



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. **Course: ECOLOGY 419 – TERRESTRIAL COMMUNITIES AND ECOSYSTEMS**

Lecture Sections:	L01	MWF	13:00-13:50	ST 139	WINTER 2017
Labs		T	09:00; 12:00; 15:00	BI 236	
		W	09:00; 14:00	BI 236	
Instructors:	Dr. P. Dunfield		BI 319D	220-2469	pfdunfie@ucalgary.ca
	Dr. D. Layzell		BI 473	220-5161	dlayzell@ucalgary.ca
Lab supervisor:	Ms. Louise Hahn		BI 264	220-5280	lhahn@ucalgary.ca

D2L: ECOL419L01 - ECOL 419 L01 (Winter 2017) - Terrestrial Comm & Ecosystem

Biological Sciences Department BI 186; (403) 220-3140; biosci@ucalgary.ca

2. **PREREQUISITE(S):** Biology 313 and one of Biology 315 or Environmental Science 401
See section 3.5.C in the Faculty of Science section of the online Calendar
(<http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html>)
3. **Grading:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

First Midterm Examination	(Feb 6)	17.5%	In-Class
Second Midterm Examination	(Mar 15)	17.5%	In-Class
Laboratory Assignments		30%	
Final Examination		35%	

(There will be a final exam scheduled by the Registrar's office.)

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Cutoff	95	88	83	78	74	70	66	62	58	54	50	<50

Each piece of work (laboratory assignments, midterm test or final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.3](#) of the University Calendar
5. **Scheduled out-of-class activities:** Dates and times of approved class activities held outside of class hours. NIL

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. **Course Materials: TEXT:** Recommended: Principles of Terrestrial Ecosystem Ecology, Chapin III FS, Matson PA & Vitousek, PM., Springer-Verlag, New York., Latest Edition.

7. **Examination Policy:** No electronic devices may be used during exams. Students should also read the Calendar, [Section G](#), on Examinations.
8. **Writing across the curriculum statement:** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also [Section E.2](#) of the University Calendar.
9. **Human studies statement:** indicating whether students in the course may be expected to participate as subjects or researchers. See also [Section E.5](#) of the University Calendar.

STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS. Students are expected to be familiar with <http://www.ucalgary.ca/pubs/calendar/current/sc-5-1.html> of the on-line calendar.

See also <http://www.ucalgary.ca/pubs/calendar/current/e-5.html>.

10. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties.
- (b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf.

Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Biological Sciences, Dr. H. Addy by email addy@ucalgary.ca or phone 403 220-3140.
- (d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: suvpaca@ucalgary.ca
SU Faculty Rep. Phone: 403 220-3913 Email: science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca;
Student Ombuds Office: 403 220-6420 Email: ombuds@ucalgary.ca; <http://ucalgary.ca/provost/students/ombuds>
- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

Department Approval _____ ORIGINAL SIGNED _____ Date _____

Ecology 419 Course Goals and Tentative Outline

Ecosystem definition <http://www.merriam-webster.com/dictionary/ecosystem>

Complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space. An ecosystem's abiotic (nonbiological) constituents include minerals, climate, soil, water, sunlight, and all other nonliving elements; its biotic constituents consist of all its living members. Two major forces link these constituents: the flow of energy and the cycling of nutrients. The fundamental source of energy in almost all ecosystems is radiant energy from the sun; energy and organic matter are passed along an ecosystem's food chain. The study of ecosystems became increasingly sophisticated in the later 20th century; it is now instrumental in assessing and controlling the environmental effects of agricultural development and industrialization.

Terrestrial ecosystems provide a home for much of the world's biodiversity, supply humans with most of the food and fibre they demand, and are increasingly looked upon to play a major role in efforts to manage greenhouse gas emissions and mitigate climate change. Ecology 419 will explore the biological principles that underpin these three major roles for terrestrial ecosystems with a focus on the forces, pathways and technologies controlling the flows of energy, carbon (C) and nitrogen (N) through terrestrial ecosystems. By the end of this course, engaged students will be able to:

- Quantitatively **compare** the annual flows of energy and carbon through biological systems with the energy and carbon flows that provide humans with fuels and electricity
- **Describe** the opportunities for using biological systems to mitigate climate change by reducing CO₂, CH₄ and N₂O emissions and by enhancing carbon sinks
- **Describe** the drivers of primary productivity and the potential for positive feedbacks among them
- **Predict** key characteristics of plant and microbial communities based on environmental factors such as temperature, rainfall, and nutrient availability
- **Describe** the biotic and abiotic processes that control nutrient and carbon cycling through soil, water, air, and biomass
- **Explain** the relationships between diversity and productivity
- **Describe** the current knowledge of climate change impacts on terrestrial systems, and suggest strategies to mitigate or minimize these impacts
- **Describe** the policy instruments that could be deployed to facilitate the use of biological systems in the mitigation of climate change in Canada and globally
- **Employ** common techniques for **quantifying** various physical characteristics (e.g. moisture, texture, composition), chemical characteristics (e.g. organic carbon and organic matter content, micro- and macronutrients, pH), biological characteristics (e.g. bacteria, fungi, invertebrates), and ecosystem processes (e.g. nitrifying potential, soil respiration) in soils
- **Develop** a unique hypothesis to **test** predictions of soil responses to disturbance, using data analysis and literature review, and present the results as a scientific conference-style poster.

Ecology 419 – Tentative Course outline W17

Jan 9	1 L	Dunfield/Layzell	Course outline and expectations / Introduction to terrestrial ecosystems and global climate change
Jan 11 - 16	3 L	Layzell	Energy systems and the global carbon cycle
Jan 18 - 23	3 L	Layzell	Photosynthesis / Effects of elevated CO ₂ on ecosystems
Jan 25- 30	3 L	Layzell	Roots and the cost of N assimilation / N fixation
Feb 1 - 3	2 L	Layzell	Biological solutions to climate change
Feb 6		Layzell	Midterm 1
Feb 8 - 10	2 L	Dunfield	The flow of C through ecosystems / Trophic interactions / Decomposition
Feb 13 - 17	3 L	Dunfield	Soils
Feb 20 - 24	-		Reading Week, no classes
Feb 27 -Mar 3	3 L	Dunfield	Plant-Soil-Microbe interactions
Mar 6 - 8	2 L	Dunfield	The nitrogen cycle / Mitigating N ₂ O emissions
Mar 10 - 13	2 L	Dunfield	The methane cycle / Mitigating methane emissions
March 15		Dunfield	Midterm 2

Mar 17 - 22	3 L	Dunfield	Terrestrial ecosystem types / Biogeography / Biodiversity and ecosystem functioning
March 24 - 27	2 L	Dunfield	Predicted impacts of climate change on biodiversity / The Tragedy of the Commons
March 29- April 3	3 L	Layzell	Anthropogenic ecosystems and their energy flows: Agriculture, forestry, urban systems
April 5-10	3 L	Layzell	Enabling biological solutions to climate change: policy instruments, opportunities and challenges
April 12	1 L	Dunfield/Layzell	Review, Q and A

Ecology 419 – Tentative Laboratory Schedule W17

Lab 1 (Jan 10, 11)	Introduction to communities and ecosystems, soils, and scientific writing
Lab 2 (Jan 17, 18)	Soil texture, moisture and organic content
Lab 3 (Jan 24, 25)	Root and plant biomass, soil bacteria and fungi
Lab 4 (Jan 31, Feb 1)	Soil and forest invertebrates
Lab 4 (Feb 7, 8)	Soil and forest invertebrates
Lab 5 (Feb 14, 15)	Soil nutrients and ions
Feb 21, 22	READING WEEK: NO LABS
Lab 6 (Feb. 28, Mar 1)	Data Analysis, soil nitrifying potential (set-up)
Lab 7 (Mar 7, 8)	Soil respiration (set-up)
Lab 8 (Mar 14, 15)	Soil respiration (finish) and nitrifying potential (finish)
Lab 10 (Mar 21, 22)	Poster presentation workshop
Lab 11 (Mar 28, 29)	Open lab: poster assembly
Lab 12 (Apr 4, 5)	Term project due, project presentations

Details

Jan. 10, 11	<p>Lab 1: Introduction to communities, ecosystems, soils, term project, and scientific writing</p> <ul style="list-style-type: none"> - introduce Ecology 419 labs - introduce term project - review of scientific writing - preliminary examination of soil samples - dry soil samples (for Lab 2, Walkley-Black method for soil carbon determination) - start soil invertebrate extraction (for Lab 4)
Jan. 17, 18	<p>Lab 2: Soil texture, moisture and organic content</p> <ul style="list-style-type: none"> - soil moisture content analysis - soil organic matter estimation (incineration method) - soil organic carbon estimation (Walkley-Black method) - soil texture analysis - Assignment 1: Literature review on the effects of clearcutting on the abundance and distribution of soil organisms (invertebrates, bacteria, fungi, plants). (value = 6%, due Jan. 31, Feb. 1)
Jan. 24, 25	<p>Lab 3: Root biomass, plant biomass, soil fungi and bacteria</p> <ul style="list-style-type: none"> - begin root biomass estimation - begin plant biomass estimation - start soil bacteria plates - start soil fungi plates
Jan. 31, Feb. 1	<p>Lab 4: Soil and forest invertebrates</p> <ul style="list-style-type: none"> - weigh root biomass - weigh plant biomass - count fungi plates - count bacteria plates - soil and forest invertebrate ID and enumeration - Assignment 1 due
Feb. 7, 8	<p>Lab 4: Soil and forest invertebrates (Midterm #1, Monday Feb. 6)</p> <ul style="list-style-type: none"> - finish soil and forest invertebrate ID and enumeration - Assignment 2: Proposed term project topic (value = 5%, due Feb. 28, Mar. 1)

- In-class exercise to help choose your topic

Feb. 14, 15 Lab 5: Soil nutrients and ions

- pH
- ammonia, nitrate, phosphate
- calcium, potassium, sodium
- **Assignment 1 returned**

Feb. 21, 22 READING WEEK, NO LABS

Feb. 28, Mar. 1 Lab 6: Data Analysis

- overview of data analysis
- set up soil nitrifying potential (requires a 2 week incubation)
- **Assignment 2 due**
- **Assignment 3: Data analysis methods and preliminary results (value = 6%, due Friday March 17 by 4pm for everyone to avoid conflict with Midterm #2)**

Mar. 7, 8 Lab 7: Soil respiration

- set up soil respiration experiment
- class discussion of preliminary results
- **Assignment 2 returned**

Mar. 14, 15 Lab 8: Soil respiration and nitrifying potential

- complete soil respiration
- complete soil nitrifying potential
- **Assignment 3 due Friday March 17 by 4pm to avoid conflict with Midterm #2**
- **Assignment 4: Term Project (value 10%, due April 4, 5)**

Mar 21, 22 Lab 9: Poster workshop

- work on project/poster in lab

Mar 28, 29 Open lab:

- work on project/poster in lab
- peer review of posters (optional)
- **Assignment 3 returned**

Apr. 4, 5 Poster presentations in lab

- **Assignment 4 due**

Participation: Value = 3% Students are expected to be prepared for labs, and to participate fully in all labs. This means having read the lab manual before coming to lab, being on time, being able to answer pre-lab questions, completing pre-lab assignments, and attending all labs. Labs that are missed for invalid reasons will result in lost participation marks.