Syllabus for
ENVS 122 Tropical Ecology and Conservation
Fall Quarter 2009

This course is an introduction to the ecological processes, principles, and players of tropical ecosystems, and to conservation issues facing tropical forests, with particular emphasis on the American (neo) tropics. We will look at how tropical ecosystems work, roles of humans in shaping them, and current conservation opportunities and dilemmas (5 units).

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Course Readers:
Joe Spraker
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office: Thimann Greenhouse Roof
office hours: Wed 9:30-10:30; Th 10-11

Matt Auerbach
email: mauerbac@ucsc.edu
office: S&E library
office hours: Tues and Thurs, 6-7 p.m.

Class meetings:
Lecture MWF 8:00-9:10 in 101 Natural Sciences 2 Annex
ENVS 122-01A, Wednesday, 2-3:10 p.m. in ISB 455
ENVS 122-01B, Wednesday, 5-6:10 p.m. in ISB 455
ENVS 122-01C, CANCELLED – please enroll in a different section if you haven't already
ENVS 122-01D, Thursday, 2-3:10pm in ISB 455

Class website: The course website will be hosted on WebCT at http://ic.ucsc.edu/webct.
Be sure to log on soon – course syllabus, quizzes, assignments, and important links will all be available there. See below for help, if you need it.

Required course resources:
3. EndnoteWeb. Access directly at www.myendnoteweb.com or through Web of Science on the University library site. See below for help in registering. This includes the citations of all the literature used in this course, with easy click-through to UC-eLinks to get pdfs.
4. ERes. Some readings may be placed on ERes at http://eres.ucsc.edu/.
5. An understanding of basic ecological principles and terms, as you would get in ENVS 24 or Biology 150. You should also have a working understanding of reading graphs and interpreting statistics.
Course goals and philosophy

I want you to take several things away from this course. First, I want to move beyond the “Discovery Channel” approach to the tropics, and, while keeping a sense of the wonder of tropical diversity, help you develop a sound background in modern tropical ecology and conservation. Second, I want to ensure you have a sound understanding of how scientists come to reach understanding about tropical ecosystems through the use of natural history/observational studies, experiments, and models/theory. Finally, I want you to have the analytical tools you need to continue learning about and acting on behalf of tropical ecosystems and other environmental issues of importance to you. Specifically, by the end of the course:

1. You should have an understanding of modern ecological and evolutionary theory that applies to “how the tropics work”, and why tropical ecosystems are different (if they are) from temperate systems. For example, why are there so many more species in a tropical rainforest than a temperate forest? How is species diversity maintained? How do physiological and behavioral adaptations shape interactions among organisms?

2. You should be able to critically evaluate ecological theory with data. This means being comfortable reading primary scientific literature that provides empirical tests of ecological theory. Students often find this very challenging, but this is an important skill for you to be able to keep up to date about tropical ecology (or for that matter, conservation biology, agroecology, climate change, or just about any other aspect of environmental studies you could name). We will provide abundant help for you to get comfortable with primary literature, if you aren’t already.

3. “The Tropics” are not monolithic – there are high diversity rain forests, low diversity dry forests, coastal mangroves, alpine páramo, seasonally flooded forests, and many kinds of agro-ecosystems - these systems vary widely in what makes them work. I want you to have a working knowledge of ecosystem diversity in the tropics, and its biogeographic distribution. Nevertheless, because we cannot do everything in ten weeks, the emphasis will be on neotropical forest systems.

4. You should come away from the course with a critical understanding of threats to tropical ecosystems - exactly how do land-use change, global climate change, fire and other anthropogenic factors affect tropical ecosystems? How do current human activities differ from those of the last several thousand years?

5. Finally, you should be actively thinking about how an understanding of the workings of tropical ecosystems contributes to designing effective conservation strategies and sustainable agroecosystems, and be able to effectively communicate your ideas to others.
Course expectations
1. Come to lecture (on time), and participate actively. Engage the material – challenge yourself, the instructors, and each other to get the most out of the material and think critically about it.

2. Do the readings before class. Form reading groups – it is the best way to get the most out of dense readings. Bring specific questions about the readings to lecture.

3. Do the work ahead of time to be able to make positive contributions to group work in sections. This is where most of the heavy lifting in the course really happens.

4. Come to office hours often - don't wait until the last minute (or later). All three of us actually WANT you to come to office hours!

5. If you don’t already know, learn to use the library and the on-line literature databases such as the Web of Science (http://www.webofscience.com/) and UCLink to find and read recent articles from the scientific literature.

Course evaluation
The course is evaluated on many components to allow you to play to your strengths. Of course, this also means you will be quite busy.

15% One midterm exam (FRI 10/23)
15% One comprehensive final exam (WED 12/9)
20% One 2500-word analytical final paper (DUE WED 11/25)
20% Best eight of nine group critical essays (Mondays noon)
15% Ten weekly on-line quizzes on assigned readings (Fridays 4pm)

OR
Substantive comments to author on Tropical Ecology text (Fridays 4pm)
15% Attendance, preparedness, and participation

Extra credit: up to 5% of final grade for substantive 2-way peer-review of final paper.

Midterm (10/23) and final (12/9) exams. There will be a midterm exam and a cumulative final exam. Materials in lectures, handouts, and readings are all fair game for the exams. Expect a mix of short answers, some graphs or figures to be drawn or labeled, and multiple choice questions on the exams. I will focus on the main concepts and patterns, and on how we know what we think we know (i.e., the scientific process), but expect you to be able to incorporate the natural history into a larger ecological framework and synthesize what you have learned.

Final analytical paper. Due Wednesday 11/25
Prepare an analytical research paper based on a review and synthesis of the literature on a specific topic related to this course, using a minimum of four articles from the primary peer-reviewed literature. Your topic should be focused enough to cover well in the allotted space, but general enough that there is adequate primary literature about it. It is most effective to chose either a specific scientific question about tropical ecology or evolution or a specific issue in tropical conservation. The citation style (in the text and in the literature cited section) should follow the style use in the journal Ecology. The word count (excluding the literature cited section) should be between 2000-3000 words.
Here are some examples of appropriate topics for the final analytical paper:

* Importance of seed trees for restoration of degraded tropical pastures
* Evolutionary limits to specialization by herbivores in hyper-diverse tropical forests
* Predicted impacts of climate change on montane herps in the tropics
* Biological prospecting as a tool for tropical conservation

Whereas these are too big or general:

* The role of humans in tropical forests
* Climate change in the tropics
* Natural medicines of tropical indigenous people

Your goal here is to bring together several publications, think carefully about how they compliment or contradict one another, and put them together into a coherent, synthetic research review. This does not mean a paper that simply provides an introduction, then an overview of paper #1, then paper #2, then paper #3, then paper #4, then a conclusion. You are expected to develop a particular theme, and use the literature to explore that theme in a critical and analytical way. The challenge here is to take a body of work, understand it well, and tell a coherent story about the topic informed by and supported by the best available scientific literature. One of the best places to find good examples of this kind of writing is in the journal *Trends in Ecology and Evolution* (TREE).

Each student is expected to produce their own paper, but peer-review of each other's work is strongly encouraged.

**Group critical essays (Mondays noon).** For each week, I will provide a particular question for you to grapple with, based specifically on reading of the primary scientific literature. Each student is expected to read the literature and draft some responses independently, and then work in groups of 4 students in Section to craft a group response. The goal here is for you to be carefully and critically reading the primary scientific literature related to tropical ecology and conservation, engaging others in scholarly discussion about the literature, and then working with others to craft a well-written, thoughtful response to the question. All participants will receive the same grade for the paper on which they worked. Group membership will rotate throughout the quarter.

To help ensure that each student is prepared to contribute fully in the group discussion in section, each student must, before their section meeting, post their thoughtful, substantive draft comments on the assignment on webCT. The quality of these submissions will represent half of the "Attendance, preparedness, and participation" component (15%) of the final course grade.

The specific assignments will vary from week to week, depending on the theme of that week. You may be asked to provide a critical assessment of a particular study cited in your text; you may be asked to read two specific papers on a similar topic but with different conclusions and reconcile them; I may take a particular claim from the text (or some other source) and ask you to find papers from the scientific literature to support or refute the claim. You are expected to use the scientific literature to substantiate your arguments in specific and substantial ways.

Each group critical essay should be about 500-600 words (roughly one page, single spaced). At the top of the paper, please include the First and Last names of all authors, the date of submission, and which section you attend. The full reference of any papers directly discussed in the essay should be included at the end of the essay (not included in the word count). Use the

The essays must be uploaded to WebCT by noon on the Monday following your section (this applies to both Wednesday and Thursday sections). File to be uploaded should be in a .doc, .docx, or .rtf format, and should include that tag designation in the file name.

**Quizzes OR Comments on Text (15%). (Fridays at 4 p.m.)** This component is designed to ensure you are engaged in the reading. There are two ways you can do this, either through weekly on-line quizzes or by providing substantive feedback to John Kricher about the text manuscript.

**Quiz option:** On-line quizzes are based on the assigned readings for the week, and must be completed by 4 p.m. on the Friday of each week. There will be ten quizzes with 5 multiple-choice questions each week. You may only attempt a quiz once, and you have 15 minutes to complete it. That means you must do the readings ahead of time. You can work ahead, if you choose.

**Comments option:** The author of your text is anxious to receive constructive criticism of the *Tropical Ecology* text, which is currently in manuscript form. For each week, you need to provide a minimum of five substantive comments on the *Tropical Ecology* text readings for that week. Your comments should be specific, substantive, and constructive, such as pointing out particular sections (by page and line numbers) that were confusing or particularly enlightening, (and why); suggestions for special sidebars or appendices that would be helpful; specific suggestions for structural changes; notations of problematic terminology or frameworks; terms that need to be better defined; notes on what you take away from the chapter. Copy-editing comments like "you need a comma here" or "lianna was misspelled" are helpful, but don't really count as substantive. You must post your comments on the week's readings on WebCT by 4 p.m. on the Friday of each week. I will compile all the contributed comments and forward them to Kricher. You will need to input each of five comments independent. I suggest you write out the comments ahead of time in a word processor, and then cut and paste. Each comment has a maximum of 500 characters. You have 30 minutes to enter all five comments, but you can start over if you run out of time (but you’ve have to re-enter everything).

For any given week you can choose to do the Quiz, provide Comments, or do both, but you will only get a maximum of 5 points for any given week, with a total of 50 points for the quarter for this component. That is, if you take the quiz and get 3/5 correct, and provide 4 substantive comments, you would get 5 points for the week.

You are expected to take the quizzes and write the comments independently, not as group work.

**Attendance, preparation, and participation (15%).** I expect you to attend and participate in lectures and discussion sections. Class begins promptly at 8:00. The lectures are designed to expand on the readings, so it is up to you to do the readings before class. Bring specific questions about the readings to the lectures, and ask them. Active, prepared participation in the discussion section groups is essential. Your preparation will be assessed based on your submission of thoughtful, substantive draft comments for the group discussions on webCT before your section meets (50% of this component), and the remainder based on attendance at
lecture, section, and office hours, and evidence of active participation in lecture (e.g., asking questions) and section (i.e., engagement in the group process).

**Sections.** Discussion sections are specifically designed for work on the group critical essays. In this way, you will be actively engaged in discussing the scientific literature in small groups (generally 4 students) so that each student has a opportunity to contribute, as well as receiving the benefits of working as part of a group. A course assistant will be present in each section to help groups with specific questions that you can't resolve on your own (e.g., difficulty in interpreting a graph, or statistical test), or to help you with group process, or working with you on how best to use the scientific literature to support your arguments. They are there to help with the process of reading, interpreting, and using the scientific literature, and can help with writing issues as they come up. They will rotate among the groups, and offer help where it is needed. They are not Teaching Assistants, in that they are not expected to explain or review materials covered in the text or lectures. They are available in office hours for help specifically with writing. Both are strong writers with skills for reading and interpreting ecological literature.

**Late policy and makeups.** Five percent will be deducted from the final score of each group paper or final paper for each calendar day late. Makeups on the midterm and final exams are by oral exam only. I will NOT give early final exams for you to leave Santa Cruz early. The final exam is 9 December, 8-11 a.m. Plan accordingly. There are no available makeups for quizzes or comments on the text or individual drafts of group critical essays.

**Regrading of papers or exams.** We strongly encourage you to come to office hours to talk about things you don't understand at any point, including about graded papers, quizzes, and exams. Requests for regrading, however, (of papers or particular questions on exams) will ONLY be considered when accompanied by a written request that explains clearly why you think the grade was incorrect. Written requests will be accepted no sooner than 12 hours after receiving the graded work, and no later than 1 week after receiving it. Only Greg will handle regrades.

**Academic integrity.** When a student enrolls at UCSC he or she automatically agrees to abide by University policies. The student policy and regulations handbook is available at [http://www2.ucsc.edu/judicial/handbook.shtml](http://www2.ucsc.edu/judicial/handbook.shtml). Academic integrity and scholarship are core values of the UCSC community; plagiarism and cheating contradict these values, and so are very serious academic offenses. I have a zero tolerance policy for plagiarism and cheating. No credit will be given for an assignment where a breach of academic integrity is established, and we will follow the established UCSC process for violations of academic integrity ([http://www.ucsc.edu/academics/academic_integrity/undergraduate_students/](http://www.ucsc.edu/academics/academic_integrity/undergraduate_students/)). Please review the handout on Avoiding Plagiarism (also available on the course web page) that summarizes what is considered violations of academic integrity. If you have any questions about UCSC policy please consult your professors and the course reader. In addition, UCSC has an excellent Information Literacy Tutorial at [http://nettrail.ucsc.edu](http://nettrail.ucsc.edu), that includes a clear discussion of plagiarism and the ethics of information use and citing.

For additional clear descriptions and discussion of what constitutes plagiarism, please see the following web pages from the Learning Center.
[http://www.plagiarism.org/learning_center/what_is_plagiarism.html](http://www.plagiarism.org/learning_center/what_is_plagiarism.html)
[http://www.plagiarism.org/learning_center/plagiarism_faq.html](http://www.plagiarism.org/learning_center/plagiarism_faq.html)
Returning of final papers and exams. If you would like your final papers and exams returned (I hope you do!), please provide Greg with a large self-addressed, stamped (with adequate postage) envelope by day of the final exam, or see Greg during office hours early in Winter Quarter. Otherwise they will be recycled on 30 January 2010.

Peer-review of papers for extra credit.
You can receive up to 5 points extra credit toward your final course grade (out of 100) by participating in peer-review of the final paper. Full credit requires (1) providing substantive review comments to a peer in the class, (2) receiving and incorporating comments from a peer in the class, (3) turning in the original reviewed drafts of both reviewers together as a bundle at the same time as turning in the papers, along with a brief joint cover letter noting who the reviewers were, and an assessment of the value of doing the reviews.

WebCT help.
Web Browser Compatibility. In order to use WebCT, your web browser must be compatible. The first thing you should do is click on "Check Browser" at the top of the WebCT screen and follow the instructions to make sure your browser is supported for all the functions of WebCT. Next, make sure you visit our page about preparing your computer settings for WebCT: http://ic.ucsc.edu/docs/webct/browser.shtml

Logging in to WebCT. To login to WebCT, go to ic.ucsc.edu/webct/. There is a help page to assist students in logging in to WebCT. It is at: ic.ucsc.edu/docs/webct/login.shtml

WebCT Support for Students. The best way for students to request support for WebCT is to complete the help request form available at ic.ucsc.edu/docs/webct/contact.php

Adding a link to WebCT to your MyUCSC page. This is a link to a tutorial showing students how to add a WebCT Login section to their MyUCSC homepage: http://ic.ucsc.edu/docs/tutorials/webct-onmyucsc/

Students can Self-Enroll. Student accounts are uploaded to WebCT from your AIS course list. This is currently done at specific intervals during the quarter. First before the first day of instruction, then once a week until the last day to add (usually fifth week of instruction.) Students who are in the process of enrolling in the course and are not on the original AIS course list can add themselves right away at http://ic.ucsc.edu/docs/webct/create-account.php until the last day to add. This way they will not miss class WebCT activities.

WebCT Information for Students. Students may want to consult https://ic.ucsc.edu/docs/webct/students.shtml, which is a comprehensive site for students to get information about WebCT.

EndnoteWeb. From on campus (for the first time), go to the Web of Science page in the University Library web site. On the right, under Customize Your Experience, register with your UCSC email address. After that, you will have access to Endnote Web (see links at top of WoS page) from any internet connection, including the shared library of readings for ENVS122.

Some useful web links
Course Web Page : http://ic.ucsc.edu/webct
E-Res http://eres.ucsc.edu
UCSC University Library : http://library.ucsc.edu/
UCSC University Library from off campus: http://oca.ucsc.edu/login
EndnoteWeb: http://www.myendnoteweb.com
Lecture topics and assigned readings

The chapters from Kricher’s Tropical Ecology are required, and will be covered in the quizzes. The recommended readings will be discussed in the lecture, and you will get much more from the lectures if you have read them. You can find all the recommended readings through UC-links, and they are in the EndnoteWeb ENVS122 shared library.

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<td>0</td>
<td>F</td>
<td>9/25</td>
<td>Course introduction</td>
<td>Syllabus; avoiding plagiarism</td>
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<tr>
<td>1</td>
<td>M</td>
<td>9/28</td>
<td>What and where are the tropics</td>
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<td>Tropical climate; life zones</td>
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<td>Webb 1991</td>
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<td>F</td>
<td>10/2</td>
<td>Plate tectonics; great interchange</td>
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<td></td>
<td>M</td>
<td>10/5</td>
<td>Speciation, endemism</td>
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<td>Gentry 1992; Brower 1994</td>
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<td></td>
<td>W</td>
<td>10/7</td>
<td>Climate variation; refugia; pollen</td>
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<td>Colinvaux 1996</td>
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<td>F</td>
<td>10/9</td>
<td>Tropical biomes</td>
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<td>2</td>
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<td>10/12</td>
<td>Rainforest structure; plant forms</td>
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<td>Diversity: Measuring it</td>
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<td>F</td>
<td>10/16</td>
<td>Diversity: Gradients &amp; Correlates</td>
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<td>Givnish 1999</td>
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<td>M</td>
<td>10/19</td>
<td>Diversity: Genesis &amp; Maintenance</td>
<td>4</td>
<td>Wright 2002</td>
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<td></td>
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<td>10/21</td>
<td>Diversity: Genesis &amp; Maintenance</td>
<td>5</td>
<td>Hubbell 2008</td>
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<td>10/23</td>
<td>Midterm Exam (GG to OTS)</td>
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<td>M</td>
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<td>Disturbance and dynamics</td>
<td>6</td>
<td>Finnegan 1996; Yih 1991</td>
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<td>W</td>
<td>10/28</td>
<td>Disturbance and dynamics</td>
<td>6</td>
<td>Hubbell 1999; Wright 2003</td>
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<td></td>
<td>F</td>
<td>10/30</td>
<td>Restoration: facilitated succession</td>
<td>6</td>
<td>Holl 2000</td>
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<td></td>
<td>M</td>
<td>11/2</td>
<td>Parasitism &amp; predation</td>
<td>7</td>
<td>Gilbert 2007; Terborgh 2008</td>
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<td>11/6</td>
<td>Mimicry</td>
<td>8</td>
<td>Kapan 2001; Darst 2006</td>
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<td>4</td>
<td>M</td>
<td>11/9</td>
<td>Evolutionary Chemical Ecology</td>
<td>8</td>
<td>Coley 1985; Coley 2005</td>
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<td>Multitrophic</td>
<td>8</td>
<td>Dyer 1999</td>
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<td>F</td>
<td>11/13</td>
<td>Primate behavior (Nate Dominy)</td>
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<td>M</td>
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<td>Bioprospecting (Roger Linington)</td>
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<td>Kursar 2007; Shiva 2007</td>
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<td>W</td>
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<td>Bird communities (Bruce Lyon)</td>
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<td>Primary productivity</td>
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<td>Clark 2001</td>
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<td>Carbon Flux &amp; Climate Change</td>
<td>9</td>
<td>Lewis 2004</td>
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<td>T-day holiday</td>
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<td>a good novel</td>
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<td>Humans (Flora Lu)</td>
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<td>Mann 2002</td>
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<td>Forest Fragmentation</td>
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<td>Other tropical ecosystems</td>
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<td>Final Exam 8-11</td>
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Recommended readings to accompany lectures


Group Critical Essay Topics

Week 1. Biogeography

*Topic*: Holdridge and Wallace used different kinds of data to delineate biogeographical patterns. Briefly describe the objectives of each scientist and the approaches they used. What are the strengths and weaknesses of each if they are to be used by conservation biologists?

Week 2. Climate and the tropics
*Readings*: Your choice

*Topic*: Read any peer-reviewed scientific publication that uses pollen records to examine long-term changes in tropical vegetation (hint: Mark B. Bush and Paul A. Colínvau are leaders in this area). You can decide ahead of time as a group to read one paper, or each person chooses their own. As a group, write an essay that uses findings from those papers to specifically argue either “Climate change is a major threat to the continued existence of tropical rain forests” or “Climate change is of minor concern for the continued existence of tropical rain forests”. Be clear about your criteria, rationale, and the strengths and limitations of your scientific evidence.

Week 3. Diversity
*Readings*: Condit et al. 2002; Novotny et al. 2007

*Topic*: Alpha and Gamma diversity in the tropics is astounding. The Condit and Novotny papers focus on measures of Beta diversity in tropical trees and insects. (Note: don’t worry about the test of neutral theory part in the Condit paper, but be sure you understand how the Sørensen Similarity Index is calculated.) Describe one case where you would expect that species overlap should decline with physical distance, and one case where it might not. For instance, you might consider different taxa, topography, climate, or other environmental factors. Be specific about your rationale.

Week 4. Speciation
*Readings*: Hughes and Eastwood 2006; Richardson et al. 2001

*Topic*: First consider what molecular evidence suggests about explosive speciation and the mechanisms of speciation in tropical plants. Next, look at the discussions in Kricher, pp 20-22 on Speciation and pp. 48-53 on the “Perfect Storm” hypotheses. For any of the models presented by Kricher, briefly discuss how the results of Hughes and Eastwood (2006) and Richardson et al. (2001) challenge or support assumptions of the models. Discuss at least two assumptions.

Week 5. Succession
*Readings*: Guariguata & Ostertag 2001

*Topic*: Given the rapid recovery of tropical forest structure and function following anthropogenic disturbance, is there a need for active restoration efforts? If so, what specifically is needed (i.e., what is not adequately recovered?) and why? Either way, provide a clear, supported argument for your position.

Week 6. History
*Readings*: Janzen & Martin 1982

*Topic*: Write a convincing essay about why it is essential for all conservation biologists to be trained in evolutionary biology. Include a specific example of where an evolutionary understanding can be important to tropical conservation (note: the example should be something other than one presented by Janzen & Martin).

Week 7. Bioprospecting / Biopiracy
*Readings*: Kursar et al. 2007; Shiva 2007

*Topic*: What role, if any, should biosprospecting take in integrated tropical conservation and development efforts, and why? Support your argument.
Week 8. Gradients and climate change
Readings: Colwell et al. 2008; Engelbrecht et al. 2007  Topic: These papers describe how two kinds of gradients affect the current distribution of species in tropical forests. Draw on the results of these studies to make specific recommendations about protected area design for conservation of tropical forests.

Week 9. No Sections or Group Critical Essays this week

Week 10. The future of the rainforest
Readings: Wright and Muller-Landau 2006; Laurance 2007  Topic: Consider the following statement: “The scale of the threat of mass extinction in tropical forest has been dramatically exaggerated”. Present a science-based argument supporting or refuting this statement. Be specific in how you support your argument, and include at least one peer-reviewed paper (other than the two assigned papers) to support your position.

Required readings for Sections and Group Critical Essays