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).

**Instructor:** Gregory S. Gilbert
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Lab website: [http://people.ucsc.edu/~ggilbert](http://people.ucsc.edu/~ggilbert)

**Quicklinks**
Expectations and Evaluation
Academic Integrity
Lecture schedule and readings
Section assignments
Readings from primary literature

**Teaching Assistants:**
Daniella Schweizer
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office hours: W 12:30-1:30, F 9:30-10:30

Getachew Eshete
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office: 433 NatSci2
office hours: Tu 1:30-3:30

**Class meetings:** Lecture MWF 11:00-12:10 in 175 Stevenson Academic
ENVS 122-01A, Monday 02:00-03:10 p.m. in ISB 431 (Schweizer)
ENVS 122-01B, Monday 03:30-04:40 p.m. in ISB 431 (Schweizer)
ENVS 122-01C, Tuesday 10:00-11:10 p.m. in ISB 431 (Eshete)
ENVS 122-01D, Tuesday 12:00-01:10 p.m. in ISB 431 (Eshete)

**Class website:** The course website will be hosted on ecommons. Be sure to log on soon – course syllabus, quizzes, assignments, and important links will all be available there.

**Required course resources:**
2. i>Clicker. Available from Bay Tree Bookstore for about $40 (can get used for cheaper)
4. An understanding of basic ecological principles and terms, as you would get in ENVS 24 or Biology 107. You should also have a working understanding of interpreting graphs and interpreting statistics, and basic mathematics like logarithms, exponents, and simple algebra.
Course goals and philosophy
I want to you take several things away from this course. Even if you haven't been to the tropics, you have all seen Discovery Channel-David Attenborough-National Geographic-YouTube videos of amazing natural history moments. We won't ignore the magic of the tropics, but this course is designed to move beyond phenomena and brightly colored red-eyed tree frogs to help you develop a sound background in what is known about the how and why of tropical ecology and conservation. 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. I also 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, and because of the disproportionate amount of research done in the New World tropics, there will be a bit of a bias toward examples from 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. Lectures highlight, expand, and complement the readings in the textbook. We will use i>clickers in class to facilitate discussion and monitor attendance and engagement. Challenge your self, the instructors, and each other to get the most out of the material and think critically about it. No cell phones or internet connection during class. Class is only 70 minutes long – please use the restroom before class to avoid disturbing others.
2. Do the readings from the text before class. To help you with this, you will need to complete on-line quizzes about the readings on eCommons before class on the day readings are assigned.
3. Come to sections well prepared. This is where a lot 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Lecture attendance and participation</td>
<td>10%</td>
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<tr>
<td>Section attendance and participation</td>
<td>10%</td>
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<tr>
<td>On-line quizzes on assigned readings from textbook</td>
<td>10%</td>
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<tr>
<td>Section assignments</td>
<td>10%</td>
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<tr>
<td>2-page analytical brief on a tropical controversy</td>
<td>20%</td>
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<tr>
<td>One midterm exam (Friday 5/4)</td>
<td>20%</td>
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<tr>
<td>One comprehensive final exam (Monday 6/11 7:30 p.m.)</td>
<td>20%</td>
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Lecture attendance and participation (10%). I expect you to attend and participate in lectures. Class begins promptly at 11:00. 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. Attendance at faculty office hours can add up to 2% to your score, up to the maximum 10%. Attendance and participation are recorded based on i>clicker use and vocal participation.

Section attendance and participation (10%). Active, prepared participation in the discussion section groups is essential. Active, constructve participation in discussions and presentations in section is the key element. Regular attendance at TA office hours can add up to 2% to your score, up to the maximum 10%.

On-line quizzes on assigned readings (10%) I expect you to have read and thought about the assigned readings before coming to class. To help you along, there are timed on-line quizzes about major points from the readings on eCommons that must be completed before the class for which the readings are assigned. There are no make-ups on missed quizzes, but you can get full points for this dimension of the class by correctly answering 90% of the questions throughout the
quarter (that means if you miss a quiz or two, you can still get full points for the class). You cannot get more than 10% total for this section, however, even if you correctly answer more than 90% of the quiz questions.

Section assignments (10%) Section assignments range from quantitative worksheets to on-line search exercises to drafting answers to questions about assigned papers. Assignments will be scored on a 2 (full points for a thorough, thoughtful job), 1 (half points for a significant effort but that was missing major components or sloppy work), 0 (none or minimal engagement). Only assignments turned in before section begins can get credit.

Midterm and final exams. There will be a midterm exam (20%) and a cumulative final exam (20%). Materials in lectures, handouts, section assignments, and the textbook are all fair game for the exams. Due to the size of the class these will be primarily multiple choice, short answer, and illustrative graph-type questions. The final exam is Monday 6/11 from 7:30-10:30 p.m. Plan accordingly. I will not give early exams to accommodate your early departure from UCSC.

Two-page analytical brief (20%). The brevity of the written product is not a reflection of how much work this assignment is. The Minister of Tropical Environments has decided to establish research institutes in 10 areas of current controversy; five areas will be on basic ecological/evolutionary questions about tropical systems and five on applied problems. You are asked to identify one current tropical controversy (basic or applied) that you are passionate about, and write a 2-page (single-spaced, 12-point font, 1-inch margins) brief that synthesizes published scientific literature in tropical ecology to help the Minister of the Environment understand the current state of relevant tropical ecological research. You need to use a minimum of four articles from the primary peer-reviewed literature in a significant way, and go beyond just reporting the results to present a clear, coherent, synthetic statement based on your analysis of the research. 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). The complete citation for each article (in the format used in the journal *Ecology*) MUST be included for all citations in a Literature Cited section. Similarly, the in-text citations of the references must follow the style used in *Ecology*.

Late policy and makeups. There are no make-ups for online quizzes. Section assignments will not be accepted after the start of the section at which they are due. If you are ill and cannot attend section, you can email it to the TA before section starts to get credit for having done the work. Five percent will be deducted from the final score for the analytical brief 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 Monday 11 June, 7:30-10:30 p.m. Plan accordingly. Please attend the section in which you are registered; in exceptional circumstances you can arrange with the TAs to join a different section if you are unable to attend your assigned section in a particular week. This should be a rare event, however.

Regrading of papers or exams. We strongly encourage you to come to office hours at any point to talk about things you don't understand, 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 6 hours after receiving the
graded work, and no later than 1 week after receiving it. Only Greg will handle regrades. If there are simple problems with the tally of the scores, you can check with your TA.

**Academic integrity.** I expect you to adhere to the highest standards of academic integrity in this class. 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 violation of academic integrity – this handout will be included in your quizzes and exams. 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)

Obviously, because i>clicker use in lecture constitutes part of the grade, using someone else's i>clicker, or having someone else use yours, are both cheating. If we catch someone doing this, i>clickers will be confiscated and BOTH students will be prosecuted in accordance with UCSC academic integrity rules.

**Returning exams.** If you would like 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.

**Peer-review of analytical brief for extra credit.** You can receive up to 3 points extra credit toward your final course grade (out of 100; e.g., move from B+ to A-) by participating in significant 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. This is the only extra credit.

**Course evaluation extra credit.** Course evaluations are now done through eCommons. They are extremely important to me as a professor that you complete them. I won't be able to see what you put on the evals until after the course grades are in, and I will never know what you wrote (they are anonymous), but I will know if you completed a course eval. You will get 1% added to your course grade for completing the course eval no later that 24h after the end of the final exam.

**Registering your i>clicker** To get credit for your i>clicker responses, you MUST register your i>clicker on line at [http://www.iclicker.com/](http://www.iclicker.com/).
G.S. Gilbert - ENVS122 Tropical Ecology and Conservation Spring 2012

**Lecture topics and assigned readings**

The Readings are required, and will be covered in eCommons quizzes. TE is Kricher's Tropical Ecology; other readings are in Resources on eCommons. There are online quizzes for the reading materials for every lecture except 4/2, 4/4, 5/4, 5/28, 6/6, 6/8

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture</th>
<th>Qz</th>
<th>Readings</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 4/2</td>
<td>Course introduction</td>
<td></td>
<td></td>
<td>Wk 1. No section this week</td>
</tr>
<tr>
<td>W 4/4</td>
<td>What and where are the tropics</td>
<td></td>
<td>TE1; Holdridge 1947</td>
<td></td>
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<tr>
<td>F 4/6</td>
<td>Tropical climate; life zones</td>
<td>1</td>
<td>TE1; avoiding plagiarism; syllabus</td>
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<tr>
<td>M 4/9</td>
<td>Biogeography, plate tectonics</td>
<td>2</td>
<td>TE2</td>
<td>Wk 2. Numeracy and literature</td>
</tr>
<tr>
<td>W 4/11</td>
<td>Evolution: selection, adaptation, speciation</td>
<td>3</td>
<td>TE2; Jiggins 2001</td>
<td></td>
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<tr>
<td>F 4/13</td>
<td>Behavioral ecology of birds (Lyon)</td>
<td>4</td>
<td>TE2; Martin 1996</td>
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<tr>
<td>M 4/16</td>
<td>Climate change, refugia, G.Exchange</td>
<td>5</td>
<td>TE2; Bush 2004</td>
<td>Wk 3. Evolution; Janzen &amp; Martin 1982</td>
</tr>
<tr>
<td>W 4/18</td>
<td>Rainforest structure</td>
<td>6</td>
<td>TE3</td>
<td></td>
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<tr>
<td>F 4/20</td>
<td>Diversity: measures and patterns</td>
<td>7</td>
<td>TE4</td>
<td></td>
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<tr>
<td>M 4/23</td>
<td>Diversity: genesis and maintenance</td>
<td>8</td>
<td>TE4</td>
<td>Wk 4. Diversity; Gilbert et al. 2010</td>
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<tr>
<td>W 4/25</td>
<td>Diversity: genesis and maintenance</td>
<td>9</td>
<td>TE4; Wright 2002</td>
<td></td>
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<tr>
<td>F 4/27</td>
<td>Tropical tree diversity</td>
<td>10</td>
<td>TE5</td>
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<tr>
<td>M 4/30</td>
<td>Forest dynamics</td>
<td>11</td>
<td>TE6</td>
<td>Wk 5. Dynamics; Laurance 2004</td>
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<tr>
<td>W 5/2</td>
<td>Forest dynamics</td>
<td>12</td>
<td>TE6; Ingwell et al. 2010</td>
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<tr>
<td>F 5/4</td>
<td>Midterm exam</td>
<td></td>
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<tr>
<td>M 5/7</td>
<td>Biotic interactions - dispersal, pollination</td>
<td>13</td>
<td>TE7</td>
<td>Wk 6. Interactions; Dyer &amp; Letourneau 1999</td>
</tr>
<tr>
<td>W 5/9</td>
<td>Mimicry and defenses</td>
<td>14</td>
<td>TE8; Analytical Topic DUE</td>
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<tr>
<td>F 5/11</td>
<td>Phylogenetic ecology</td>
<td>15</td>
<td>TE9; Gilbert &amp; Webb 2009</td>
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<tr>
<td>W 5/17</td>
<td>Nutrient cycling</td>
<td>17</td>
<td>TE10</td>
<td></td>
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<tr>
<td>F 5/18</td>
<td>Tropical savannas and dry forests</td>
<td>18</td>
<td>TE11</td>
<td></td>
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<tr>
<td>W 5/23</td>
<td>Ecosystem goods &amp; services (Eshete)</td>
<td>20</td>
<td>TE13</td>
<td></td>
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<tr>
<td>F 5/25</td>
<td>Humans in neotropical forests (Lu)</td>
<td>21</td>
<td>TE13; Lu &amp; Wirth 2011; Lu 2005</td>
<td></td>
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<tr>
<td>M 5/28</td>
<td>Memorial Day Holiday</td>
<td></td>
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<td>Wk 9. No section this week</td>
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<tr>
<td>W 5/30</td>
<td>Forest fragmentation</td>
<td>22</td>
<td>TE14</td>
<td></td>
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<tr>
<td>F 6/1</td>
<td>Tropical forest restoration (Schweizer)</td>
<td>23</td>
<td>Holl et al. 2000 Analytic Brief DUE</td>
<td></td>
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<tr>
<td>W 6/6</td>
<td>REDD Where to?</td>
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<tr>
<td>F 6/8</td>
<td>Critical issues</td>
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<tr>
<td>M 6/11</td>
<td>Final Exam 7:30-10:30 p.m.</td>
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**Required readings from primary literature**


Section assignments
To get credit, section assignments must be submitted on eCommons before the start of the section to which you are assigned. Bring a copy with you to section, because you will be using it there. Written assignments will be graded on a 2 (well done), 1 (done, but could be better developed), 0 (minimal effort or not turned in) basis. Readings from section are fair game for exams, but will not be on quizzes.

Week 1. No sections this week

Week 2. Numeracy and literature. eCommons: numerical quiz. In-section review of reading and thinking about statistics and finding relevant scientific literature.

Wk 3. Evolution; WILL MEET AT THE THIMANN GREENHOUSES, OUTSIDE ON THE ROOF. Readings: Janzen & Martin 1982. eCommons: Write a clear and comprehensive paragraph that describes the process of natural selection. In a second paragraph, provide a convincing argument about why it is essential for all tropical biologists and conservationists to be trained in evolutionary biology. In section: Group discussions of essays and J&M paper.

Wk 4. Measuring Diversity Readings: Gilbert et al. 2010 eCommons: From the reading AND exploring the Center for Tropical Forest Science web site (http://www.ctfs.si.edu/), write a brief essay (~500 words) on one or more questions about tropical forest diversity that can (or has been) addressed using the CTFS mapped plot systems. You should reference at least one publication from the CTFS plots other than Gilbert et al. 2010. In section: Calculations of diversity measures from FERP and BCI plot data.

Wk 5. Dynamics Readings: Laurance et al. 2004 eCommons: Write a 90-second script for a podcast that present the work described in Laurance et al. for a general listening audience. You need to catch their attention, explain the main findings and implication, as well as provide enough description of what they actually did to understand it. In section: Group development and recording of podcast for a general audience.

Wk 6. Interactions Dyer & Letourneau 1999 eCommons: The tremendous diversity of tropical forests creates myriad opportunities for biotic interactions. State a clear question you would like to ask about some specific biotic interaction in tropical forests. Design an experiment to answer your question. In section: Create a group experimental design based on a prompt in section.

Wk 7. Ecophysiology Readings: John et al. 2007; Engelbrecht et al. 2007. eCommons: These papers describe how two kinds of gradients affect the current distribution of species in tropical forests. Write a synthetic paragraph about the importance of these gradients in tropical ecology In section: What other gradients are important in thinking about tropical systems? When is it OK to think about discrete conditions vs. gradients? How can we use gradients in conservation?

Week 8. Bioprospecting / Biopiracy Readings: Kursar et al. 2007; Shiva 2007 eCommons: What role, if any, should biosprospecting take in integrated tropical conservation and development efforts, and why? Support your argument. In section: Panel debate

Week 9. No Sections this week

Week 10. The future of the rainforest Readings: Wright and Muller-Landau 2006; Laurance 2007 eCommons: 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. In section: Panel debate.