

Tropical Ecology and Conservation (Bio 181)

2011 Syllabus and Schedule

Colin Orians

Barnum 203, x7-3543, colin.orians@tufts.edu
Office hours: T 10:30 to noon, or by appointment

Fall 2009 Meeting Time: G+ Block,
Mon 1:30-2:45 in Barnum 113
Wed 1:30-2:45 in Barnum 114

Course Goals: Study the ecology and conservation of the terrestrial tropics, and gain first-hand research experience.

Text: Nature of the Rainforest, Adrian Forsyth, 2008, Cornell University Press, New York.

Optional: Travellers' Wildlife Guides: Costa Rica, Les Beletsky, 2005, Interlink Books, MA.

Reference Texts at Tisch or in my Office:

Carson, W.P. and S.A. Schnitzer. 2008. Tropical forest community ecology. Wiley-Blackwell.
Chazdon, R. and T.C. Whitmore, 2002. Foundations of tropical forest biology. University of Chicago Press.
Janzen, D.H. 1984. Costa Rican Natural History. University of Chicago Press.
Kricher, J. 2011. Tropical Ecology, Princeton University Press.
Leigh, E. G., Jr. 2002. A Magic Web: The tropical forests of Barro Colorado Island. Oxford University Press.
Losos E.C. and E.G. Leigh, Jr. 2004. Tropical forest diversity and dynamism. University of Chicago Press.
McDade, L.A., K.S. Bawa, H.A. Hespenehede, G.S. Hartshorn, eds. 1994. La Selva: Ecology and natural history of a neotropical rain forest. University of Chicago Press.
Montagnini F., C.F. Jordan. 2005. Tropical forest ecology: the basis for conservation management. Springer Berlin
Richards, P.W. 1996. The tropical rain forest, 2nd Edition. Cambridge University Press.
Terborgh, J., ed. 2002. Making parks work: strategies for preserving tropical nature. Island Press, Washington, DC.
Whitmore, T.C. 1998. An introduction tropical rain forests, 2nd edition. Oxford University Press.

Course Requirements and Grading:

- Topic Presentation 20%
- Research Proposal & Presentation 30%
- Daily Article 10%
- Research Reports & Presentations (in Costa Rica) 30%
- Participation 10%

COURSE SCHEDULE

Wk	Date	Topic	Readings
1	W Sept 7	Introduction to course and to biomes of Costa Rica. What is science? Developing Hypotheses in Science	Forsyth: Preface (In class reading)
2	M Sept 12	Tropical Biodiversity	Forsyth: Roots of diversity (1-11); Tails of glory (82-89); The virtues of sloth (142-151); The essence of snake (47-55); Osa (130-141)
	W 14	Evolution of Biodiversity	Forsyth: Rarity (36-45); Hermits & heliconias (100-109); Gentry 1986; Jablonski et al. 2006; Boyce and Lee 2010
3	M Sept 19	Tropical Seasonality	K&T (ch 3); Forsyth: Guanacaste (12-25), Monteverde (56-69); Kreft et al. 2004
	W 21	Resource Limitation in the Tropics	K&T (ch 4, pp 55-71); Forsyth: Salts of the earth (90-99); Termites & Tamanduas (110-117); Wright 1992
4	M Sept 26	Consequences of Resource Limitation to Plants	Fine et al. 2006; Brenes-Arguedas et al. 2009
	W 28	Tisch Library Session (meet in ERC room)	none

5	M	Oct 3	Consequence of Resource Limitation to Animals? Research Proposal: Topic Discussion	Forsyth: Fruits of a reason (70-81); Terborgh 1986; Kaspari & Yanoviak 2001 <i>Oral presentations</i>
	W	5	Tri-trophic interactions in the tropics	Forsyth: The hidden (118-129); Beetle juice (152-161); Augspurger and Kelly 1984; Stireman et al. 2005
6	M	Oct 10	<i>Tufts Monday, no class</i>	
	W	12	Topic Presentation 1. Loss of vertebrate predators: why should we care? Topic Presentation 2. Shrimp farming: direct and indirect effects on mangrove ecosystems	TBA
7	M	Oct 17	Research Proposal: Paper presentations	<i>Peer Review</i>
	W	19	Topic Presentation 3. History of Corcovado National Park: challenges and opportunities Topic Presentation 4. Drug discovery in the tropics	TBA
8	M	Oct 24	Research Proposal: Hypothesis and Rationale	<i>Peer Review</i>
	W	26	Topic Presentation 5. Why should we pay more for organic coffee? Or should we? Topic Presentation 6. GM Soybean in Brasil	TBA
9	M	Oct 31	Amphibian decline (climate change and disease)	Forsyth: Frogs (27-35); Pounds et al. 2006; Siemon et al. 2007; Connolly et al. 2008; Woodhams et al. 2008
	W	Nov 2	Communicating Science/In class write (amphibian decline)	Porder et al. 2004; Rivalan et al. 2007
10	M	Nov 7	Tufts Daily Article (bring draft)	<i>Peer Review</i>
	W	9	Topic Presentation 7. Carbon Sequestration in the tropics: Is it scientifically sound? <i>(due Tufts Daily Article)</i>	TBA
11	M	14	Individual Meetings to Discuss Research Proposal	Open work sessions -- Proposals
	W	16	Agriculture: Traditional vs. Intensified	K&T – ch 8; and ch 9 or ch 10
12	M	Nov 21	Guest Lecture: Selena Ahmed Draft Research Proposal (Optional)	Biocultural diversity and the role of indigenous knowledge, perceptions and practices in tropical conservation
	W		Thanksgiving Break - No Class	
13	M	Nov 28	Tropical Forests & Forestry	K&T (ch 6); TBA
	W	Nov 30	Consequences of Climate Change	Clark 2004; Stireman et al. 2005
14	M	Dec 5	Research Proposal Presentations	
	W	7	Research Proposal Presentations	
15	M	14	<i>(due written proposal)</i>	

Bibliography of Assigned Readings

- Augspurger, C.K., C.K. Kelly. 1984. Pathogen mortality of tropical tree seedlings: Experimental studies of the effects of dispersal distance, seedling density and light conditions. Oecologia 61:211-217.
- Boyce, C.K., J.-E. Lee. 2010. An exceptional role for flowering plant physiology in the expansion of tropical rainforests and biodiversity. Proceedings of the Royal Society B 277:3437-3443.
- Brenes-Arguedas, T., P.D. Coley, T.A. Kursar. 2009. Pests vs. drought as determinants of plant distribution along a tropical rainfall gradient. Ecology 90:1751-1761.
- Clark, D.A. 2004. Tropical forests and global warming: slowing it down or speeding it up. Front Ecol Environ 2:73-80.
- Connolly, S., C.M. Pringle, R.J. Bixby, R Brenes, M.R. Whiles, et al. 2008. Changes in stream primary producer communities resulting from large-scale catastrophic amphibian declines: can small-scale experiments predict effects of tadpole loss? Ecosystems 11:1262-1276.
- Dirzo, R., A. Miranda. 1990. Contemporary neotropical defaunation and forest structure, function and diversity: a sequel to John Terborgh. Conservation Biology 4:444-447.
- Fine, P.V.A., Z.J. Miller, I. Mesones, S. Irazuzta, H.M. Appel, et al. 2006. The growth-defense trade-off and habitat specialization by plants in amazonian forests. Ecology 87:s150-s162.
- Gentry, A.H. 1986. Endemism in tropical versus temperate plant communities. Pages 153-181 in Conservation Biology: The Science of Scarcity and Diversity. Sinauer Associates, Sunderland, MA
- Jabolonski, D., K. Roy, J.W. Valentine. 2006. Out of the tropics: Evolutionary dynamics of the latitudinal diversity gradient. Science 314:102-106
- Kaspari, M., S.P. Yanoviak. 2001. Bait use in tropical litter and canopy ants-evidence of differences in nutrient limitation. Biotropica 33: 207-211.
- Pounds, J.A., M.R. Bustamante, L.A. Coloma, J.A. Consuegra, M.P.L. Fogden, et al. 2006. Widespread amphibian extinctions from epidemic disease driven by global warming. Nature 439:161-167
- Seimon, T.A., A. Seimon, P. daszak, S.R.P. Hallow et al. 2007. Upward range extension of Andean anurans and chytridiomycosis to extreme elevations in response to tropical deglaciation. Global Change Biology 13:288-299.
- Stireman, J.O., L.A. Dyer, D.H. Janzen, M.S. Singer, et al. 2005. Climatic unpredictability and parasitism of caterpillars: Implications of global warming. PNAS 102:17384-17387.
- Terborgh, R.B. 1986. Keystone Plant Resources in the tropical forest. Pages 330-344 in Conservation Biology: The Science of Scarcity and Diversity. Sinauer Associates, Sunderland, MA
- Woodhams, D.C., R.A. Alford, C.J. Briggs, M. Johnson, L.A. Rollins-Smith. 2008. Life-history trade-offs influence disease in changing climates: strategies of an amphibian pathogen. Ecology 89:1627-1639.
- Wright, S.J. 1992. Seasonal Drought, soil fertility and the species density of tropical forest plant communities. TREE, 7:260-263
- Communicating Science*
- Porder, S., Chan, K.M.A. and Higgins, P.A.T. 2004. Scientists must conquer reluctance to speak out. Nature 431:1036.
- Rivalan, P. et al. 2007. Can bans stimulate wildlife trade? Nature 447:529-530

Topic Presentations: (20 minutes/team + 10 minutes for questions) **20% of grade**

In teams of two you will first provide a **reading** for the class to read in advance and then in class you will give an overview of 1) the general problem, 2) the science behind the problem, and 3) the human dimension.

Remember this is a biology course so stay focused on what we can learn from science. At the time of your presentation, you must provide handouts (key points and references cited) at the time of your presentation and turn in an annotated bibliography for six of your sources.

Research Proposal & Presentation: **30% of grade**

In teams of two you will propose a research project that can be done when we are at the La Selva Biological Station or at Corcovado National Park (see suggested topics below). This proposal is not a contract. You may end up modifying the project once you have had a chance to see the sites first-hand.

First, you will identify a topic, do a literature review, gather background information, identify a particular paper, and give a 10 min talk to the rest of the class (**on Oct 20th; 5% of grade**). This talk is intended to focus on the most interesting question that the selected paper addresses. The background information you provide should be very brief and designed to explain why you think the question is so interesting. Then focus on 1 or 2 tables and figures that address that question. End with a suggestion for further research (Hypothesis and Rationale)

Second, you will write and present a research proposal. For this, you will familiarize yourselves with the methods employed by researchers in the field and adapt them to your problem. This is essential if you are going to design your own experiment. You will give a 20-minute oral presentation (**week of Dec 8th or 10th; 10% of grade**) that gives an overview of your topic, explains why it is interesting and significant, and describes the methods you plan to employ. You will then hand in a written proposal (**due Dec 14th; 15% of grade**). The written proposal should be 8-10 pages in length and must cite at least 7 primary references.

Journals/Article: **10% of grade**

You will use a journal or notebook for in-class writing assignments, for peer review and to make notes about your readings, and during the trip to Costa Rica. I will not read your journals.

As scientists we also need to learn to communicate our science to the general public. How do you convince the public to care enough to take action? You will each write an article on a topic of your choice, in the form of a "Features" article for the Tufts Daily (**due Nov 19th**). I encourage you to submit them to the Daily.

Costa Rica Trip: **30% of grade**

The trip begins on Dec. 30th and ends on January 14th. We will travel to the Atlantic lowlands (La Selva Biological Station), Pacific lowlands (Sirena-Corcovado National Park) and to the highlands (Copey de Dota). At the two lowland locations you will complete your independent research projects and at the highland site you will write your final report, meet with local farmers and visit a coffee plantation.

Participation: **10% of grade**

This is a seminar and thus its success depends upon class participation. Thus, you are expected to express your thoughts and ideas when we discuss readings. I may call on you individually if I have not heard from you.

Possible Research Topics that focus on seasonality or nutrients

(Topics in bold and example questions below)

To find a topic that interests you, I suggest you browse books and recent publications in *Biotropica* or *Journal of Tropical Ecology* or other ecological journals..

Below are some general ideas and a list of previous projects is on the next page

- **Biodiversity of plant types (shrubs, vines, epiphytes, bromeliads, ant plants, trees with buttresses, etc.)**
e.g., Are understory shrubs more dominant at one location or the other? Does the ratio of epiphytes to vines differ?
- **Frequency of stress adaptations in plants (thick succulent leaves, long-lived leaves, drip tips, sunken stomata, bark that repels vines, wood anatomy, etc.)**
e.g., Are thick (or succulent) leaves more common at either site?
- **Abundance of seedlings, saplings and trees of a focal plant species**
e.g., Are saplings more clumped at Sirena? If so, does this influence the density of adult plants?
- **Biodiversity of animals (ants, moths, herbivores, spiders, soil invertebrates, lizards, insectivorous birds, etc.)**
e.g., Does seasonality affect patterns of herbivory/herbivore abundance? Does predator abundance follow a similar pattern? Are insects that use phytotelmata less common/diverse at Sirena?
- **Behavioral Ecology**
How do baits differ in their attractiveness to flies, butterflies, rodents, etc. between the two sites?
- **Behavioral ecology of ants (leaf-cutting or predatory ants)**
e.g., Do leaf-cutting ants use a greater diversity of resources at Sirena? Do leaf-cutter ant colonies, on average, travel longer distances to find adequate resources at Sirena?
Does resource limitation influence interactions among ant species? Are ants at resource-limited sites more omnivorous?
- **Plant-animal interactions**
e.g., Are hummingbirds or hummingbird-pollinated plants less common at either site?
- **Plant defense strategies**
e.g., Are leaves/plants more heavily defended at La Selva or Sirena? Are ant-plant mutualisms more common at either site?

Alternatively you could focus on some other key difference between the sites and focus on that factor

Previous Projects

2009

- Territorial aggression and antipredator response in male anole lizards (genus *Norops*) in seasonal vs. non-seasonal environments (Hillevi Jaegerman and Titania Ng)
- Sexually dimorphic avoidance behavior of UV-B radiation in two leaf litter species of frog (*Oophaga pumilio* and *Eultheradactyls stejnegerianus*) in Costa Rica (Anne Madden and Laura Sloan)
- Variations in herbivore pressure between two Neotropical rain forest sites and across multiple ontogenetic stages in *Piper reticulatum* (Ann Gisinger and Joshua Gordon)
- The stability and structure of avian frugivorous groups and the effect of group size on frugivore vigilance behavior (Christine Lattin and Gautam Surya)
- Salt limitation of tropical ants (Family Formicidae) in a biogeographical context (Jessica Oh & Emily Wier)
- Testing for island biogeographic principles in phytotelmata communities (Tegan Morton and Adam Steinbrenner)

2007

- The effect of human development on differential defaunation and seed removal in two Neotropical forests (Alyssa Corbett & Kelley Smith)
- Effects of Seasonality on the Constitutive Defense Evolution of Myrmecophytic Piper *cenocladum* and Acacia *allenii* Compared to Non-Myrmecophytic Piper *reticulatum* (Daniel Resnick and Jessica Small)
- Chemical defenses of epiphyllous lichens and liverworts against leaf cutter ant herbivory of *Cyclanthus bipartitus* (Colleen Butler and Patricia Dao-Tran)
- Avian body plan design: Are migrant bird species adapted for life in tropical rainforests? (Sophia Kostelanetz and David DesRochers)
- Understory terrestrial pteridophyte distribution patterns along a topographic slope in Costa Rica (Judy Winglee and Carrie Jones)
- The effect of environment on sugar, protein and salt limitation in *Pheidole* and other Neotropical ants (Alexander Keyel and Susan Weiner)

2005

- The effect of solute and nutrient concentration on invertebrate abundance in phytotelmata communities (Minda Berbeco and Elyse Archila)
- The effects of rainfall and seasonality on epiphyte community composition (Aditya Nochur and Jocelyn Muller)
- Assessing the effects of land use on water chemistry in Costa Rica (Karen Kesler and Ayron Strauch)
- Abundance and diversity of Neotropical-nearctic migrants wintering in two Costa Rican reserves (Stower Beals and Nicole Cyr)
- A comparative study of ant recruitment induced through the application of cues associated with herbivory in two facultative and two obligate ant-plant associations (Jeffrey Longcor and Nadaa Taiyab)
- The impact of tropical land crabs (*Gecarcinus quadratus*) on the relative abundance of local invertebrate communities (Holly Hendrickson, Tim Manning and Lisanne Petracca)

2003

- Ant Wars: Research Proposal for a Study on Kin Recognition in the Ant Genus *Azteca* (Adam Siegel and Kathryn Williams)
- Escape from horticulture: A look at pollinator visitation, herbivory rates and abundance of an introduced invasive ginger, *Zingiber spectabile* compared to native spiral gingers near Wilson Botanical Garden at Las Cruces Biological Station Costa Rica (Monisha Sharma and Tara Bledsoe)
- Can the Amino Acid Composition of Nectar Explain Flower Preference in *Heliconius* Butterflies? (Peter J. Clark, Jodi M. Gilman, and Margaret S. Keeler)
- Olfactory and visual/echolocational cues in local foraging behavior by nectarivorous bats (Andrea Morehouse and Karen Alroy)
- Mantled Howler Monkeys: Reactions to Predation, Territorialism (Erin Allweiss and Emily Morrison)