



Organization for Tropical Studies

Tropical Biology on a Changing Planet in Costa Rica

Undergraduate Semester Program

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Faculty

Two senior academics and a teaching assistant

- A senior academic with a PhD and teaching experience in relevant fields to lead the Fundamentals of Tropical Biology module (will work together with the other OTS academic staff to coordinate the Field Skills Module).
- A senior academic with a PhD and teaching experience in relevant fields to lead the Conservation in Action module (will work together with the other OTS academic staff to coordinate the Field Skills Module).
- A teaching assistant, preferably with an MSc.

Outside service providers will be hired to run the homestays and language courses. Invited lecturers and local stakeholders also participate in the course.

Module 1. Fundamentals of Tropical Biology

Course Description

This experiential learning course allows students to explore tropical biology by engaging in scientific res. Lectures, workshops, and field trips in some of the most diverse ecosystems on the planet. Students will come to recognize ecological processes and patterns through research and exploration of a wide variety of Costa Rica's ecosystems, including lowland tropical forests, tropical dry forests, cloud forests, paramo, and wetlands. By moving through these diverse habitats, students will learn how biomes and ecosystems are shaped by geology, climate, and biotic interactions. Observing each field site with a keen ecological perspective will afford students a unique opportunity to become versed in top-down and bottom-up forces shaping tropical ecosystems.

There will be a strong emphasis on classic ecological theory and the fundamentals of Tropical Biology, and we will discuss global and local patterns of diversity, abiotic and biotic ecosystem processes, species interactions (pollination, symbioses, predator-prey, plant defenses), community ecology, ecosystem functioning, patch dynamics, gap dynamics, niche-theory, and plant- and animal life-histories. Classroom instruction will provide a foundation for understanding field-based observations and will include lectures given by resident and visiting professors, and discussions of assigned readings.

Fieldwork is a central component of the course. During the semester, the course visits OTS research stations as well as other sites. Field orientation at each site includes the identification and natural history of important plant and animal species. Orientation activities also serve to stimulate the reasoning of making questions that students may address in subsequent student-led research projects, via student-driven learning. Students will also systematically document biodiversity to advance from basic observations to gain skills relevant to conservation and ecology.

Learning objectives and skills

At the end of the course, students will be able to:

- Identify and understand key processes influencing biodiversity and ecosystem dynamics in terrestrial tropical habitats;
- Distinguish among different tropical ecosystems and identify the key characteristics of lowland wet forest, dry forest, cloud forest, wetlands, and paramo;
- Understand the principles of ecological succession and gap dynamics in tropical ecosystems;
- Understand the basic natural history of important plant and animal taxa in each of the ecosystems visited

Selected readings

- Janzen. 1983. Costa Rican Natural History. University of Chicago Press.
- Sapp, J. 2016. Coexistence: The Ecology and Evolution of Tropical Biodiversity. Oxford University Press.
- Beyond Paradise—Meeting the Challenges in Tropical Biology in the 21st Century

Course Evaluation

	% Final Grade
Long-term Research Project (LRP) (Research paper 20%, Poster 10%)	30
Final Research Project	40
Exam	30

Long-term Research Project

OTS contributes to conservation and science in Costa Rica by conducting iterative research on topics that are relevant to park agency science managers. Therefore, there is a pre-existing list of projects (and associated methodologies) for you to choose from. In groups of 3 to 5, select one project that is of particular interest to you and work with a faculty member to refine the question and methodology. You will then conduct the fieldwork and data analysis and produce a report and a **poster** to relay your findings: The report should be roughly 2000-2500 words in length and follow the OTS Instructions to Authors document. The draft must be handed in separately and should include adequate referencing (minimum of 10). **Posters** will be marked on content, structure, and the use of visual techniques to portray your findings and key messages.

Final research projects

Students will design, implement, analyze, and write-up a final capstone project in small groups. Four days will be spent in data collection and four days will be spent in analysis and writing. In

the final **paper**, ten peer-reviewed sources should be cited, appropriate statistics should be presented, and informative figures should be included.

Exam

There will be one exam toward the end of the semester. It will cover material presented in class, readings, during laboratories, activities, and field trips. Exam questions may take a number of formats but are typically short-answer questions. The exam is intended to encourage students to review the information presented and demonstrate an understanding of ecosystem principles and patterns of biodiversity.

Participation

Participation includes attendance of lectures, workshops, field trips, completion of assignments, 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.

Module 2. Conservation Action in the Tropics

Course Description

In this module, students will focus on issues affecting the natural environment in Costa Rica and the tropics more broadly. This module will begin with a history of Conservation Biology, including threats to biodiversity, elements of conservation planning, environmental policy, and understanding the conflicts that have arisen due to increasing demands by people on nature. There will be a strong emphasis on problem-solving and finding sustainable solutions to complex modern conservation problems, such as human-wildlife conflict, climate change, alien invasives, overharvesting, disease control, and restoration. Students will become deeply engaged in social and scientific analyses of environmental conservation through the lens of pertinent, timely subjects affecting natural resource management and conservation. The restoration processes that have been going on at Las Cruces and La Selva Research Stations will expose the students directly to the dynamism of restoration ecology. Through Las Cruces and La Selva, as case studies view, students will learn which methodologies have worked so far and which ones have not, all being upported by data-driven solid results and conclusions. Parallel to these immersive case studies the social and political history of Costa Rica will provide the backdrop for these analyses, as well as serve as a platform from which students will discuss tropical ecosystem management and the global environment. The purpose of being on-site where restoration projects are, alongside the study and analysis of other global and local issues on the matter is to put in perspective all the parties involved in actual and ongoing conservation projects. To link the social aspects and results with the ecological basic research and how new technologies are been incorporated into the projects in order to maintain their sustainability through time as new challenges arise.

Case studies will focus on restoration and governance in Las Cruces and the vicinity, as well as the impact of La Selva projects on national policies, and all the parties involved (stakeholders, conventions, and treaties). The students will link the research projects and scale up from local to global conservation issues in developing countries make relations with similar issues in their hometowns. They will do it by addressing natural resource management, sustainability, green energy, and climate change adaptation. Other themes for the case studies include the disconnection between human society and the natural environment, linking threats to individual action, carbon footprints, waste management, resource economics, and impact at a distance.

As in all OTS courses, active learning will be based on field trips, discussions, lectures by resident faculty, and invited experts. Students will be provided with relevant background readings from texts and peer-reviewed papers to prepare them for field trips and discussions. Field trips will include visits to banana and coffee plantations, managed wetlands, forest fragments, private farms, national parks, and reserves. To strengthen retention and demonstrate knowledge, students will give presentations (at least one presentation will be in Spanish, to the best of students' ability) and write an analysis paper of an environmental issue they observed in Costa Rica.

Learning objectives and skills

Through issues-based learning students will:

- Understand the historical and social context of environmental planning and conservation actions in Costa Rica and the tropics broadly
- Understand the major threats to tropical biodiversity and ways in which they may mitigate these threats, and how all the parties tend to be involved in a conservation program of any kind
- Understand the application of ecological principles to restoration
- Understand practical issues affecting the management of diverse ecosystems in Costa Rica and the tropics using case studies at each research station e.g.
- Understand the relationship between agroecology and the conservation of biodiversity in the tropics
- Understand global environmental issues through examples relevant to Costa Rica and the tropics
- Understanding of conservation in a cultural context “Science & Society” – local and cultural considerations.

Selected readings (a more complete list of readings will be provided in the course syllabus)

Roberts and Thanos. 2003. *Trouble in Paradise: Globalization and Environmental Crises in Latin America*. Routledge.

Romero and West. 2005. *Environmental Issues in Latin America and the Caribbean*. Springer Science & Business Media.

Sodhi and Ehrlich. 2010. *Conservation Biology for All*. Oxford University Press.

Download electronic copy at <https://conbio.org/publications/free-textbook/>

Course Evaluation

	% Final Grade
Field Faculty Project	35
Final exam	20
Conservation seminar	20
Popular article	15

Exam

There will be a final exam in which students will demonstrate knowledge of environmental issues in the tropics by answering a series of essay questions. Questions will draw from field trips, readings, lectures, and course discussions.

To develop public speaking skills and encourage deeper analyses of environmental issues, students will work in pairs to give a 15-minute oral analysis of an environmental topic affecting Costa Rica and the global community. Students will draw from observations and readings to discuss local and global aspects of the selected issue and will then open the floor to the class for solutions-orientated brainstorming. Students will give a summary version of the presentation in Spanish.

Science communication: Popular Article

Communicating science to a non-scientific audience is increasingly important. After three field trips (students may select any of the three field trips), students should write a brief (one-page)

summary of the topics covered and their own observations and reactions with the aim of presenting critical information to the broader public. Students may opt to write these reactions in Spanish to continue practicing their language skills.

Participation

Participation includes attendance of lectures, workshops, and field trips, completion of assignments, positive contributions to discussions and lectures, respectful listening to peers, and demonstration of academic initiative and enthusiasm in the field as well as in the classroom.



Module 3. Field Research in Tropical Biology

Course Description

This course has a strong focus on developing skills in natural history, biodiversity studies, and the basics of field research. Students are introduced to an ecological “toolbox” for developing and answering ecological and conservation questions. Through an understanding of natural history, students will build up to learning ecological principles. Students will gain an appreciation for the diversity of species interactions in the tropics historically and in the face of global change. They will also study restoration ecology and gain an understanding of issues affecting ecological integrity in a landscape context.

Field Research in Tropical Biology will prepare the students to face their advances toward graduate school or careers in the natural sciences, not only with skills but also by boosting their confidence in doing science in the field. Through conducting research at OTS stations and other field sites in Costa Rica, students will gain invaluable experience in tropical biology. Students will participate in the entire scientific process by learning to ask appropriate questions, develop relevant hypotheses, design robust methods for their questions, analyze data, write scientific reports, and give research presentations. They will be mentored in research by invited experts and will take part in a variety of formative projects, gaining skills applicable to future work in ecology and conservation.

The course is based on two types of projects that build students up to the goal of conducting independent, yet collaborative research. One of the major benefits of an OTS education comes from developing networks with other tropical biologists, and students’ participation in faculty-led field projects (FFPs), is the basis of this. Students will have the unique experience to conduct research with invited experts who will guide them in addressing a pertinent ecological question. Under the mentorship of the invited faculty, students will work in small groups to design and complete a short study. There will be multiple such projects throughout the term, and students should assist in the fieldwork of all of these projects to broaden their experience, but they will only need to write a report for one project. Students will also give a presentation on their project to the class.

After building skills in the FFPs, students will complete a small group research project. They may work in groups of up to three people. These projects will be completed at La Selva Biological Station. Under the mentorship of course faculty, students will work through the entire scientific process, from hypothesis conception to analysis and write-up. Students will also present their work in a research symposium for the class and invited guests at the end of the term.

The research involved in the course requires students to develop statistical analysis and scientific writing skills. Targeted exercises will help students practice analysis and writing prior to turning in reports. Students will also participate in discussions of the ethical issues that often surround scientific research, emphasizing topics relevant to working in the tropics.

Learning objectives and skills

At the end of the course, students will:

- Be competent in conducting research following the scientific method
- Conduct biodiversity surveys and carefully document and analyze the diversity of key taxa
- Good practices in science – ethical considerations, publishing, communication, animal rights
- Be familiar with a variety of key methods in ecological research
- Be able to design appropriate studies, taking into consideration replication and analysis
- Use and interpret statistical analyses and make inferences from observations
- Write effective scientific papers
- Present research in scientific symposia
- Collaborate effectively, including coordinating activities, dividing responsibilities, and integrating multiple perspectives
- Understand ethical issues pertinent to conducting research at national and international levels

Selected readings

Ambrose and Ambrose 1987. *A Handbook of Biological Investigation*. 4th edition. Hunter Textbooks.

Minteer and Collins. 2005. Why we need an “ecological ethics”. *Frontiers in Ecology and the Environment* 3:332-337.

Zar. 2010 *Biostatistical Analysis*. 5th Edition.

Calvin Dytham 2011. *Choosing and Using Statistics: A Biologist's Guide*. Blackwell.

Course Evaluation

	% Final Grade
Statistical exercises	10
Writing workshop	10
Faculty-led projects	30
Capstone project	35

Statistical exercises

In-class exercises will prepare students to determine appropriate statistical analyses and analyze ecological data using R Software. Focal analyses include chi-squared tests, t-tests, ANOVA, regression, and multivariate analyses.

Writing workshop

In groups, students will conduct a small research project and independently write a short scientific paper. The class will also discuss the writing and format of published papers. Ample feedback will be provided by the course instructors to help students develop their writing skills.

Ecology proposal

Students will design an ecological study according to their knowledge and interests, and write a research grant proposal (modelled on a real grant application) that includes relevant background, hypotheses, methods, and expected results. Detailed formatting guidelines will be provided, but students should expect to include 10 peer-reviewed citations and focus on pertinent questions and a strong experimental design.

Biodiversity Survey / Natural history assignments

Students will work in small groups to conduct biodiversity surveys. Focal taxa will include vascular plants, Lepidoptera, birds, and mammals in primary and secondary forest. Groups will participate in data collection for all taxa and the final products will include (1) An herbarium collection, (2) a Lepidoptera collection, (3) a list of observed birds, (4) IDed photos of mammals recorded by camera traps, and (5) a brief report with calculations of diversity for all taxa in primary and secondary forest.

Faculty-led projects

Students are expected to participate in fieldwork for all faculty-led field projects (FFP). In groups, students will analyze and write-up just one of the FFPs. Ten peer-reviewed sources should be cited, appropriate statistics should be presented, and informative figures should be included. Students will turn-in a draft for comments before turning-in their final papers. The component grades are the following: Participation (5%), Scientific Paper (written as group paper, 15%) and an oral presentation of the work conducted by (10%).

Research presentations

Students will present their FFPs and capstones in class research symposia to develop their speaking skills and practice giving scientific presentations. Presentations will run for 12 minutes with 3 minutes for questions. The FFP presentations will be graded, but the final presentations are not graded as they are meant to be a show-casing of the students' efforts.

Ethics seminar

The ethics seminar is designed to introduce students to some of the philosophical, political, and practical issues that surround scientific research. During the first weeks of the program, students choose a topic with faculty guidance (e.g., "the ethics of experimental methods," "scientists as policy advocates"). Students then work in small groups to find case studies relevant to the topic and to develop a 15-minute presentation that summarizes the case studies. They then lead the class in a 45-minute discussion of the topic.



Module 4. Culture and Language in Costa Rica

Students will be assessed and qualify for one of (a) beginner, (b) intermediate, or (c) advanced Spanish, and will spend three weeks in intensive Spanish classes while living with a Costa Rican host family in San José. Language learning will focus on expanding vocabulary and conversational skills and strengthening grammar. Students will experience key social, cultural, and environmental issues in Costa Rica. Classes will be taught solely in Spanish. Informal learning will encompass music, theatre, authentic Costa Rican cuisine and Tico dancing.

Learning objectives and skills

During this module, students will:

1. Receive 60 hours of Spanish instruction;
2. Gain Spanish proficiency in a variety of professional and personal scenarios;
3. Build familiarity with Costa Rican culture, history and sociology.

Instructors

Classes are taught by Cost Rican Language Academy (CRLA) teaching staff, accredited by the Costa Rican Department of Education. Instructors hold degrees in Spanish, Education, Linguistics or Philology, from either the University of Costa Rica or the Universidad Nacional.

Textbooks

- For beginner students: ¿Todo bien? 1. Student's book 2018 by CRLA.
- For intermediate students: ¿Todo bien? 2. Student's book 2022 by CRLA.
- For advanced students: ¿Todo bien? 3. Student's book 2022 by CRLA.

Selected material will also come from current social, cultural and environmental issues in Costa Rica.

Course Evaluation

Class participation and homework

Attendance is obligatory. Students will be graded based on their active, dynamic and creative participation in all classroom activities (reviews, presentations, oral exercises, reading). Students will have homework every day. It will include grammar exercises, bibliographic research, newspaper readings and short interviews.

Oral presentation

Students will be evaluated according to depth, vocabulary, lack of repetition, grammar, structure, noun and verb agreement, pronunciation, intonation and fluency.

Composition

Students will be expected to demonstrate knowledge acquired, including grammatical structure and vocabulary. Students will be allowed to choose composition topics from a list provided by the professor.

Final exam

At the end of the course, students will complete a final exam over all of the material covered. It will include grammar, reading, auditory, writing and oral exercises and will last approximately 2.5 hours.

Grading

	% Final Grade
Class participation	30
Homework	25
Oral presentation	10
Composition	10
Final exam	25

Course details

Beginner's level

This course introduces elementary Spanish. The primary objective is to offer students the opportunity to acquire communication skills in “survival Spanish.” Functions include asking/giving directions, using appropriate greetings, introductions, and courtesy expressions as well as being able to communicate in different social situations such as visiting a bank, restaurant, or other public places. Students should be able to give their personal information and talk about personal preferences and activities. Students will practice grammar rules within the context of specific themes chosen to enhance students’ familiarity of daily customs.

Intermediate level

This course covers most grammatical structures which will give students the tools needed to achieve more confidence when using the language. Student will learn these grammatical structures while improving vocabulary, pronunciation, comprehension, as well as written and oral skills. At this level students learn to use different compensation strategies to communicate their ideas when they do not know the exact structure or word that should be used. Students will also be able to hold conversations on various subjects with native Spanish speakers, using the appropriate forms for each situation. This course emphasizes cultural aspects of the language.

Advanced level

This course focuses on advanced Spanish grammar. Students will begin to handle complex syntactical and morphological structures. In addition, students will converse about current topics using a higher level of complexity and abstract thought to improve fluency. This level includes cultural, social, and historical aspects of different Spanish speaking countries to explain the relationship between language, history, and culture. The course includes an historical background of Latin America and continues with an overview of different cultural manifestations: art, literature, music, traditions, and customs. Short stories, articles, and essays, followed by class discussions are used to cover the content of the course. Works by Costa Rican and other Latin American writers will be introduced to discuss social change and identity.

Ancillary Course Rules

Grade conversion table

Course (%)	grade	Letter grade
97-100		A+
93-96.99		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. The University of Connecticut's policies can be found here: <https://accessibility.uconn.edu/policies/>

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.