leader: responsible for meeting all deadlines, seeing stuff gets done
- Quality Assurance/Control: responsible for following correct protocols and logging in notebook
- Keeper of Data

September 8: Meet Bailey 242. Have bound notebook (discuss 5 notebook checks.) Hypothesis development and research plan; read Chpt. 1,2,3,4,5 in preparation: During this class period, each group will:

- Develop its hypothesis with Dr. D’s assistance
- Develop its draft research plan with Dr. D’s assistance (we are going to recycle on this idea throughout the class, but, in order to collect data in a timely way, we are going to rely on the expertise of Dr. D and the other faculty to short-circuit the process.☺) If you are going to work with another faculty member’s expertise, then you must be able to meet with him/her before class on September 13<sup>th</sup> to “fill in the holes”
  - a. Develop a “to collect list, to contact list, to do list”
  - b. Agree on cost parameters to track in project notebooks
- Conceptualize final project: written presentation, report (Sample technical report)

September 13: JMC 242 Read Chapters 6, 15 and 16 for group discussion on research plan methodology; small group refinement of hypothesis and research plan; begin work with instruments and data logging

September 15: JMC 242 Instruments and Data logging

September 20: Data\* First submission of team’s hypothesis and work plan for Dr. D. critique; report of experiences of setting up instruments: problems and challenges

September 22: Data\* Read Chapters 13 and 14; have consultation with librarian; Dr. D’s expectation of literature review (4 different peer reviewed journal articles per student)

September 27: Data\* Dr. D. returns hypothesis and work plan for revision; notebook check

September 29: Data\* Students turn in first literature review paragraph for critique

October 4: Data\* Team finalizes hypothesis and work plan section of final report, submits to Dr. D.\*\*

October 8: Data\* Dr. D. returns first literature review paragraph with comments

October 13: Data\* Notebook check; Teams check on status/work on literature search and plan for integration; teams have “Thinking Matter” requirements in hand for discussion.

October 18: Data\* Team finalizes literature search and submits to Dr. D.\*\*; Re-read Chapter 6. Class discussion/class check list development on sampling and analysis

October 20: Data\* Notebook check; team planning and execution on second literature search on “why this method; what do I compare my numbers to?” (“Why this method?” will be an Appendix to the report; “what do I compare my numbers to?” will be part of discussion section.) <Two different references per student for each topic.>

October 25: Data\* Read Chapter 12; team discussion if whether modeling has applicability to your research problem. Team members who have had statistics: come prepared to talk about data treatment. \*\* a

October 27: Data\* Notebook check; discussion on quality assurance and control

November 1: Data\*; Measuring soils

November 3: Data\* Notebook check\*\*; measuring water quality

November 8: Data\* First write up of statistical approach and rationale. \*\*a, measuring vegetation

November 10: Data\* First write up of “why this method?” \*\*b; write up on “what do I compare my numbers to?”\*\*c measuring social issues

November 15: Data\* Dr. D. returns write-up of statistical approach

November 17: Data\* Dr. D. returns write-up of “why this method” and “what do I compare my numbers to”

November 22: Re-writes of statistical method, why this approach, what do I compare my numbers to:

November 29: Hand-in sections on statistical methods, why this approach, what do I compare my numbers to

December 1: Guest speakers from DEP on applied research

December 6: Workshop on deliverables; equipment competencies

December 8: Workshop on deliverables; equipment competencies

December 13: Final papers due \*\*; cost tracking due\*\*

December 15: “Thinking Matters” poster board and presentations \*\*

Peer evaluations \*\*

\*Data means collecting data these days; those who are working on Dr. D's air pollution projects, it means collecting data in the Bailey library for no less than six hours.

EVALUATION: Total of 100 possible points:

INDIVIDUAL GRADES:

- \*\*Notebook checks: 5 at two points each= 10 points
- \*\*\*abc= individual contributions to paper = 10 points
- Completed literature search paragraphs= 10 points
- Competency on one large and one small instrument (see below) = 10 points
- Peer review = 10 points

Individually can earn 50 points

GROUP GRADES

- Cost estimate = 5 points
- Instructor's judgment of students group work = 5 points
- Number and quality of data points = 15 points
- Final paper = 15 points
- Poster board presentation = 10 points

Each student will also receive an individual grade based on competencies on two of the pieces of analytical equipment we cover in class. Each student may choose the equipment they wish to be assessed on, but must include one major and one minor piece of equipment. Students will be given 3-5 unknown substances to analyze, and competency grades will be based on accuracy and precision; any error >5% from the true value will result in no credit. Students will have the option of redoing an analysis (once) to increase their grade.

This course will not use plus or minus grading.

90-100 points = A  
80-89 points = B  
70-79 points = C  
60-69 points = D  
Below 60 points = F

All grades will be posted on Blackboard, along with any announcements or supplemental material. The Blackboard web site for this class may be found at <http://www.courses.maine.edu>.

**Attendance:** Attendance in class and labs is mandatory. If a circumstance arises whereby you have to miss class, you must notify the instructor and your group members 24 hours prior to the class meeting. Any other absence will be considered unexcused, and  $\frac{1}{4}$  of a letter grade will be deducted from your overall course grade for every unexcused absence.

**Rules of Engagement for Active Learning (Group Behavior and Dynamics):**

- Working well as a group does not happen naturally – it is a learned skill. As part of learning this skill, group problems should be worked out amongst yourselves whenever possible. However, Dr. D. will be happy to advise or serve as a mediator regarding strong group conflicts that you are having difficulty resolving internally.
- Group members must treat each other with civility and respect at all times.
- Free and open communication between all participants is expected.

**Technical expertise:**

Surface water: Dr. Wright

Air quality: Dr. D'Orsie

Groundwater: Dr. Fitts

Soils and vegetation: Dr. Langley-Turnbaugh

Environmental impact: Dr. Sanford

Surveys and environmental policy: Dr. Wagner

**ADA:** Support for Students with Disabilities – Students who may need assistance due to a disability are encouraged to contact the Office of Support for Students with Disabilities, Luther Bonney 242. Phone: 780-4706, TTY: 780-4395.

*Begin with the End in Mind*

**Technical Report Table of Contents**

- I. Title
- II. Persons who did the work plus
- In partial fulfillment of the requirements of ESP 280 (G1199), Fall 2005, Dr. Sharon D'Orsie
  - III. Table of Contents
  - IV. Executive Summary
  - V. Introduction <why did you study this phenomenon>
- This section will include the 12 peer review summaries; and will state your hypothesis
  - VI. Materials and methods
  - VII. Results (findings)
  - VIII. Discussion (what does it mean)

Appendices:

A: Summary table and graphs

A-1: xxxxxx

A-2: xxxxxx

- B. Selection of Sampling and Analysis
- C. Statistical methodology
- D. References
- E. Raw data
- F. Cost estimate
- G. Important notes and contacts