



FUNDACION CENTRO DE ESTUDIOS INTERAMERICANOS, CEDEI
ENV 330 TROPICAL ECOLOGY

Tropical ecosystems are the world's most species-rich and are characterized by a complexity of species interactions and specializations. They include tropical rainforests, tropical dry forests, savannas, deserts, tropical mountains, lakes and rivers, mangrove forests and coral reefs; they protect watersheds and soil, moderate local and global climate, act as carbon reservoirs, provide sources of new medicines and agricultural products and are home to many indigenous cultures. These ecosystems, and the multitude of unique species they support are threatened by increasing human populations and activities.

This course will provide students with a general overview of tropical ecology, with an emphasis on the neotropics. We will first define the tropics geographically and discuss the abiotic factors that give rise to different types of tropical ecosystems. We will examine the evolutionary and ecological factors that have led to the extraordinary species diversity of tropical regions that has fascinated and inspired biologists since the times of Humboldt, Darwin and Wallace, and continues to be investigated and debated today. We will look at the structure and function of tropical ecosystems (particularly rainforests) and explore the many complex interactions and relationships that exist between plant and animal species. We will consider the local and global importance of tropical ecosystems and the consequences of deforestation, fragmentation, overhunting and other human activities, as well as conservation and management strategies.

This is a class-based course but students will be able to experience a variety of tropical ecosystems during their stay in Ecuador and many lectures will be illustrated with photos and videos. Throughout the term, students will carry out an original investigation on a topic of their choice in their own time. This will be written up and handed in at the end of the course and students will prepare a presentation of their

project for the final class. There will also be several assignments that consist of preparing presentations for a following class.

Course objectives

1. Understand the geographical definition and abiotic features of the tropics
2. Describe the characteristics of the major tropical ecosystems on earth and know where they are found.
3. Discuss the various hypotheses that may explain the evolution and maintenance of the extremely high species diversity of the tropics
4. Understand the basic ecological concepts that underlie the structure and function of tropical ecological communities.
5. Gain a basic knowledge of the ecology of major animal and plant groups in the tropics, their adaptations and interactions (including plant defenses, pollination, seed dispersal, co-evolution etc.)
6. Gain a basic understanding of the role of tropical ecosystems in the control of global climate.
7. Learn some of the ways in which humans utilize tropical wildlife
8. Understand how and why tropical ecosystems are being degraded and destroyed, and why this matters for species existence, including our own.
9. Discuss the sustainable use of tropical ecosystems

Reading material

Selected reading from:

Kricher, J. 2011 *Tropical Ecology*, Princeton University Press

Ghazoul, J and Sheil, D 2010. *Tropical Rain Forest Ecology, Diversity and Conservation*, Oxford University Press)

Additional articles

Exams and grading

1. Mid-term exam 30%
4. Assignments / class work 10%

5. Final exam 30%
6. Term Project 25%
7. Oral presentation of project 5%

Introduction to tropical ecology

Where are the tropics and how are they defined geographically? Tropical climates and life zones

Reading: Kricher Introduction and Chapter 1.

Tropical Forests

Introduction to tropical rainforests, tropical dry forests, savannas

Reading: Kricher chapter 11. Tropical Savannas and dry forests.

Tropical Mountain Ecosystems (Student presentations)

Changes in abiotic characteristics, adaptations, diversity and endemism with altitude.

Different types of tropical high altitude ecosystems and where they are found.

Reading: Kricher chapter 12 Other Tropical Ecosystems pp 422-446

Tropical freshwater and marine ecosystems (DVD)

Tropical rivers and lakes. Coral reefs, mangroves

Reading: Kricher chapter 12 Other tropical ecosystems pp 446-468

Tropical diversity

Why are there so many species in the tropics?

Reading: Kricher chapter 2: Biogeography and evolution in the tropics

Chapter 4 Inside Tropical Rainforests: Biodiversity

Tropical rainforests – structure and function

Types, adaptations and growth forms of forest plants and fungi. Disturbance and gap ecology. The rainforest canopy

Reading: Ghazoul and Shiel, Chapter 2 An Exuberance of Plant Life. Chapter 3 The Great Unseen: Fungi and microorganisms.

VISIT TO CUENCA ZOO AMARU - 4 h (together with ENV 310)

Tropical rainforests - animal species - the vertebrates (Student presentations)

Mammals, birds, reptiles, amphibians, fish. Diets and adaptations, feeding guilds, coexistence.

Reading: Ghazoul and Shiel Chapter 4 More than monkeys: The Vertebrates

Tropical rainforests - animal species – the invertebrates

Insects – butterflies, beetles, social insects (ants, bees, wasps)

Reading: Ghazoul and Shiel chapter 5 The little Things: Invertebrates

Seasonality in tropical environments

Flooded forests of the Amazon

Seasonality of fruiting and reproduction

Mid-term exam

Tropical soils and nutrient cycling in tropical rainforests

Types of tropical soil, leaching, decomposition, rapid nutrient cycling, termites, fungi, mycorrhizae, nitrogen fixing.

Reading: Kricher chapter 10: Nutrient cycling and tropical soils

Species interactions and coevolution part 1

Herbivory and plant defenses, predator-prey relationships

Reading: Kricher Chapter 8 Trophic dynamics in evolutionary context

Species interactions and coevolution part 2

Pollination, seed dispersal

Reading: Kricher Chapter 7 Biotic interactions and Coevolution in Tropical Rain Forests

Carbon cycling and climate change in tropical ecosystems (Student presentations)

Primary productivity, carbon storage and flows, carbon in soil and plants.

How climate change affects species distribution, interactions, phenology and extinction risk in tropical ecosystems

Reading: Kricher Chapter 9. Carbon Flux and Climate Change in Tropical Ecosystems

Humans in tropical rainforests - DVD

Indigenous people and tropical ecosystems today

Tropical agriculture and sustainability

History of agriculture in the tropics. Indigenous agriculture versus cash crops.

Reading: Kricher: Chapter 13. Humans as Part of Tropical Ecosystems

Forest Fragmentation and Biodiversity

Habitat loss and fragmentation, BDDF experiments.

Reading: Kricher Chapter 14 Forest Fragmentation and Biodiversity

Conservation in the Tropics

Agroforestry and sustainability. Forest products.

Tapping local knowledge, ethics, bioprospecting and biopiracy. Ecotourism in the tropics and misc. conservation issues.

Reading Kricher Chapter 15 Conservation Outlook for the Tropics

Final exam

Student project presentations