



**Biology 490: Seminar in Plant Ecology
Spring 2008**

Professor Andi Lloyd

BIH 372 x 3165

lloyd@middlebury.edu



Why are Vermont forests the way they are? In this course, we will explore the forces that have shaped Vermont's forest ecosystems, with particular attention to the influence of humans— past, present, and future— on Vermont's plant communities. We will learn a variety of techniques for reconstructing ecological history, with particular emphasis on the use of tree rings to reconstruct forest history. The course will be based on reading and discussing papers in the primary literature, as well as intensive fieldwork at a local field site.

Course meeting time:

Monday 1:30-4:15, MBH 405

(Plus miscellaneous out-of-class time to do field and lab work!)

How this class works

- There are two components to this class: 1) discussion of primary literature and (2) completion of a collaborative field project. Details on each component follow the schedule of classes.
- 25% of your grade in this class is based on participation. There are three elements to participation: (a) attendance, (b) attentive listening during discussions, and (c) active participation in discussions. You therefore will earn maximum points for participation by being there, listening respectfully and actively to your classmates, and contributing your own thoughts or ideas. The purpose of a discussion is *not* that everyone articulates perfectly conceived, incredibly insightful concepts from the outset, but rather that by sharing our roughly formed ideas with one another and responding to each other's ideas we can, as a group, come to a more complete understanding of a paper or issues. Free exchange of *all* ideas is a prerequisite for good discussion, and I ask therefore that you bring an attitude of respect and engagement to class with you!
- We will be in the field for all or part of class on 4 weeks of the semester (2/11, 2/25, 3/17 and 3/31). It may be wintry for some or all of those weeks, so you will need to come to class prepared with appropriate clothing and footwear to be outside for 3 hours conducting fieldwork! The Charcoal Swamp is really a swamp, so rubber boots are strongly advised! Inadequate preparation is not an excuse for missing class, and if I feel that you are not adequately dressed to be outside I reserve the right to ask you to stay here. If it snows, snowshoes might be handy. If you don't own your own, consider borrowing from the Middlebury Mountain Club. Gear is available from the 1st floor of FIC Tuesdays and Thursdays between 8-10 PM. If any of you have problems acquiring appropriate outdoor gear, please let me know and I will do what I can to accommodate you.
- Needless to say, it is imperative that you complete readings and response papers before coming to class.
- This course involves extensive collaborative work. Failure to work in a collaborative fashion will be reflected in your participation grade; in extreme cases, I reserve the right to remove people from groups if their attitude is detrimental to the group as a whole.
- Your conduct is governed by the Honor Code and Middlebury College's Plagiarism Policy. Precisely because we are going to work collaboratively, it is *imperative* that you give proper attribution to ideas! Good collaborative work is built on a trusting working relationship, and this means that your peers can trust you to give credit where credit is due!

Schedule of class meetings

Date	Topic
2/11	Introduction to course <i>Field trip</i> to Battell Research Forest to meet our study site
2/18	Past research at BRF and tools of the trade <i>Discussion 1</i> (Andi leads): The known (and unknown) history of the Battell Research Forest <i>Introduction to methods of paleoecology</i> : A very brief introduction to the methods of dendrochronology and macrofossil analysis.
2/25	Fieldwork <i>Second field trip to BRF to plan specific field methods for projects</i>
3/3	Methods of paleoecology <i>Discussion 2</i> : The use of tree rings to reconstruct forest history: strengths, weaknesses, and case studies beyond Vermont <i>Discussion 3</i> : The use of macrofossils (& pollen) to reconstruct forest history: strengths, weaknesses, and case studies beyond Vermont <i>Group planning meetings with Andi</i>
3/10	Presentation of research plans <i>Group 1</i> : Vegetation change from macrofossils <i>Group 2</i> : Tree ring evidence for forest change around Charcoal Swamp <i>Group 3</i> : Tree ring analysis of Great Appalachian Windstorm <i>Group planning meetings with Andi</i> NSF style written proposals due! (1 per group; 15 page maximum)
3/17	Fieldwork <i>Fieldwork at BRF</i>
3/31	Fieldwork <i>Fieldwork at BRF</i>
4/7	Climate as a driver of forest composition <i>Discussion 4</i> : What was the post-glacial history of Vermont? What is the sequence of species colonization after ice retreat? What are the relative roles of migration and climate in controlling the pattern of recolonization? <i>Discussion 5</i> : How did climate change during the Holocene affect the forest composition of New England? Is there evidence that species' abundances have responded to the more subtle climate fluctuations during the last 8-10,000 years?
4/14	Natural disturbances in New England's forests <i>Discussion 6</i> : What role has fire played in the long-term history of New England's forests? Which factor has a larger role in controlling fire in New England: climate or vegetation? <i>Discussion 7</i> : What role have pests and pathogens played as disturbances in New England? Was the mid-Holocene hemlock decline <i>really</i> the result of an insect pest outbreak?

4/21	<p>People as drivers of forest dynamics in New England</p> <p><i>Discussion 8:</i> What impact did New England's indigenous inhabitants have on the landscape? The case for and against widespread landscape management by Native Americans in New England</p> <p><i>Discussion 9:</i> What impacts—both persistent and transient--did settlement by European colonists have on the New England landscape? Which was more important: clearing, or manipulation of the fauna of New England? Furthermore, what is the continued legacy of land use change: are New England forests still responding to historical clearing? Is there any chance they will return to their previous (pre-settlement) condition?</p>
4/28	<p>Looking to the future: can the past shed any light on how Vermont forests will change in the future?</p> <p><i>Discussion 10:</i> What effect will introduced pests and pathogens have on Vermont (New England) forests? Are those effects comparable to past events, or are they really genuinely new?</p> <p><i>Discussion 11:</i> How does future climate change interact with all of these other processes? Is there any hope of predicting what forests in Vermont will look like 100 years hence?</p> <p><i>Individual group meetings with Andi to plan presentations</i></p>
5/5	<p>Presentation and discussion of final project results: Each group will have 30 minutes to present plus 15 minutes of questions</p>
Last day of exams	<p>Final paper due, 1 per group</p>

Due dates and how your grade will be determined

Presentation of research proposal	March 10	5%
Research proposal	March 10	20%
Presentation of research findings	May 5	10%
Final manuscript	End of exams (noon, last day)	25%
Leading discussion	(Varies)	15%
Participation (includes response papers)	Every day!	25%

Field research projects

Topics:

You will work with a group (3-4 people per group) to conduct research on one of the following general topics. Each group will choose a topic, and then have to craft a specific research proposal that addresses that topic.

1) What is the Holocene history of vegetation change at the Battell Research Forest?

There are two wet hollows (Sarah's Pond and Charcoal Swamp) above the BRF. These were cored approximately 20 years ago by Dr. Dan Mann, who was then director of the Vermont Field Naturalist Program at UVM. He obtained preliminary dates that indicated that the sediments in the hollows spanned the Holocene. His test core was rich in plant macrofossils, which we can use to reconstruct vegetation change.

2) What is the recent (Very Late Holocene) history of forest dynamics in the area around the swamps?

Tree rings can give us a different record of forest change around the swamps. The area around the swamps includes recently cut hardwoods (<150 years old) and old-growth hemlock and pine stands. Trees can be cored to establish recent patterns of change.

3) What is the disturbance history revealed in the swamp?

The sediments of the swamp are rumored to contain ample charcoal, with which we can learn something about fire. In addition, the swamp itself is full of intriguing and tantalizing stumps, some of which seem to be from very large trees. Together, the charcoal and stumps may tell us about pre-settlement (and possibly post-settlement) disturbance!

Preparing your research proposal

All proposals must be prepared in the exact format of an NSF proposal. Full instructions can be found in the Grant Proposal Guide of the NSF's website:

http://www.nsf.gov/pubs/policydocs/pappguide/nsf08_1/gpg_index.jsp

Pay particular attention to section II.C.2, which identifies the components of a proposal. You are not expected to submit a cover sheet, but must submit the following.

1. Project summary
2. Table of Contents
3. Project description (don't need to include Results from Prior NSF Support)
4. References cited

The page limits are the same as for an NSF proposal: your proposal may not exceed 15 pages! You will submit one proposal per group. (See the page on "Collaborative writing" for guidelines on how to effectively write as a group.)

You can download a copy of my most recent proposal (which was funded in fall of 2006) on the course website.

Timeline for conducting the research

- *Planning field trip* will take place in class on February 25. Use this time to look at the study site, take pictures, make notes, and generally plot out your research plan.
- *Proposals* are due in class on March 10. You will present a 20 minute overview of your proposed research at that point, and receive feedback from your classmates.

- *Fieldwork* will be conducted in class on March 17 and March 31. The group tackling topic 1 will arrange a Saturday or Sunday trip out to the swamp with Andi to obtain the core, and can use the weeks of 3/17 and 3/31 to process samples or collect any additional information.
- *Labwork* will be conducted during available class times (after discussions) and outside class on your own time. You will have access to Andi's research lab for this purpose.
- *Oral presentations* of project results will take place during the last week of class (5/5). You will meet with Andi to plan your presentation the previous week (4/28).
- *Final written manuscripts*, due no later than the last day of exams (by noon) in the format of the Journal of the Torrey Botanical Society, which is a possible target source for these papers. (Note: I fully intend that at least some of the groups will yield publishable results, so if your papers are good enough, we will actually submit them for publication. With your permission, of course.)

Writing your final manuscript

You will write up your results as a manuscript to be submitted to the Journal of the Torrey Botanical Club. *My hope is that you will actually yield publication quality research!* Once all of the papers are submitted, if the data seem to be of sufficient quality, I will work with any interested students to compile them into a single paper (on which you will be authors) describing the paleoecological history of Charcoal Swamp.

You must follow the formatting guidelines exactly. These can be found online:

<http://www.torreybotanical.org/Submission.html>. Note that the minimum length is 5 journal pages, which is equivalent to approximately 12-13 pages of text. This is a bare minimum, and I expect your papers will mostly be longer than this!

All papers are expected to have abundant in-text citations that relate the results of this study to other published studies. A *minimum* of 15 references should be included, but this is only a benchmark and most papers will probably have more. These references should primarily be publications in peer-reviewed scientific journals. References from books and magazines for general readers (e.g., Scientific American) should be used *very* sparingly, and should constitute no more than 10% of your total references. Web pages should be cited if used, but they do *not* count towards the minimum of 15 references. Electronic versions of print journals (such as those available on J-stor) *do* count, however.

Guidelines for working collaboratively

One of the skills that we will develop in this course is your ability to work (think, write, present, analyze) collaboratively. You all have experience doing this in other classes, so we will build on those experiences and hone your skills. You will find that the science of ecology is highly collaborative. The vast majority of papers are written by >1 author, most research proposals have multiple investigators. When you leave Middlebury, whatever you end up doing, it is highly likely that you will have to write and work as part of collaborative teams.

Some guidelines and ideas to get you started:

1. Start any collaborative project by identifying the skills and strengths that each member brings to the group. Once you have identified these, you will be better able to plan out particular tasks. For example, if you know that you are really good at thinking of ideas, but not so good at the mechanics of writing, say so! Nobody is good at everything, so if you map out who is good at what, you can play to each person's strengths.
2. For any writing project, it is best to have one person volunteer to write the first draft. This can be rough, it can include big sections that say things like "I don't know what to say here", but it is a start. If you're an idea person, but less interested in the mechanics of smooth writing, this might be a great task for you!
3. Develop a system for working on the draft. Get used to using the "Track Changes" feature of Word.

4. Set strict deadlines with each other. For example, if 3 people are writing a proposal that is due in 14 days, they might set out a timeline like this:
 1. Jane will send the rough draft to Hank and Lucy by day 3.
 2. Hank and Lucy will read, comment on, edit, and add to the draft by day 5.
 3. On day 6, all three will meet to decide how to merge everyone's comments.
 4. Hank will volunteer to come up with draft #2, which he will circulate to Jane and Lucy by day 9.
 5. Jane and Lucy will read, edit, etc. by day 11.
 6. On day 11, the group will meet to decide what needs to be done for the final draft.
 7. Lucy volunteers to write the final draft, which she circulates to the others by day 13.
 8. Final edits are made and Jane takes responsibility for submitting the final draft on day 14.
5. Act early if one group member is not participating or meeting deadlines. Talk to that person, and involve Andi in those conversations!
6. If you haven't done so in a previous class (and even if you HAVE), read Chapter 6 of Pechenik's Short Guide to Writing About Biology (which is on reserve in Armstrong). It has great tips for how to be a good reviewer and how to receive criticism well.

Class discussions

Responsibilities of the discussion leader

As discussion leader, you will be in charge of the class. This includes: (1) finding the readings, (2) presenting an overview of the topic, and (3) leading the discussion. You will each lead one discussion during the semester. Discussion leaders have the following responsibilities.

1. Identify 1 target and 5 support articles for the discussion topic. You must meet with Andi to have your list of articles approved at least 1 week before the date of the discussion.
 - a. The *target* article is read by everyone in the class, and forms the central focal point for the discussion. It should be a particularly thought-provoking, insightful, or relevant article.
 - b. The *support* articles are each read by 2 members of the class. You will need to find five support articles, and each person in the seminar (including Andi) will sign up to read one of the five.
2. Make a sign-up sheet and a PDF file of all articles available in the Share folder of the Classes server. You will notice that there is a folder for each of the discussions, in which there is a blank sign-up sheet that you will fill in with the target and support articles. If an article is not available as PDF, give the hard copy to Andi and we'll have it turned into one!
3. Read all of the articles: the discussion leader must read all six articles, plus additional background reading as needed.
4. Prepare an oral presentation that will accomplish the following goals.
 - a. Provide background information. What additional information does the group need to help them think through the question we are tackling this week? What particularly compelling case studies can you provide to illustrate your points? Most of you will start with this, and I anticipate that the first 10-15 minutes (or so) of your presentation will involve you teaching us the background that we need.
 - b. Stimulate discussion. Think creatively about how to do this! Come armed with questions about the target article that you think merit discussion (points you don't understand, or disagree with, or just found really compelling). Come prepared to call on people who read particular support articles, and ask them to summarize or share their views. You are the teacher for the day, so think broadly and creatively about how to spark discussion.
5. Provide a good summary at the end. Be prepared to take a step back in the last few minutes and summarize. How have we answered the questions that we posed? What are the points that we found particularly interesting or about which we really disagreed? What stumped us? Anything that you think is important in the way of concluding material is important here.

Responsibilities of discussion participants

1. Good participation involves three components: (i) being present (obviously), (ii) active listening, and (iii) contribution of your ideas. An excellent discussion will be one in which you exchange ideas freely with each other, learning from what your peers contribute.
2. You must do the readings carefully before coming to class.
3. You must bring, to each class, a response paper that answers the following questions for each reading. I will collect these, and they will be graded (with a scale of check-plus, check, or check-minus).
 - a. What struck you most about this reading (what was the most interesting conclusion)?
 - b. What concepts/conclusions need clarifying—what didn't you understand?
 - c. Were you convinced that the author(s) conclusions were justified based on their data? Why or why not?
4. For some weeks, you may be given additional (or alternative) discussion questions to think about before coming to class.