CIEE Monteverde, Costa Rica

Course title: Tropical Community Ecology
Course code: ECOL 3001 MVCR
Programs offering course: Tropical Ecology and Conservation
Language of instruction: English
U.S. semester credits: 4
Contact hours: 60
Term: Fall 2020

Course Description

This course explores the variety of tropical communities, how they are organized, how they function and how they are compromised by human activity. Students will build a tropical community from the ground up, both theoretically and through direct experience and experimentation in the field. They will learn to define the Tropics based upon global climate patterns, to know why tropical forests are productive despite poor soils, how plants adapt to live according to their growth form, how energy flows through Tropical communities and what this tell us about their organization and stability, the many ways species interact and how this impacts ecosystem function. Students contrast intact and human-transformed Tropical communities and assess how they are different structurally and understand how this can lead to loss of function. Ecosystem functions that are vital to human wellbeing are explored. Finally, students will extrapolate these issues to conservation and how to lessen human impact on Tropical communities.

Learning Objectives

By completing this course, students will:

- Understand fundamental ecological concepts, particularly those related to Tropical Ecosystems and how the Tropics are different from Temperate and Boreal forests.
- Appreciate the full range of variation in Tropical communities, where this variation comes from and how it impacts structure, function and conservation of these communities.
• Critique models of Tropical Conservation and how likely these are lessen human impact.
• Merge Language, Culture and Ecology to construct a more holistic conservation ethic.
• Tackle the biological complexity of Tropical communities, more fully appreciate their importance and forge a stronger and more effective resolve to save them.

Course Prerequisites

One year of Introductory Biology and one elective in whole organismic biology or conservation.

Methods of Instruction

Students will attend lectures and related activities. Lectures will emphasize theory and current empirical patterns. Students will read and analyze current literature. In addition, students will travel and spend extensive time in the field in different ecosystems to understand the impact of climate on their composition, structure and function. Faculty-led, short experiments in groups will emphasize patterns of diversity and species interactions.

Assessment and Final Grade

1. Midterm Exam 25%
2. Final Exam 40%
3. Written Field Report 15%
4. Oral Field Reports 15%
5. Participation 5%
   TOTAL 100%

Course Requirements

Midterm Exam

The midterm exam will include True/False, Multiple Choice, Short and Long Answer formats for material covered in lecture or in readings. These will cover objective, factual information.

Final Exam
The final exam will include True/False, Multiple Choice, Short and Long Answer formats for material covered in lecture or in readings. These will cover objective, factual information.

Written Field Report

One short experiment will result in a field report, which is written as manuscript in the style of a short note in a scientific journal. This will be no more than three pages in length and will include cited literature, data analysis, presentation and interpretation.

Oral Field Reports

Short field experiments on topic of species interaction, behavioral ecology, etc. Will require an oral presentation with specific grading rubrics. The student will be graded on how well they present and explain the project: justification, study question, methods, results and conclusions.

Participation

Students are expected to attend all lectures and activities, hand in all assignments, as well as ask questions and participate in discussions. Only students who are active participants will receive full credit. Perfect attendance and handing in all assignments will result in 3 of 5 points. To earn beyond 3 points, students must engage fully in all lectures, activities, and discussions.

Attendance

Regular class attendance is required throughout the program, and all absences will result in a lower participation grade for any affected CIEE course. Due to the intensive schedules for Open Campus and Short Term programs, absences that constitute more than 10% of the total course will result in a written warning.

Students who transfer from one CIEE class to another during the add/drop period will not be considered absent from the first session(s) of their new class, provided they were marked present for the first session(s) of their original class. Otherwise, the absence(s) from the original class carry over to the new class and count against the grade in that class.
For CIEE classes, excessively tardy (over 15 minutes late) students must be marked absent.

Attendance policies also apply to any required co-curricular class excursion or event, as well as to any required field placement. Students may not miss placement/work hours at an internship or service learning site unless approved in advance by the Academic Director and placement supervisor. All students must complete all of the requisite 100 minimum work hours on site at the internship or service learning placement to be eligible for academic credit.

Students who miss class for personal travel, including unforeseen delays that arise as a result of personal travel, will be marked as absent. No make-up or re-sit opportunity will be provided.

Attendance policies also apply to any required class excursion, with the exception that some class excursions cannot accommodate any tardiness, and students risk being marked as absent if they fail to be present at the appointed time.

Absences for classes will lead to the following penalties:

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<thead>
<tr>
<th>Percentage of Total Course Hours Missed</th>
<th>Minimum Penalty</th>
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<tr>
<td>Up to 10%</td>
<td>Participation graded as per class requirements</td>
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<tr>
<td>10 – 20%</td>
<td>Participation graded as per class requirements; 3% grade penalty &amp; written warning</td>
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<tr>
<td>More than 20%</td>
<td>Automatic course failure, and possible expulsion</td>
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N.B. Course schedule is subject to change due to study tours, excursions, or local holidays. Final schedules will be included in the final syllabus provided to students on site.

Weekly Schedule

Week 1

Class Orientation; Field Trip 1 (Survey of Seasonal Tropical Ecosystems)


Activities:

Outings in Paramo, Mangroves, Lowland Wet Forest.

Field Experiments: Diversity and Species Interactions. Statistical analyses.

Discussion:

Current State of Tropical Forests

Readings:

Malhi et al. (2014)

Janzen and Martin (1981)

Assessments:

Oral report on field experiment due

Week 2

Class Field Trip 1, continued

Activities:

Outings in Lowland Moist Forest, Lowland Dry Forest

Field Experiments: Diversity and Species Interactions. Statistical analyses.

Readings:

Seddon et al. (2014)

Corlett (2012)

Assessments:

Written field report assigned (not due)

Week 3

Class

Defining and Distinguishing between Ecological Communities

Lecture: How to define ecological communities and distinguish between tropical communities. Hierarchy of biological organization, community assembly rules, stochastic vs. deterministic effects, empirical patterns, Tropical forests vs. temperate forests.

Activities:

Field experiments: Diversity and Species Interactions. Statistical analyses.

Readings:

Gillespie (2004)

Fayle et al. (2015)

Assessment:

Written field report due
Week 4
Class Global Climate and Ecology

Lecture: Global Climate: Impact in Defining the Tropics and Tropical Community Types. The impact of Earth’s relationship with the sun on global rainfall and seasonality, windward/leeward effects, Costa Rican and Monteverde weather, el Niño and global warming effects, Holdridge Life Zone Classification System.

Activities:

Weather activity

Field Experiments: Diversity and Species Interactions. Statistical analyses.

Readings:

Corlett (2014)

Brodie et al (2012)

Olson et al. (2001)

Assessment:

Oral field report due.

Week 5
Class The Paradox of Tropical Luxuriance

Lecture: The paradox of tropical luxuriance. The causes and consequences of Tropical soil composition and fertility, plant responses and sustained high productivity, mycorrhizae, likelihood of sustainable agriculture in the tropics.

Activities:
Soil analyses

**Readings:**

Townsend (2008)

Mann (2002)

Nadeau and Sullivan (2015)

**Week 6**

**Class** Movement of Matter and Energy through Tropical Communities

Lecture: How energy moves, how much is captured, trophic relationships, food webs, that matter is finite and is recycled, major biogeochemical cycles, how cycles are disrupted by humans.

**Readings:**

Laurance, et al. (1997)

Bello et al. (2015)

Poorter et al. (2016)

**Week 7**

**Class** Plant Growth Forms

Lecture: Plant growth forms: their ecology and physiology. Identifying and defining growth form: understory, subcanopy, canopy, lianas, vines, epiphytes, hemi-epiphytes, epiphylls. Abiotic differences experienced by different growth forms, morphological and physiological adaptations

**Activities:**

Plant growth form presentations

**Readings:**
Rundel and Gibson (1996)
Valladares et al. (2002)
Collins et al. (2015)

Assessment:
Midterm exam

Week 8
Class  Field Trip 2
Community assemblages and ecological relationships in Atlantic Slope Forests and Caribbean Marine ecosystems
Activities:
Hikes in Atlantic Slope Forest

Week 9
Class  Field Trip 2 (continued)
Community assemblages and ecological relationships in Atlantic Slope Forests and Caribbean Marine ecosystems
Activities:
Hikes along Caribbean coastal ecosystems
Swim in coral reefs in Bocas del Toro

Week 10
Class  Gap Dynamics and Natural Succession in Tropical Forests
Lecture: How a gap forms, gap size distribution and frequency, succession in gaps, who wins a gap, the random walk to extinction.
Readings:
Brokaw and Busing (2000)

Chazdon (2008)

Hunter et al. (2015).

Week 11
Class Introduction to Species Interactions.

Lecture: Species interactions in the tropics and beyond: Mutualism, Commensalism, Parasitism, Predation, Neutralism, Ammensalism, Competition

Readings:

Janzen (1983)

Schoener et al. (2005)

Bregman et al. (2015)

Lecture: Herbivory and Plant Defenses in Tropical Forest. Defining and quantifying herbivory, how the tropics differ from temperate forests in amount and type of herbivory, physical and chemical plant defenses and their impact on herbivores, mimicry and coevolution.

Readings:

Hunt (2003)

Fine et al. (2004)

Salazar and Marquis (2012)

Leal et al. (2014)

Week 12
Class Pollination and Seed Dispersal
Lecture: Pollination and Seed Dispersal: Payoffs of both partners, optimal outcrossing distances, morphological, physiological and behavioral changes, density-dependent mortality, impact on gene pool and distribution, disruption by humans and associated problems.

Readings:

Mawdsley, et al. (2008)
Wang and Smith (2002)
Betts et al. (2015)
Bruna (1999)
Hamilton (1999).

Topic: Seasonality. Patterns related to seasonality in flowering and fruiting, underlying reasons and consequences to mutualistic partners.

Readings:

Sakai (2001)

Week 13
Class Disturbance, Biodiversity and Community Stability

Lecture: How high biodiversity in Tropical communities impacts its stability, including resistance to invasion, resistance, resilience, robustness, redundancy, Portfolio Effects, increase in function with biodiversity, loss of biodiversity and its impact on stability.

Readings:

Zavaleta et al. (2009)
Lewis (2009)
Basic and Blummenthal (2005).
The Future of Tropical Forests and How to Save Them

Lecture: The Future of Tropical Forests and How to Save Them. Personal behavior vs. government policy, regeneration and restoration, the importance of reserves, the place humans have in an intact ecosystem, the future, where to go with the knowledge gained on the program, how to make difference.

Readings:

Wright (2005)
Laurence (2005)
Tabarelli et al. (2012)
du Toit et al. (2004)
Wilson (2000)
Orr (2004)

Assessment:

Final exam

Course Materials

Readings

- PNAS, 112: 3433.