School of Science

BIOL 220

Ecology

Fall 2021

3 Credits

Course Outline

INSTRUCTOR: Scott Gilbert, BSc., Ph.D.

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OFFICE HOURS: Tues / Thurs 10:35-11:35 via Zoom. Link provided on course web site.

LECTURE: Tues / Thurs 9:00-10:30 **Room**: A2801 **Dates:** Sept. 7 – Dec. 7
LAB: Friday **Room:** A2202 **Dates:** Sept. 10 – Dec. 3

COURSE DESCRIPTION

Biology 220 introduces the science of ecology by focusing on the interrelations between individual organisms, their populations and communities. The course begins by reviewing the factors that limit distributions and then considers population demography, life tables, regulation of natural populations and managing harvested populations. We briefly review some of the mathematical models to explain interspecific competition and predation. The course continues with an overview of community ecology and considers selected topics: succession, species diversity gradients, energy flow, biogeochemistry, and the role of predation, competition and disturbance in structuring communities. Finally, we conclude by considering the prospects for global change and the ecological processes that may shape these changes.

PREREQUISITES

BIOL 101 and 102 or equivalent; COMM 193 or COMM 204 recommended.

RELATED COURSE REQUIREMENTS

Lectures and lab activities during Fall 2021 are planned as face-to-face classes.

EQUIVALENCY OR TRANSFERABILITY

UBC BIOL 230 (3)	TRU BIOL 2170 (3)
UBCO BIOL 201 (3)	UVIC BIOL 215 (1.5)
SFU BISC 204 (3)	

See https://bctransferguide.ca/ for an up-to-date list of transfers within BC. Further information and assistance with transfers may be available from the School of Science.

LEARNING OUTCOMES
On successful completion of this course students will be able to:

- describe the ecological factors that affect the distribution and abundance of organisms;
- understand the interplay between evolution and ecology;
- construct simple life tables and interpret simple models of population growth, interspecific competition and predator-prey interactions;
- propose testable hypotheses along with experimental tests to resolve ecological questions.

COURSE FORMAT
Lectures: Three hours per week (2 classes of 1.5 hours, face-to-face). This is a fast-paced course and students are strongly encouraged to attend lectures so they can ask questions and participate in class discussions. If technically possible, a video recording of the classroom lectures will be made available online after class but students should participate in each class rather than relying on a possible video archive.

Labs: Three hours per week, face to face, with physical distancing as required. The 11 activities will include 4 tutorials focused on numerical problem sets, 2 field data collection exercises with formal lab reports and 5 seminars that will focus on critiquing papers or ideas in ecology. Students are encouraged to obtain two COVID-19 vaccines.

ASSESSMENTS:

Attendance & Participation
Students are expected to attend both lectures and the scheduled activities (including field activities). Several of the lab exercises involve collecting data or making observations and this would make it difficult or impossible for students who miss the lab to complete the lab assignment. There is a strong correlation between regular attendance and academic performance.

Assignments
There will be several short take-home assignments and there will be a written assignment with each week's lab activity. Students must pass the field/lab portion of the course to receive a passing grade for the overall course.

Tests
Rather than a single mid-term examination we will have two shorter quizzes. The final exam will be scheduled by the Registrar's office during Dec 10-22 and will be comprehensive and cover all topics taken up during the term.

EVALUATION:

Short in-class quizzes	5%
Take home readings & questions	5%
Field / lab exercises	35%
Midterm exams (2 @15% each)	30%

Final Exam	25%
Total	100%

REQUIRED TEXTBOOKS AND MATERIAL

Manuel C. Molles, Andrew Laursen. 2020. *Ecology: Concepts and Applications* 5th Canadian ed.

ACADEMIC AND STUDENT CONDUCT

Information on academic standing and student rights and responsibilities can be found in the current Academic Regulations that are posted on the Student Services/ Admissions & Registration web page.

PLAGIARISM

Plagiarism is a serious academic offence. Plagiarism occurs when a student submits work for credit that includes the words, ideas, or data of others, without citing the source from which the material is taken. Plagiarism can be the deliberate use of a whole piece of work, but more frequently it occurs when students fail to acknowledge and document sources from which they have taken material according to an accepted manuscript style (e.g., APA, CSE, MLA, etc.). Students may use sources which are public domain or licensed under Creative Commons; however, academic documentation standards must still be followed. Except with explicit permission of the instructor, resubmitting work which has previously received credit is also considered plagiarism. Students who plagiarize material for assignments will receive a mark of zero (F) on the assignment and may fail the course. Plagiarism may also result in dismissal from a program of study or the University.

YUKON FIRST NATIONS CORE COMPETENCY

Yukon University recognizes that a greater understanding and awareness of Yukon First Nations history, culture and journey towards self-determination will help to build positive relationships among all Yukon citizens. As a result, to graduate from ANY Yukon University program, you will be required to achieve core competency in knowledge of Yukon First Nations. For details, please see www.yukonu.ca/yfnccr.

ACADEMIC ACCOMMODATION

Reasonable accommodations are available for students requiring an academic accommodation to fully participate in this class. These accommodations are available for students with a documented disability, chronic condition or any other grounds specified in section 8.0 of the Yukon University Academic Regulations (available on the Yukon University website). It is the student's responsibility to seek these accommodations. If a student requires an academic accommodation, he/she should contact the Learning Assistance Centre (LAC): lac@yukonu.ca.

TOPIC OUTLINE – Chapter references refer to our course text Molles & Laursen (2020)

Date	Topic	Concepts	Chapter
Sept. 7	Introduction, Hypothesis testing	def'n ecology, levels of organization, hypothesis testing, theme of temporal and spatial heterogeneity, proximate vs. ultimate explanations	Chapter 1
Sept. 9	Land and Water	Biomes, water & temperature as master limiting factors, soil horizons, hydrological cycle, flux, turnover time, oceanic zonation (horizontal and vertical), still waters, zonation, lake turnover, isothermal , limits to distributions, abiotic and biotic factors, allelopathy	Chap 2 (skip pp 29-36), Chap 3 (skip 55-64, 68-74)
Sept. 14	Natural selection and evolution	Evolution, genetic drift, natural selection, adaptation, fitness, , phenotype, genotype, ecotypes, common garden expts., stabilizing selection, disruptive selection, directional selection	Chap 4
Sept. 16	Coevolution and speciation	Coevolution,, Mullerian and Batesian mimicry, Mayr's biological species concept,2 types of reproductive isolation – pre- and postzygotic isolating mechanisms, 3 types of speciation,	con'd
Sept. 21	Temperature relations	How do organisms respond to temperature? range of tolerance, heart budgets, ectotherms, endotherms, thermal neutral zone, 8 strategies for extreme conditions	Chap 5
Sept 23	Nutrient & energy relations	Energy sources, trophic classifications, light (PAR), 3 photosynthesis pathways by name, C:N ratios and challenges to herbivore diets,	Chap 7 (skip 181-183) (delay 187-191)
Sept 28	Behavioural ecology / Optimal foraging	Kin selection, inclusive fitness, costs & benefits of group living Foraging decisions, numerical & functional responses, optimal foraging theory and assumptions, diet width mode & predictions. , 3 types of functional responses	Chap 7 Read 187-191, Chapter 8
Sept. 30	**Truth and Reconciliation Day holiday – no classes**		
Oct 5	Life History Patterns	Fundamental & realized niche, principle of allocation, trade-offs, life history classifications, r & K selection, principle of allocation, Grimes approach to plant life histories, disturbance, stress tolerance, Winemiller & Rose – 3 factors to classify life histories, climate change	Chap 9 up to page 246
Oct 7	Intro to Populations & Estimating density	(see Sept 11 notes where we introduced limits to dist'n), what is an individual: unitary, modular organisms, genet, ramet; patterns of dist'n: random, regular clumped, def'n of pop'n, metapopulation, relative and absolute abundance	Chap 10
Oct. 12	Population Structure	Intro to life tables, mortality, static and cohort life tables, n_x, l_x, d_x, q_x, 3 types of survivorship curves, fecundity schedules, net reproductive rate	Chap 11
Oct 14	Pop'n Structure (continued)	Generation time, T, actual or realized *r,* dispersal, jump dispersal , sex ratios & frequency dependent selection,	con'd
Oct. 19	Population Growth	Density dependent and independent birth and death rates , , lambda - geometric rate of increase, exponential growth using dN/dt = *r*N, eq'n for logistic pop'n growth, assumptions of models, realized *r* vs r_{max}	Chapter 12
Oct. 21	Population Growth	Conclude pop'n growth section	
Oct. 26	Competition – Intraspecific & Interspecific	Types of spp interactions, exploitation or resource competition, interference competition, impacts of competition on growth, survival and reproduction, Lotka-Volterra model of interspecific comp. and how to interpret LV graphs, comp. coefficients	Chap 9 – p 247-251; Chap 13 (skip 357-358)
Oct. 28	Intro to Herbivory &	Types of predation, impacts of exploitation on individuals and	Chap 14

	Predation	populations, invasive spp and enemy release hypothesis, LV-predation equations, coupled oscillations, neutral stability, Huffaker's case history showing role of prey refuges, other ways to escape predators	
Nov. 2	Exploitation, Predation and Harvesting populations	Recruitment curves, role of intraspecific comp in determining shape of curve, maximum sustainable yield, fixed quotas harvests, managing harvest effort	pp. 325-327
Nov. 4	Mutualism & Parasitism	Parasites can affect behaviour; winter ticks and moose, flour beetles and competition affected by parasites. Plant-ant protection mutualisms	Chapter 15 – up to page 407
Nov. 9	Community structure and function	Emergent properties of communities, species abundance, spp diversity, role of disturbance, conclude spp diversity & disturbance	Chapter 16
Nov 11	**Remembrance Day**	**Holiday**	
Nov. 16		TBD	
Nov 18	Food webs & keystone species	Review 2nd midterm . Who eats who? Food webs. Why are food chains short (2 hypotheses), Keystone species vs dominant spp, ecosystem engineers	Chapter 17 (skip 17.2)
Nov. 23	Community succession	Primary & secondary succession, climax, patterns in succession, Connell & Slatyer model of succession. Facilitation, inhibition & tolerance,	Chapt 18 (skip p 490-492)
Nov. 25	Community stability	Disturbance & stability, resilience and resistance – Park Grass expt	con'd
Nov. 30	Energy flow	Primary production, GPP, NPP, limits to NPP in terrestrial and aquatic systems, tropic cascades , Top down or bottom up control,	Chapter 19
Dec. 2	Patterns in Species Richness - Macroecology	Island Biogeography - Equilibrium model of biogeography, immigration & extinction rates	Chapter 22 (skip Sect 22.1)
Dec 7.	Continued	Gradients in species richness , hypotheses to explain patterns, detailed evaluation of hypotheses to explain latitudinal patterns	Chapter 22
Dec. 9	Ecology & Global Change	Course review & highlights – themes and integration. [Habitat fragmentation] Make up lecture for Remembrance Day	pp 574-581

Biology 220 Laboratory Schedule - *Draft - July 27*

Sept. 10	#1 Tutorial: Hypothesis Testing in Ecology	Due Sept 17
Sept. 17	#2 Lab Exercise: Decomposition and Forest Soil CO_2 Emissions	TBD… in early Oct.
Sept. 24	#3 Seminar: Natural Selection question	Due before lab
Oct. 1	#4 Seminar – Human Impacts on Ecosystems[1]	Due before lab
Oct. 8	#5 Seminar – Critique of a scientific paper (snakes, loons or turtles)[2]	Due before lab
Oct. 15	**Quiz #1**	
Oct. 22	#6 Lab Exercise: Population estimate using mark recapture	TBD… in mid-Nov
Oct. 29	#7 Life Table Analysis Tutorial	Nov. 5
Nov. 5	#8 Seminar Critique of paper salmon nutrients[3], snail paper[4] or Eider ducks[5]	Due before lab
Nov. 12	**Quiz #2**	
Nov. 19	#9 Tutorial: Harvesting Populations[6]	Due Nov 26
Nov. 26	#10 Tutorial: Ecology of Disease	Due Tues Nov 30
Dec. 3	#11 Seminar: Keystone Species	Due before lab

1 Read 3 papers: Stokstad, E. 2014. The empty forest. (Vanishing Fauna/ Special Section). Science (345) 6195: 396-400;
Redford, K.H. 1992. The empty forest. BioScience (42) 6: 412- 422; and
Dirzo, R., H.S.Young, M. Galetti, G.Ceballos, N.J.B. Isaac, B. Collen. 2014. Defaunation in the Anthropocene. Science (345) 6195: 401-406.

2 Diaz, Franciso R. and Blouin-Demers, Gabriel 2017. Northern snakes appear much more abundant in old fields than in forests. Canadian-Field Naturalist 131: 228-234 plus supplement.
Dickson, Lynne 1992. The Red-throated Loon as an indicator of environmental quality. Canadian Wildlife Service, Occasional Publication No. 73.
Seburn, D.C., and H. McCurdy-Adams. 2019. Do turtle warning signs reduce roadkill? Canadian Field-Naturalist 133(3): 216–220.

3 Reimchen, Thomas E. 2017. Diverse Ecological Pathways of Salmon Nutrients Through an Intact Marine-terrestrial Interface. Canadian Field-Naturalist 131: 350-368.

4 Hershey, Anne 1990. Snail populations in Arctic lakes: Competition mediated by predation? Oecologia 82: 26-32.

5 Reed, J.A., D.L. Lacroix and P.L. Flint 2007. Depradation of Common Eider, *Somateria* mollissima, Nests on a Central Beaufort Sea Barrier Island: A Case Where No One Wins. *Can. Field-Nat. 121*: 308-312.

6 Readings from Pauly, D. V. Christensen, S. Guénette T.J. Pitcher, U.R. Sumaila, C.J. Walters, R. Watson and D. Zeller**.** 2002. Toward sustainability in world fisheries. Nature 418: 689-695