



Organization for Tropical Studies

Fundamentals of Tropical Biology in Costa Rica

Summer Study Abroad Program - Syllabus

Course Description

Understanding the dynamics of tropical ecosystems is paramount to modern societies facing global change. The tropics contain the regions most threatened by deforestation and land-use change, and tropical regions play a major role in preventing biodiversity loss and sequestering greenhouse gases. One major challenge for tropical biology is to understand the complexity of tropical ecosystems and their internal processes, and to elucidate general patterns of multiple species interactions in a heterogenous landscape. This course will take advantage of Costa Rica's unique diversity of species, topography, climate and soils to study multiple ecosystem types, such as seasonally dry, lowland wet, montane and cloud forests. You will also study ecosystem processes and services, using Costa Rica's unique environmental history to glimpse into the future of conservation challenges here. Finally, this course will use a hands-on methodology while students reside in three OTS field stations (La Selva, Las Cruces, and Palo Verde), interact with resident and visiting experts, take part in field trips to other relevant sites and develop an independent research project.

Goals

1. Understand the key ecological mechanisms determining biodiversity, ecosystem function and landscape heterogeneity in tropical habitats.
2. Elucidate how tropical ecosystems influence global dynamics of biodiversity loss, land conversion and climate change, and how their conservation and management in Costa Rica can lead to different sustainability scenarios for society.
3. Underscore the relevance of tropical ecosystems for understandings the consequences of global change, by using the scientific method to conduct research and use of multiple communication skills to connect that science to society.

Specific Objectives and Skills

By the end of the semester, students will be able to:

1. Recognize the key biotic and abiotic interactions determining tropical ecosystem processes, identify the most common plant and animal taxa, and understand their natural history within an ecological and evolutionary context.
2. Characterize landscape patterns of climate, topography and soil diversity that are linked to different ecosystem types in Costa Rica, and distinguish among different lowland, montane, wetland and coastal/marine ecosystems, while highlighting their specific characteristics and variability related to successional dynamics.
3. Identify key ecological processes and ecosystem services, such as biodiversity and soil conservation, cycling of water, and nutrient, sequestration of greenhouse gases, provision of food and materials, and zoonoses control.
4. Identify the impact of human-ecosystem interactions in tropical regions and provide specific cases of how climate change, deforestation, pollution, and human demographics impact their conservation, restoration, and sustainable use in Costa Rica.
5. Use the scientific method for conducting original research (e.g. field observations, hypothesis formulation, methods design, data collection and analysis, communication).
6. Learn and practice how to use interpersonal skills for discussing and communicating science with peers and to broader audiences.

Course modality

This course can be offered in two different modalities:

1. As an **In-Person (P)** class that will take place in Costa Rica.
2. As a **Hybrid/Blended (HB)** with both in-person and online components. Classes will not meet in person for all scheduled meetings. At least 25% of mandatory instruction for the class will occur in person.:

Course structure

The course will be divided in modules, each centered at a particular OTS station/location:

The **first module** will include the orientation sessions (including the description of the course objectives and milestones) and will cover introductory topics about Costa Rican biogeography,

conservation history and future challenges. Most of this phase will be based in San José, specifically at the **OTS-Costa Rica Office** at the University of Costa Rica campus, but some other visits may be included to relevant sites in the Central Valley.

After the first module, the course will move in turn to each of the three OTS field stations, to study the different aspects of biodiversity and ecosystem function of three different ecosystems of Costa Rica. While we visit each principal site, we will also explore other ecosystems to have a more comprehensive understanding of Costa Rica's landscape diversity, including major ecosystem types, soils and dominant vegetation. In this module, the students will also be presented with the guidelines of the course projects.

The **second module** will include time at **Palo Verde Biological Station**, in the dry forest of northwest Costa Rica, where we will study dry forest biodiversity, focusing on subjects of plant-animal interactions, mutualism/antagonism and coevolution. The Palo Verde experience will also include studying the ecology and management of tropical wetland ecosystems.

The **third module** will take place at **La Selva Biological Station**, in the humid tropical rainforest ecosystem of the northeast Caribbean lowlands. We will take advantage of La Selva rainforest's biodiversity and its history in scientific research to delve into the subjects of tropical biodiversity and biological research. In this module, we will also introduce the fundamentals of experimental design and statistical analysis we will require for the rest of the course.

For the **fourth module** the course will move to **Las Cruces Biological Station** in the humid montane forests of southeast Costa Rica, where we will study the biodiversity of tropical pre-montane forests and montane cloud forests. Because of Las Cruces' longstanding research in secondary succession, forest fragmentation and conservation biology, we will use the site to study aspects of forest restoration. This module also includes the final project presentations.

The course will meet back at the OTS office in San José for course wrap-up and evaluations.

Course Grading

Grades in this course are based on written assignments, research talk readings, general participation, and the independent and group projects. Class participation is based on attendance, completion of assignments, positive contributions to discussions and lectures, ability to work well with peers, and demonstration of academic initiative and enthusiasm in the field as well as in the classroom.

Activity	% Final Grade
Written Assignments	25
General Participation	20
Independent Project	30
Group Project	25

Assignments

Students will have a series of assignments as defined by course and invited professors during site visits, field trips and invited lectures. These assignments will consist of diverse activities ranging from short field projects to discussions of scientific articles about the course topics. By means of these assignments the students will practice abilities for developing scientific experiments (including data collection, analysis, and interpretation), and for understanding, integrating, and interpreting relevant primary literature.

General Participation

Participation includes attendance of lectures, workshops and field trips, positive contributions to discussions and lectures, listening to others, and demonstration of academic initiative and enthusiasm in the field as well as in the classroom. Participation will also judge how students conduct fieldwork as part of the modules and as directed by invited and course professors.

Student Projects

Following the applied and hands-on style the course will be based in two student projects, and **independent field research**, and a **group project**.

Independent field project

Students will continuously practice the initial phases of conducting a field research project during our “20 questions” activity. Here they will spend one hour in the field and generate 20 questions, for which they will develop their hypotheses and the experimental design to test each one of them. Each student will then select one question to develop and conduct a short research project in the field. They will take and analyze the data, present their results to the group and write up a short report in the format of a scientific article.

Group project

The Organization for Tropical Studies is a worldwide leader in tropical biology, with a long history in research, education and outreach in Costa Rica. During its five decades of continuous activity, OTS developed several research and outreach programs in diverse subjects that made significant contributions to science, conservation, environmental management and education. Some of these science programs (e.g. ALAS, TEAM, CARBONO, STREAM, ECOS, BOSQUES, etc.) were supported by a series of long-term research projects at the three OTS field stations, focusing on diverse subjects such as systematics, biodiversity monitoring, biogeochemical cycling, stream ecology, natural succession, wetland ecology, forestry, and plant-animal interactions. The students will organize in groups to investigate the history of any of these subjects at OTS, including a description of the projects involved, their scientific findings and published information, and their contributions to both the scientific, local and international communities. The groups will use bibliographic resources available in the databases and OTS libraries, and will have access to resident scientists and field personnel for additional information. The faculty in the course will

provide sufficient guidance to choose the different science program subjects and for gathering the information. The students will present their findings to the rest of the class in a formal presentation series at the end of the course.

Course Faculty

The course faculty will consist of a course coordinator and an assistant, together with the contributions of invited professors, guest lecturers, local experts and stakeholders.

Course Schedule*

A detailed calendar with topics, instructors, and meeting times will be presented at the beginning of the course and of each module. However, scheduling is subject to change due to unforeseen circumstances typical of a field course (e.g. weather, last-minute cancellations, etc.). Meeting locations will be specified upon arrival at each site.

Module (Site)	Topics and Activities
1 - San José	Visit to the OTS office Orientation and Introduction to the program. <u>Lectures:</u> - Costa Rican Natural History, Biogeography - Background and future challenges of Costa Rican environmental science and management - History and contributions of OTS to tropical biology and conservation Visit to nearby academic/environmental institutions Explanation of projects (independent and group projects) Organization of groups and project logistics Selection of program subjects for group projects; project resources Lecture on scientific research and communication
2 - Palo Verde	<u>Palo Verde topics:</u> - Introduction to dry forest and wetland dynamics - Plant-animal interactions: Mutualisms, antagonisms and coevolution - Birds, insects, and herps of the dry forest - Wetland Ecology and Management - Water Conservation in the dry tropics - Ecotourism and conservation Implementation of '20-question activity' for independent projects

3 - La Selva	Scientific method workshop Discussion of independent projects: questions, hypotheses & exp. design <u>La Selva topics:</u> <ul style="list-style-type: none"> - Factors affecting biodiversity - Concepts and importance of biodiversity; Origins and maintenance of biodiversity - Introduction to lowland tropical forests - Mammals, herps, birds, insects and plants of the lowland tropics - Forest Ecology and Biogeochemistry: coupled carbon, water and nutrient cycling; stream ecology. Climate Change and Tropical Forests
4 - Las Cruces	<u>Las Cruces topics:</u> <ul style="list-style-type: none"> - Introduction to montane tropical forests - Plant and animal ecology in high elevation forests - Secondary succession - Conservation: restoration, fragmentation, biological corridors Group Project Presentations
5 - San José	Group Project Presentation Course Wrap-up and presentation of independent projects Course evaluation (end of week)

Course Bibliography (not required):

Reference Book:

Costa Rican Ecosystems. 2017. Ed. Maarten Kappelle. University of Chicago Press. 744 p.

Reference Articles:

Silva et al. 2013. Response of an old growth tropical rainforest to transient high temperature and drought. *Global Change Biology* 19:3423-3434.

Breeze et al. 2011. Pollination services in the UK: How important are honeybees? *AgriEcosystEnv* 142:137-143.

Brosi and Briggs. 2013. Single pollination species losses reduce floral fidelity and plant reproductive function. *PNAS*. 110(32):13044-13048.

Enquist 2002. Predicted Regional Impacts of Climate Change on the Geographical Distribution and Diversity of Tropical Forests in Costa Rica. *JBiogeog.* 29(4):519-534.

Guimaraes et al 2008 Seed Dispersal Anachronisms: Rethinking the fruit extinct megafauna ate. *PlosOne* 3(3):e1745.

Janzen & Martin. 1982 Neotropical anachronisms: the fruits the gomphotheres ate. *Science* 215:19-27.

Kricher, J. 2017, *The New Neotropical Companion*.

Lamarre et al. 2014 Leaf synchrony and insect herbivory among tropical tree habitat specialists. *Plant Ecology* 215:209-220.

Memmott et al. 2007 The Conservation of Ecological Interactions. In Stewart A. J. A. et al. (eds) *Insect Conservation Biology*, Chapter 10. pp. 226-244.

Siikamaki et al. 2012. Global economic potential for reducing carbon dioxide emissions from mangrove loss. *PNAS* 109(36):14369-14374.

Primary literature and review articles are also assigned throughout the course. A schedule of reading assignments is provided at the beginning of the semester. Readings take two forms: those that are intended to reinforce class material by presenting the subject in a different framework, and those that are intended to complement and add to material presented in class by expanding on a particular topic.

Ancillary course Rules

Grade conversion table

Course grade (%)	Letter grade
93-100	A
90-92.99	A-
87-89.99	B+
83-86.99	B
80-82.99	B-
77-79.99	C+
73-76.99	C

Statement of Accessibility

This class represents an environment that is open and welcoming to all students. If you believe you may need accommodations during the class that may not traditionally be available, please contact Brooks Bonner (brooks.bonner@tropicalstudies.org) in the North American Office prior to the start of the course with a request for accommodation. Once the course has begun, please notify any of the instructors or teaching assistant to plan a way to meet these needs within the potential logistical restrictions posed by a field course. Please communicate with us openly and recognize that accommodations are collaborative efforts between students and faculty.

Statement of Expectations for Student Conduct

We expect you to conduct yourself in a professional, honest, and ethical manner. As such, you will be held to the highest standards regarding academic integrity. Academic dishonesty includes: lying (communicating untruths or misrepresentations); cheating (using unauthorized materials, information, or study aids); fabrication (falsifying or inventing information); assisting (helping another commit an act of academic dishonesty); tampering (altering or interfering with evaluation instruments and documents); plagiarism (representing the words or ideas of another person as one's own); and stealing (appropriating the property of another without permission).

Additional Policies & Procedures

The Organization for Tropical Studies complies with and will comply with all applicable federal, state, and local laws, regulations and guidelines.

American with Disabilities Act

“The Organization for Tropical Studies does not discriminate on the basis of an individual’s disability and complies with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act in its admission, accessibility, treatment and employment of individuals in its programs and activities. OTS provides academic adjustments and auxiliary aids to individuals with disabilities, as defined under the law, who are otherwise qualified to meet the institutions academic and employment requirements. For more information, visit or call the Center for Students with Disabilities. For more information on OTS policies and services to students with disabilities, please contact the North American Office.

Additional Notes on Academic Dishonesty

Academic dishonesty (i.e. plagiarism, cheating) will not be tolerated. Any person suspected of academic dishonesty will be subject to disciplinary action.

Statement on Plagiarism

Plagiarism is defined as taking the words or ideas of another person and using them without citation as though they were your own. As such, acts of plagiarism include using song lyrics, words from an interview, words or ideas from a conversation or in-class discussion, words from a lecture by a professor, jokes from a comedian, or lines from a movie or dramatic play. Other sources of plagiarism will be articles from peer-reviewed journals, news sources, books, or magazines, in a scholarly work of your own without crediting their place or person of origin. In this class, students will be expected to properly cite all sources from which words, information, and ideas in their papers come, including quotation marks for precise wording and in-text citations for all ideas, as well as a full bibliography at the end of the paper. As we will be using APA style, please consult the APA website, <http://www.apastyle.org/>, for specific instructions on proper citation.

According to the OTS policy on plagiarism, students found to have plagiarized in classwork or written assignments will be given a grade of “F” for the paper on which they have been found to have plagiarized and may be subject to an official investigation of their academic honesty by OTS. This investigation, even if the student is found to have been innocent, will be permanently documented on the student’s record. If you are uncertain about the citation criteria for an idea in your paper, please see the instructor and ask before submitting. Your honesty is greatly appreciated and will serve you in the rest of your life!

Class Attendance & Authorized/Religious Absences

Regular and punctual attendance is expected. Attendance begins on the first day of class. Attendance is taken every class period. Class attendance is essential for participation, performance, and intellectual progress. Attendance is generally an indication of how serious of a student one is, and will most likely account for the success, or lack of success, of a student. In this class, attendance is a symbol of participation, which represents part of your grade. Notes taken during class will enhance that physical presence by allowing you to capture essential information, meaning, and details of the course. OTS authorized absences and religious absences are provided in accordance with OTS policy and state law.

Acting Responsibly

Please remain respectful of others’ time. Turn off cell phones, let others speak, and be on time to class, field trips, and activities. Tardiness is inconsiderate and unacceptable. Please let us know if you will not be able to make it to class. It is your responsibility to obtain notes from a classmate for any missed time. Also, please mind your food and drinks. Avoid creating disruptions related to eating/drinking during class or other activities. Avoid spills, crumbs, etc. and clean up after yourself immediately. Remove any trash you or others create. Finally, an essential element to successful class meetings is your preparation. Please read and complete assignments on time and be prepared for class participation and discussion. We will do everything in our power to provide you with a positive and inclusive learning environment and will guide and assist you in your learning experience. However, ultimately, your education is your responsibility. Please take this responsibility seriously.