Biology Foreign Studies Program (Bio 55,56,57): Winter 2015
Course description and grading policy

Instructors: Matt Ayres, Hannah ter Hofstede, Brad Taylor

Graduate TAs: Carissa Aoki, Tom Kraft

Textbooks: *Tropical Nature* by A. Forsyth and K. Miyata (Charles Scribner's Sons, NY)
The Tapir's Morning Bath by Elizabeth Royte (Mariner Books)
Neotropical Companion by John Kricher (Princeton University Press, 2nd ed., 1997).
A Guide to the Birds of Costa Rica by Stiles and Skutch (Cornell University Press)
Costa Rican Natural History, edited by D.H. Janzen, University of Chicago Press.
A Field Guide to Coral Reefs: Caribbean and Florida. Roger Tory Peterson. 1982.
Reef Fish Identification: Florida, Caribbean, Bahamas. Humann and DeLoach. 2002.
Reef Fish Behavior: Florida, Caribbean, Bahamas. DeLoach and Humann. 1999.

Meeting times: Various sites in Costa Rica (5 Jan - 17 Feb). See schedule.
Little Cayman Research Center (18 Feb - 9 March). See schedule.

Course website: www.dartmouth.edu/~biofsp

Ecological Research in the Tropics I and II (Bio 55 and 56)
The Biology Foreign Studies Program (Biology 55, 56, 57) exposes students, through intensive, full-immersion study, to Earth's most diverse biological communities. Biology 56 is a continuation of Biology 55; these courses comprise the first two-thirds of the FSP, and focus on land (tropical forests) and tropical freshwater ecosystems in Costa Rica. Biology 57 focuses on coral reef ecosystems in the Caribbean. Students are challenged to know, understand and appreciate the diversity of form and function in organisms, and the interactions that generate the often-spectacular patterns they see in the field. Habitats in Costa Rica include lowland rain forest (La Selva and Corcovado), cloud forest (Monteverde), dry forest (Palo Verde and Santa Rosa), pre-montane wet forest (Las Cruces), montane forest (Cuerici), alpine paramo, streams, and wetlands. The schedule is full, including fieldwork, laboratories, lectures and discussions, with emphasis on original research, mostly in small groups of 2-3. Faculty and advanced graduate TAs share field accommodations with students and are in continuous contact as mentors throughout the program. Students master field and analytical methods (including hypothesis testing, statistical and software skills) for observational and experimental research. We pursue a great variety of research topics, including plant-pollinator and plant-herbivore interactions, processes driving coral reef structure (and coral reef decline), determinants of species distributions, animal behavior, and conservation ecology. Students practice contemporary scientific inquiry: making observations, asking testable questions, generating hypotheses, developing experimental protocols, collecting data, making statistical inferences - including multi-model comparisons, writing scientific papers, and presenting seminars. Research papers are published in an annual book. Accommodations are at field stations in Costa Rica, and at a marine laboratory in the Caribbean.

Ecological Research on Coral Reefs (Bio 57)
Field and laboratory investigations of marine organisms and coral reef communities. A continuation of Bio 55 and 56 above. Lecture and research topics include studies of algae, aquatic plants, invertebrates, and fish, with emphasis on populations, species interactions, community structure and energetics, and reef conservation and management. The course is based at the Little Cayman Research Center, Little Cayman Island. Scuba diving is optional.

Prerequisite: Bio 16; one course from among Bio 20-28, 31; acceptance into program. Bio 15 and 29 recommended.

Grading policy: Grades are based on the quality of research projects (including seminar presentations and resulting manuscripts); development of skills in natural history; development of skills in research design, statistical analyses, and strong inference; and development of skills as collaborators within research work groups.

Students with disabilities are encouraged to discuss them with the staff so that appropriate accommodations can be made.

Bio FSP 2015. Detailed schedule for Costa Rica. 20 December 2014.

Date	Day	Location	Morning	Afternoon	Evening
5-Jan	Mon	To San Jose	Travel	Travel	Arrive in evening
6-Jan		In San Jose	OTS, Program overview	San Jose exploration	Group dinner in SJ
7-Jan		To Palo Verde	Travel to Palo Verde	Orientation. Research tactics 1	**Lec: Intro CR ecol (MA, AD).** Nightwalk
8-Jan		At PV	Orientation. Vert Lab (TK)	Tactics 2: questions. Arthrod lab (CA).	Tactics 2: Hypotheses & predictions
9-Jan		At PV	FIP-1 (ant-acacia)	Plant lab (CA). FIP-1 research	**Lec: Primatesl (TK, BB)**.
10-Jan		At PV	FIP-1 research	Tactics 3: Statistics (TK). FIP-1 research	Tactics 4: Theories & context.
11-Jan	Sun	At PV	FIP-1 research	Writing lab 1 (MA). FIP-1 analyses	FIP-1 symposium. FIP-1 MS v01 due
12-Jan		At PV	SIP-1 plan/proposals	FIP-1 v02 due. SIP-1 pilot studies	**Lec: DivCoex (MA, BG).** Writing lab 2
13-Jan		At PV	SIP-1 research	FIP-1 v03 due. SIP-1 research	SIP-1 revised proposals. Nightwalk
14-Jan		At PV	SIP-1 research	SIP-1 research	Data analysis. FIP-1 MS filed.
15-Jan		At PV	River trip	SIP-1 symposium. SIP-1 v01 due	Writing: SIP-1 v02
16-Jan		To Santa Rosa	Travel/walk	Orientation. Sea Turtles (MA)	Field: Sea turtle nesting
17-Jan		At SR	Orientation. Mangroves (CA)	Exploration. Disc: Purpose of science?	Field: Sea turtle nesting
18-Jan	Sun	To Monteverde	Travel	Orientation	Writing: SIP-1 v03
19-Jan		At MV	Orientation	SIP-2 planning	SIP-2 proposals. SIP-1 MS filed.
20-Jan		At MV	SIP-2 pilot & proposals	Hummingbird garden. SIP-2 research	SIP-2 refined proposals
21-Jan		At MV	SIP-2 research	SIP-2 research	**Lec: Ecosystems (MA, DCS)**
22-Jan		At MV	SIP-2 research	Bat jungle. SIP-2 research	**Lec: Avian Ecol (MA,JL)**
23-Jan		At MV	SIP-2 research	Cerro exploration. SIP-2 research	Data analyses
24-Jan		At MV	Analysis & writing	SIP-2 symposium. SIP-2 v01 due.	Peer review. SIP-2 v02
25-Jan	Sun	At MV	Revisions. SIP-2 v03 due.	Cloud forest recon. SIP-2 v04 due.	Revisions. SIP-2 filed.
26-Jan		To Cuerici	Travel to San Jose	Travel to Cuerici; Orientation	**Lec: Coevol 1 (MA, KK)**
27-Jan		At Cuerici	Orientation	SIP-3 planning / proposals	**Lec: Coevol 2 (HtH, FE)**
28-Jan		At Cuerici	SIP-3 research	SIP-3 research	Theories in EEB
29-Jan		At Cuerici	SIP-3 research	SIP-3. Data analyses	SIP-3 symposium
30-Jan		To La Palma	Exploration at Cuerici	Travel to La Palma	Sirena preparation
31-Jan		To Sirena	Hike to Sirena	Hike to Sirena	Natural history reports from hike
1-Feb	Sun	At Sirena	Orientation	SIP-4 plan	**Lec: Social insects (TK)**
2-Feb		At Sirena	SIP-4 pilot & proposals	SIP-4 research	**Lec: Bats (HtH)**
3-Feb		At Sirena	SIP-4 research	SIP-4 research	**Lec: Plant-Herb (CA)**
4-Feb		At Sirena	SIP-4 research	SIP-4 research	**Papers (PG, MS, AZ)**
5-Feb		At Sirena	SIP-4 research	SIP-4 analyses & context	SIP-4 symposium.
6-Feb		To Las Cruces	Hike out of Sirena	Travel to Las Cruces	Orientation.
7-Feb		At Las Cruces	Writing SIP-3. Botany.	SIP-3 v01 due. Botany.	Writing SIP-4.
8-Feb	Sun	At Las Cruces	Writing SIP-4. Botany.	Writing. Botany practicum.	SIP-4 v01 due.
9-Feb		To La Selva	Travel	Travel	**Lec: Behav 1 (HtH, LY)**
10-Feb		At La Selva	Orientation	SIP-5 plan/pilot	SIP-5 proposals. Night walk
11-Feb		At La Selva	SIP-5 research	SIP-5 research	**Lec: Behav 2 (HtH, MV)**
12-Feb		At La Selva	SIP-5 research	SIP-5 research	**Paper (AL).** SIP-5 analyses
13-Feb		At La Selva	SIP-5 research	Agroecology field trip	**Lec: Cons Bio (CA, PS)**
14-Feb		At La Selva	SIP-5 research	SIP-5 analyses & context	SIP-5 symposium.
15-Feb	Sun	At La Selva	Writing SIP-5 v01 due.	SIP-5 v02, v03, filed.	Final deadline for Costa Rica papers
16-Feb		To Miami	Travel to San Jose	Travel to Miami	
17-Feb		To Little Cayman until 9 March March			

* FIP & SIP = Faculty initiated research project, Student initiated research project: MS v01, v02, etc. = manuscript version 1, version 2, etc.

STUDENT PAPERS FOR BIO FSP 2015, COSTA RICA AND LITTLE CAYMAN ISLAND

What are the properties of a high-impact research paper in ecology and evolutionary biology? How can one distill the most interesting and important parts of an intellectually rich research paper so that colleagues can appreciate the value with only a few minutes of explanation? As part of our activities in Costa Rica and in Little Cayman Island, each of you will be given about 20 minutes of undivided attention from your colleagues to rock their world with a scintillating synthesis from you, customized for them, of a high quality paper that we have chosen for you. Look up your paper in the accompanying table and find the pdf in the accompanying zip file (papers for Little Cayman will be delivered later). Generally, the papers are associated with a lecture on the same topic, and generally the lecture will precede your presentation. So your audience will be warmed up.

We are sure you will want to read your paper for Costa Rica carefully before the program begins and your paper for Little Cayman before arriving in Little Cayman. The table is in the approximate order that your presentations will occur. Plan on about 12 minutes for your presentation, leaving about 8 minutes for the rich and sophisticated discussion that you will inspire. You will have a few minutes ahead of time to sketch some simple visual aids on the whiteboard that will be there.

<u>Here are some tips.</u>
Take notes as you read the papers and bring questions ahead of time to the cognizant staff person regarding logic, technical approaches, vocabulary, relevant natural history, implicit theoretical models, etc. Also talk with the staff person about what will be in the lecture that precedes your presentation so that you will know what necessary background will and will not have already been covered.

Take full advantage of knowing your audience. Help them connect your paper (beyond what the author could have possibly done) to your shared experiences on the program. Think broadly about how to start and end your presentation to grab the attention of your audience and later to leave them with new and lasting intellectual awareness. If you start and end your presentation as the authors have done with their paper then you have missed the opportunity to connect with your audience.

Organize your presentation to powerfully and efficiently communicate the most interesting single result from the paper. Of course you have to first decide what that is yourself. But here is one criterion. For results to be interesting, there has to have been at least one other way that the research could have turned out. Often it is powerful to sketch for your audience a very simple data figure, or schematic of the underlying theoretical model and explain it. With a good visual aid, you can easily sketch an alternative version showing a different possible result that could have been obtained and use this to help your audience appreciate how the core conclusions from the paper (presumably highlighted in the abstract) would have been different if this alternative result had been obtained. Note that the best visual aids for this purpose usually cannot be drawn directly from the paper (where figures and tables are designed to present detail and to be studied at length) and generally need to be simplified from data presentations in the paper. Use your creativity as well as your intellect to imagine different possible versions of simple visual aids and pick the ones that will work best for your audience. Finally, prepare in advance a short list of 2-3 thought provoking questions that you can use to stimulate discussion.

Synthesize. Your aim is not to replicate the structure and detail of the paper by laboriously going through the introduction, methods, results, etc. Instead, extract the important information and develop a presentation that will engage and inform your colleagues.

1) What was the topic or key question being addressed in the study? Why is this topic interesting or important (to understanding tropical biology, ecological theory, and/or for conservation or management?) Seek to relate the broad questions and objectives of your paper to shared experiences with your FSP colleagues.
2) What hypotheses (explicit or implicit) were tested and what experimental design(s) was used? Were there competing hypotheses? Then, succinctly, what were the findings and conclusions?
3) Your analysis. What are the strengths and weaknesses of the paper? Is the logic sound? Were the hypotheses well formulated and the tests crisp? Were the original questions answered? Summarize what was accomplished and what remains to be investigated.
4) Make sure you understand the figures and tables.
5) To be sure, your task is to present a critical review of the paper, but this DOES NOT MEAN that your goal is to be particularly critical of the paper. You need not come up with a laundry list of ways the paper could have been improved. Rather, the *critique,* is an analytical one as described in points 1-4 above.

#	Site	Lecture	Student	Student Paper	Staff
1	PV	Intro CR Ecol	Ann	McCain, C. 2009. Vertebrate range sizes indicate that mountains may be 'higher' in the tropics. *Ecology Letters* 12:550-560. (*See also: Janzen, D. H. 1967. Why mountain passes are higher in the tropics. *American Naturalist* 101:230-243.)	Matt
2	PV	Primate Ecol	Becca	Fedigan, L. M., and K. Jack. 2001. Neotropical primates in a regenerating costa rican dry forest: A comparison of howler and capuchin population patterns. *International Journal of Primatology* 22:689-713.	Tom
3	PV	Diversity & Coexistence	Brad	Janzen, D. H., and P.S. Martin. 1981. Neotropical anachronisms: the fruits the gomphotheres ate. *Science* 215:19-27.	Matt
4	MV	Ecosystems	David	Higgins S. I., and S. Scheiter. 2012. Atmospheric CO2 forces abrupt vegetation shifts locally, but not globally. *Nature* 488:209-212.	Matt
5	MV	Avian Ecol	Jenny	McDonald, D. B., and W. K. Potts. 1994. Cooperative display and relatedness among males in a lek-mating bird. *Science* 266:1030-1032.	Matt
6	Cuer	Coevol 1	Kyle	Ramirez, S. R., T. Eltz, M. K. Fujiwara, G. Gerlach, B. Goldman-Huertas, N. D. Tsutsui, and N. E. Pierce. 2011. Asynchronous diversification in a specialized plant-pollinator mutualism. *Science* 333:1742-1746.	Matt
7	Cuer	Coevol 2	Fredrik	Herre, E. 1993. Population-structure and the evolution of virulence in nematode parasites of fig wasps. *Science* 259:1442-1445.	Hannah
8	Corc	Social insects	Peter	Wray, M. K., H. R. Mattila, and T. D. Seeley. 2011. Collective personalities in honeybee colonies are linked to colony fitness. *Animal Behaviour* 81:559-568.	Tom
9	Corc	Bats	Miranda	Knörnschild, M. et al. 2012. Bet echolocation calls facilitate social communication. *Proccedings of the Royal Societ*y B 279: 4827-4835.	Hannah
10	Corc	Plant-Herbiv interactions	Amy	Kursar T. A., et al. 2009. The evolution of antiherbivore defenses and their contribution to species coexistence in the tropical tree genus *Inga. PNAS* 106:18073-18078.	Carissa
11	LaSelv	Behav 1	Leehi	Suselbeek, L. et al. 2014. Food acquisition and predator avoidance in a Neotropical rodent. *Animal Behaviour* 88: 41-48.	Hannah
12	LaSelv	Behav 2	Michael	Irwin, D. E. et al. 2001. Speciation in a ring. *Nature* 409: 333-337.	Hannah
13	LaSelv	Wild card	Abby	Mendenhall, C. D. et al. 2014. Predicting biodiversity change and averting collapse in agricultural landscapes. *Nature* 509: 213-217	Hannah
14	LaSelv	Cons. Biology	Patrick	Becker, C. G., K. R. Zamudio. 2011. Tropical amphibian populations experience higher disease risk in natural habitats. *PNAS* 108:9893-9898.	Carissa

STUDENT-LEAD DISCUSSION PAPERS FOR LITTLE CAYMAN, BIOLOGY FSP 2015

Student	Lecture	Paper
Abigail I. Leibowitz	Zooplankton	Heidelberg, K. B., K. P. Sebens, and J. E. Purcell. 2004. Composition and sources of near reef zooplankton on feeding. Coral Reefs 23:263-276.
Amy Zhang	Fish biology	Miller, G.M., S. Watson, S., J.M. Donelson, M.I. McCormick, P.L. Munday. 2012. Parental environment mediates impacts of increased carbon dioxide on a coral reef fish. Nature Climate Change 2: 858-861.
Rebecca Burten	Fish biology	Gerlach, G., J. Atema, M. J. Kingsford, K. P. Black, and V. Miller-Sims. 2007. Smelling home can prevent dispersal of reef fish larvae. Proceedings of the National Academy of Sciences of the United States of America 104:858-863.
Bradley Garczynski	Fish behavior	Grutter, A. S., J. M. Murphy, and J. H. Choat. 2003. Cleaner fish drives local fish diversity on coral reefs. Current Biology 13:64-67.
David Clemens-Sewall	Seagrass beds	Tewfik, A., J. Rasmussen, and K. S. McCann. 2005. Anthropogenic enrichment alters a marine benthic food web. Ecology 86:2726-2736.
Fredrik Eriksson	Coral biology	Wild, C., M. Huettel, A. Klueter, S. G. Kremb, M. Y. M. Rasheed, and B. B. Jorgensen. 2004. Coral mucus functions as an energy carrier and particle trap in the reef ecosystem. Nature 428:66-70.
Yuying Liu	Mangroves	Mumby, P. J., A. J. Edwards, J. E. Arias-Gonzalez, K. C. Lindeman, P. G. Blackwell, A. Gall, M. I. Gorczynska, A. R. Harborne, C. L. Pescod, H. Renken, C. C. C. Wabnitz, and G. Llewellyn. 2004. Mangroves enhance the biomass of coral reef fish communities in the Caribbean. Nature 427:533-536.
Kyle Kittelberger	Invertebrates	Carpenter, R. C. and P. J. Edmunds. 2006. Local and regional scale recovery of *Diadema* promotes recruitment of scleractinian corals. Ecology Letters 9:268-277.
Leeha Yona	Sponges	De Goeij, J.M., D. vab Oevelen, M.J.A. Verimeij, R. Osinga, J.J. Middelburg, A.F.P.M. de Goeij, W. Admiraal. 2013. Surviving in a marine desert: the sponge loop retains resources within coral reefs. Science 342: 108-110.
Michael Vestergaard	Coral bleaching	Grottoli, A.G., L.J. Rogriguez and J.E. Palardy. 2006. Heterotrophic plasticity and resilience in bleached corals. *Nature* 440: 1186-1189.
Miranda Stein	Fish ecology	Allgeier, J. E., C. A. Layman, P. J. Mumby, and A. D. Rosemond. 2014. Consistent nutrient storage and supply mediated by diverse fish communities in coral reef ecosystems. Global Change Biology.
Patrick Saylor	Herbivory	Dixson, D. L., D. Abrego, and M. E. Hay. 2014. Chemically mediated behavior of recruiting corals and fishes: A tipping point that may limit reef recovery. Science 345:892-897.
Peter Geithner	Coral disease	Patterson, K. L., J. W. Porter, K. E. Ritchie, S. W. Polson, E. Mueller, E. C. Peters, D. L. Santavy, and G. W. Smiths. 2002. The etiology of white pox, a lethal disease of the Caribbean elkhorn coral, Acropora palmata. Proceedings of the National Academy of Sciences of the United States of America 99:8725-8730.