

ERS/BIOL 383
TROPICAL ECOSYSTEMS
Winter Semester 2013
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; Wednesday 9 to 10 am
Lecture Times:	Tuesday 8:30 am to 11:20 am
Location:	AL 124
Prerequisite:	Course in ecology (eg. EnvS 200) or consent of the instructor. This course is also open to graduate students

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 12th, 2013 in class (worth 30% of the final mark)
- The midterm will cover course material up to and including Tuesday, February 5th, 2013 (lecture 5)

Final Exam:

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

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

- 8-page assignment which is worth 30% of your final mark and is due on March 15th, 2013 using the D2L Dropbox (submit by 11:59 pm). Hardcopies are not accepted. This is an individual effort. Late submissions will be penalized 2%/day. Assignments submitted three days after the due date will not be accepted and receive a mark of zero. Exceptional circumstances with appropriate documentation will be excused.

READING WEEK:

Held from February 18th to 22nd, 2013. No classes are scheduled during this time.

READING ASSIGNMENTS

- The course readings are posted on LEARN. These readings are part of the course requirement and will be used for evaluation on the midterm and final exam.

MODULE 1 – INTRODUCTION TO TROPICAL ECOYSTEMS

Lecture 1:

1. Introduction to ERS / BIOL 383
2. The Tropical Environment
 - a. Location of the Tropics
 - b. Tropical Climates and Climate Zones
 - i. Tropical seasons
 - ii. Tropical rainforest zone: the humid tropics
 - iii. Tropical monsoon
 - iv. Tropical savanna
 - v. Tropical semi-arid and arid climates
 - vi. Tropical and subtropical steppes
 - vii. Tropical and subtropical desert
 - viii. Agro-climatic zones
 - ix. Climate according to altitude and altitudinal zones
 - c. Tropical Landscapes and Landforms
 - i. Valleys
 - ii. Mountains
 - iii. Plains/savanna
 - iv. Wetlands
 - v. River deltas and basins
3. Environmental Change in the Amazon basin: Case Study

MODULE 2 – TROPICAL SOILS

Lecture 2:

1. Soils – Introduction
 - a. Tropical soils and soil forming factors
 - i. What is soil and soil composition
 - ii. Soil mineralogy
 - iii. Soil chemistry
 - iv. Soil physics
 - v. Soil biology: soil organic matter
2. Tropical Soils
 - i. What defines tropical soils?
 - ii. Tropical soil fertility
 - iii. Soil formation and factors affecting soil formation
3. DVD: The Amazon – Land of the Flooded Forest (55 minutes)
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.

Lecture 3:

1. Common Soil Types in the Tropics
2. Tropical Soils under Natural and Disturbed Conditions
 - i. Undisturbed tropical soil
 - ii. Undisturbed soils in the Amazon: case study
 - iii. Disturbed tropical soil
 - iv. Why such degradation and processes of degradation
 - v. The paradox of exuberant vegetation and poor soils in the tropics: The case of tropical forest removal

3. Biogeochemistry of Tropical Environments
 - i. What is biogeochemistry and why study it?
 - ii. Application of biogeochemistry
 - iii. Biogeochemical cycles: macro- and micro-elements
 - iv. Biogeochemistry in tropical ecosystems

MODULE 3 – TROPICAL VEGETATION

Lecture 4:

1. Tropical Vegetation
 - i. Characteristics of tropical vegetation
 - ii. Deciduous behavior
 - iii. Vines
 - iv. Epiphytes
 - v. Roots
 - vi. Vegetative reproduction
 - vii. Ethnobotany: what is it and why is it important?
2. 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 4 – TROPICAL FOREST ECOSYSTEMS

Lecture 5:

1. Tropical Forests I
 - a. Forest types and distribution in the tropics
 - i. Tropical Rainforests
 - ii. Mangrove forests
 - iii. Monsoon forests
 - iv. Sub-mountain forests
 - v. Mountain forest
 - vi. Alpine forest
 - b. The driving forces behind the loss of tropical forests
 - i. Global forest cover: then and now and some startling statistics
 - ii. Logging of tropical hardwoods (valuable hardwood tree species)
 - iii. Fuel wood and paper industries
 - iv. Grazing land and agriculture
 - v. Subsistence farming
 - vi. The influence of governments
 - vii. The effects of deforestation (local and regional)
 - viii. What can be done?

Lecture 6:

1. Tropical Forests II
 - a. Tropical forest management
 - i. Historical overview of logging in the tropics
 - ii. Methods of forest management: how it is typically done
 - iii. Methods of forest management: how it should be done
2. 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. Fascinating and thought-provoking, this film is an eloquent warning of the natural wonders we stand to lose on a world scale if human encroachment of the world's rainforests continues (56 minutes).

Lecture 7:

1. Tropical Forests III
 - a. Case Study: Environmental Services Payments
 - b. Tropical forest plantations: the bad and the good
 - c. Tropical forests and climate change
2. DVD: Odzala – Islands in the Forest (53 minutes)

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*.

MODULE 5 – TROPICAL AGROECOSYSTEMS

Lecture 8:

1. Tropical Agroecosystems I
 - a. Traditional agriculture in tropical environments
 - i. Harvest of forest products
 - ii. Shifting cultivation
 - iii. Bush fallow
 - iv. Nomadic herding
 - v. Hillside farming
 - vi. Agroforestry
 - vii. Semi-commercial farming systems
 - viii. Tropical beverage crops (coffee and cacao)
 - b. Conventional agroecosystems: the commercialization of agriculture in the tropics
 - i. Plantation agriculture (sugar cane, rubber, oil palm, banana, citrus, papaya, tropical ornamentals)
 - ii. What determines plantation success?
 - iii. The problem with plantation agriculture
 - iv. Pasture management in the Brazilian Amazon: case study

Lecture 9:

1. Tropical Agroecosystems II
 - a. Complex Agroecosystems: an old idea made modern
 - i. What are complex agroecosystems and their principles
 - ii. Examples of complex agroecosystems: home gardens, intercropping with legumes, agroforestry systems
 - iii. Agroforestry systems
 - iv. Historical perspectives on agroforestry
 - v. Agroforestry system types
 - vi. Why we need agroforestry and its benefits
 - vii. Multipurpose trees in agroforestry systems
 - b. Can agroforestry stop deforestation?
 - i. Land degradation-deforestation hypothesis
 - ii. Counter hypothesis
 - iii. Chocolate forests of the tropics: a case study of agroforestry adoption in Ivory Coast
 - c. DVD: Tropical Agroforestry Systems (22 minutes)

Lecture 10:

1. Tropical Agroecosystems III
 - a. Tropical agroecosystems and climate change
 - i. Potential impacts of climate change on agriculture in the tropics
 - ii. Biophysical responses to increased greenhouse gases
 - iii. Adaptation to climate change and limits of adaptation in the tropics
 - iv. Agroforestry an adaptive agroecosystem: case study from Costa Rica
 - b. Biodiversity in modern tropical agroecosystems
 - i. Ecological role of biodiversity in modern agroecosystems

- ii. What happens if biodiversity is lost?
- iii. Biodiversity in complex agroecosystems
- iv. Biodiversity of cacao agroecosystems in Costa Rica: a case study

MODULE 6 - CONSERVATION ISSUES IN TROPICAL ECOSYSTEMS

Lecture 11:

1. Freshwater: An Important Resource in Tropical Environments
 - a. Tropical running waters
 - b. River continuum concept
 - c. The role of streams in biogeochemical cycles
 - d. The Amazon Basin: a detailed look (case study)

2. Habitat Fragmentation in the Tropics
 - a. Island biogeography
 - b. Consequences of fragmentation
 - c. Edge effects
 - d. Solution to fragmentation: connective corridors
 - e. Agroforestry
 - f. The Meso-American Biological Corridor

3. DVD (if time permitting): Victoria Falls (52 minutes)
 Flowing from its source 1600 km to the north, the Zambezi river reaches the edge of one world and plummets into another world. Victoria Falls, spanning the border between Zambia and Zimbabwe, is over a 1.6 km wide. No other waterfall in the world can match her scale, which is why many consider this waterfall one of the seven natural wonders of the world. The Zambezi is known as the river of life across southern Africa.

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) will **NOT** be used to screen assignments on this course.