

ERS/BIOL 383
TROPICAL ECOSYSTEMS
Winter Semester 2014
Course Syllabus

COURSE INFORMATION

Instructor: Prof. Maren Oelbermann, Ph.D.
Contact Info: EV-2, Room 2008; Extension 37552; moelbermann@uwaterloo.ca
Office Hours: Tuesday 11:30 am to 12:00 noon and Thursday 9:00 am to 10:00 am
Lecture Times: Tuesday 8:30 am to 11:20 am
Location: DWE 3522A
Prerequisite: Course in ecology (eg. ENV 200) or consent of the instructor.

COURSE DESCRIPTION

This course examines the fundamental concepts of terrestrial ecosystems in tropical climates. The course is divided into three sections. The first section introduces the biophysical aspect (climate, location, landforms, soil, vegetation) of tropical environments. The second section examines tropical resource systems (forest- and agroecosystems) within the framework of conventional and sustainable resource extraction, using case studies. The third section will focus on current conservation issues; examples using case studies will also be presented.

This course is available on UW-LEARN (D2L).

COURSE GOALS

- To introduce students to terrestrial ecosystems in the tropics
- To outline the major tropical resource systems
- To define conservation issues and their management within the framework of global change

COURSE OBJECTIVES

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

- Understand the fundamental characteristics of terrestrial ecosystems in the tropics
- Have a basic knowledge of tropical resource systems: forest and agroecosystems
- Outline some of the current and relevant conservation issues affecting tropical ecosystems

COURSE EVALUATION

Midterm:

- One in-class midterm held on Tuesday, February 11th, 2014 in class (worth 30% of the final mark)
- The midterm will cover course material up to and including Tuesday, February 4th, 2014 (lecture 5)

Final Exam:

- The Final Exam is worth 40% of the final mark.
- The exam will be scheduled during the final examination period in April 2013.

Major Assignment (see specific guidelines in the separate file):

- Worth 30% of final mark
- Due March 14th, 2014 at 11:59 pm in D2L Dropbox. Hardcopies are not accepted.
- This is an individual effort.
- Late submissions will be penalized 2%/day. Assignments submitted after March 19th, 2013 (11:59 pm) will receive a mark of zero. Exceptional circumstances with appropriate documentation will be excused.

TEXTBOOK (Required)

- Kricher, J. 2011. Tropical Ecology. Princeton University Press. 632 pp.

READING WEEK (February 17 – 21, 2014): No classes scheduled

COURSE SUBJECT MATERIAL

MODULE I: TROPICAL BIOMES

LECTURE 1

Introduction

- Introduction to ERS 383/BIOL 383: Tropical Ecosystems
- Course syllabus
- Course expectations

What and Where are the Tropics (Chapter 1)

- Historical perspectives on tropical ecosystems
- Location of the tropics
- Tropical climates and seasons

Tropical Ecoregions (Chapter 3 pp. 79-82; Chapter 11; Chapter 12 pp. 446-463)

- Tropical rainforests (Chapter 3, pp. 79-82)
- Tropical and neotropical savannas
- Tropical dry forests
- Tropical wetlands and riverine ecosystems (Chapter 12 pp. 446-463)

MODULE 2: TROPICAL BIOLOGY AND ECOLOGY

LECTURE 2

Characteristics of Tropical Vegetation (Chapter 3)

- Stratification and stature
- Roots, trunks, bark and crowns
- Leaves
- Flowers, fruits, seeds and vegetative reproduction
- Climbers, lianas, stranglers and epiphytes
- Deciduous behavior

DVD: The Amazon – Land of the Flooded Forest: Journey into a tropical jungle where terrestrial rains annually transform the dry forest floor into a watery world. Watch river dolphins navigate the flooded treetops and the masterful hunting techniques of the electric eel and notorious piranha (55 minutes).

LECTURE 3

Tropical Soils (Chapter 10 pp. 375-389)

- What is soil and tropical soil mineralogy
- Tropical soil chemistry, physics, biology and soil organic matter
- What are tropical soils?
- Soil formation & factors influencing soil formation
- Types of tropical soils
- Undisturbed and disturbed tropical soils
- Processes of tropical soil degradation
- The paradox of exuberant vegetation and poor soils: the case of tropical forest removal

LECTURE 4

Nutrient Cycling (Chapter 10)

- Nutrient cycling and the soil community
- Factors affecting nutrient cycling
- Rapid nutrient recycling
- Tropical soil types and nutrient cycling
- Nitrogen and phosphorus

Carbon and Climate Change (Chapter 9)

- Primary and net productivity
- Carbon in pioneer and successional species
- What is a carbon sink?
- Seasonal fluxes and carbon losses
- Climate change and tropical forests

DVD: Panama – Venture beyond the dense and green curtain, into the rainforest that thrives in splendid isolation on a Panamanian island. Marvel at the complex interactions among the exotic species that live, feed, breed and die here (50 minutes).

MODULE 3: TROPICAL FOREST ECOSYSTEMS

LECTURE 5

Tropical Forested Landscapes and Landforms (Chapter 12)

- Montane and neotropical montane forests
- High elevation tropical ecosystems
- Mangroves
- Tropical dry forests

The Driving Forces Behind Tropical Forest Cover Loss (Chapter 15)

- Global forest cover: then and now
- Removal of valuable hardwood tree species
- Fuel wood and paper industries
- Grazing land and agriculture
- Subsistence farming
- The influence of governments
- The effects of deforestation: local, regional and global
- What can be done to reduce tropical forest removal

LECTURE 6

Rainforest Development and Dynamics (Chapter 6)

- Secondary succession in the tropics
- Early succession in the tropics
- Effect of ENSO on second-growth rainforests
- Resilient pastures: secondary succession in Amazonia
- Disturbance impacts and regeneration pathways
- Fire as disturbance in the tropics
- When succession does not succeed
- Forest gaps and tree demographics

DVD: Classic Rainforest – The tropical rainforests of the world are home to nearly half of the animal species on earth. More than 2500 mm of rainfall each year sustain this lush environment where some of the most fascinating examples of natural adaptation can be found. Journey to the dense rainforests of Costa Rica and watch as leaf-cutting ants carry sections of leaves many times their weight to underground fungus gardens; a basilisk lizard walks on water, and howler monkeys bark in the sun. (56 minutes).

LECTURE 7

Tropical Forested Management (not in textbook)

- Historical overview of logging in the tropics
- Conventional timber harvest
- Sustainable timber harvest
- Plantation forest: good, bad or indifferent?

DVD: Odzala – Islands in the Forest: Hidden deep inside the Republic of Congo lays Odzala National park, a dense, isolated rainforest that humans seldom visit. From forest elephants and lowland gorillas to water buffalo and cattle egrets show their coexistence around a swampy watering hole called a bai (53 minutes).

MODULE 4: TROPICAL AGROECOSYSTEMS

LECTURE 8

Humans as Part of Tropical Ecosystems (Chapter 13)

- Human impact on ecology: traditional agriculture in tropical environments
- Hunting and gathering: the first human societies
- Emergence of tropical crops
- From simple beginnings: the discovery of agriculture
- Agriculture in the neotropics
- Agroforestry and hillside farming
- Ethnobotany
- Semi-commercial farming systems: tropical beverage crops
- Conventional agroecosystems: the commercialization of agriculture using plantation crops

LECTURE 9

Sustainable Tropical Agroecosystems: An Old Idea Made Modern (Chapter 13, pp. 491-494)

- The principles of complex agroecosystems > LECTURE 9
- Examples of complex agroecosystems
- A detailed look at agroforestry systems
- Historical perspectives on agroforestry
- Types of agroforestry systems
- Why do we need agroforestry: what are the benefits
- What is the role of multipurpose trees
- Can agroforestry stop deforestation
- Coffee and cacao agroforestry systems

DVD: Tropical Agroforestry Systems (22 minutes)

LECTURE 10

Tropical Agroecosystems and Biodiversity (not in textbook)

- Ecological role of biodiversity in modern agroecosystems
- What happens if biodiversity is lost in modern agriculture?
- Biodiversity in complex agroecosystems
- Biodiversity in cacao agroecosystems: a case study from Costa Rica

Tropical Agroecosystems and Climate Change (not in textbook)

- Potential impacts of climate change on agriculture in the tropics
- Biophysical responses to increased atmospheric greenhouse gas concentrations
- Adaptation to climate change and the limits of adaptation in the tropics
- Agroforestry as an adaptive agroecosystem: a case study from Costa Rica

MODULE 5: CONSERVATION ISSUES IN TROPICAL ECOSYSTEMS

LECTURE 11

Forest Fragmentation (Chapter 14)

- Fragmentation
- Case studies of fragmentation: effects on wildlife
- Fragmentation, edge effects and matrix suitability
- Connectivity corridors
- The meso-American biological corridor: case study

Biodiversity (Chapter 14) and Conservation (Chapter 15, pp. 530-533)

- Approaches to understanding biodiversity
- Dealing with potential loss of biodiversity
- Biodiversity hotspots
- Ecosystem services

STUDENT CONDUCT AND APPROPRIATE BEHAVIOUR

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. www.uwaterloo.ca/academicintegrity/. Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at: <http://www.lib.uwaterloo.ca/ait/>

Research Ethics: Please also note that the 'University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.).

If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see: www.research.uwaterloo.ca/ethics/human/

Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.

Religious Observances: Please inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. When in doubt, please contact your Undergraduate Advisor for details.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties, check Guidelines for Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm

Appeals: A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals). See: www.adm.uwaterloo.ca/infosec/Policies/policy72.htm

Consequences of Academic Offences:

ENV students are strongly encouraged to review the material provided by the university's Academic Integrity office (see: <http://uwaterloo.ca/academicintegrity/Students/index.html>).

Turnitin:

Plagiarism detection software (Turnitin) may be used to screen assignments on this course.