University of Guelph, College of Biological Science, Integrative Biology

COURSE OUTLINE

Populations, Communities and Ecosystems, BIOL*3060

Winter 2018

This course will explore advanced topics in ecology, building on the foundation provided by BIOL*2060. The course material will be organized around common mechanisms that link ecological processes across levels of organization, such as organism function, species interactions, spatial connectivity and energetic transfers across trophic levels. Emphasis will be on testing ecological theory with quantitative analysis of empirical data, thereby gaining greater depth of understanding of ecological processes at the population, community and ecosystem scales. Through the examination of case studies, students will apply ecological knowledge and quantitative analysis to problem solving in areas such as resource management, conservation of populations and communities, and predicting biosphere responses to climate change.

Credits Value: 0.50 credits
Pre-requisites: A minimum of 10.00 credits including: BIOL*2060, (STAT*2230 or STAT*2040)
Restrictions: BIOL*3110, BIOL*3120

Teaching team

Dr. Kevin McCann (SCIE 2472, email: ksmccann@uoguelph.ca)
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Learning goals and rationale

Learning Outcomes: By the end of the course the successful student will be able to:
1. Identify and evaluate the validity of ecological theories that explain the distribution and abundance of species and the functioning of communities and ecosystems.
2. Identify the common mechanisms that influence population and community dynamics and ecosystem function.
3. Evaluate how ecological processes at one level of organization influence processes at other levels of organization.
4. Utilize quantitative methods to project the dynamics of populations, communities and ecosystems.
5. Evaluate hypotheses about mechanisms responsible for the dynamics of populations, the assembly of communities and the functioning of ecosystems using inferential statistical analyses.
6. Work collaboratively and apply ecological science to formulate solutions to specific conservation and management problems.
7. Communicate the results of research findings to peers in written documents and oral presentations

Course Administration

Courselink

BIOL3060 will make use of the University of Guelph Courselink website, including lectures and reading material. Please check regularly as this will be where we post the most current information and deadlines.

Top Hat

This course will utilize the Top Hat (www.tophat.com) classroom response system. This is how you will be able to submit answers to in-class quizzes and polls. You will be able to submit answers using your Apple or Android smartphone or tablet, laptop, or through text message. Visit tinyurl.com/TopHatStudent Guide for the Student Quick Start Guide, which outlines how you will register for a Top Hat account, as well as provide you with a brief overview to get you up and running on the system.

You should have received an email inviting you to register for Top Hat. You also can register by visiting tophat.com.

After the first class/lecture, please download and install Top Hat on your cell phone, iPad, or similar device. We recommend setting up several devices for the use of Top Hat to reduce the likelihood of technical problems. There is a cost associated with downloading Top Hat. We apologize for this. Top Hat allows us to do in-class testing and facilitates discussion. This allows you to get feedback about your grades and your understanding of the material quickly and allows instructors to see what topics require further coverage. Using Top Hat also reduces the grading burden for TAs, allowing us to provide more hands-on activities to you and provide a more advanced curriculum.

In registering with Top Hat, it is important that you enter your student ID. It should ask you for your student ID when you set up the account.

Although Top Hat allows uploading of answers through text messages, please note that cell connectivity can be spotty. Therefore make sure to setup connectivity through the University of Guelph's wifi network.

Course Resources

Recommended Resources

There is no required textbook for this course. You will not be able to master the learning objectives and lecture content of this course unless you fully understand the basic concepts taught in BIOL2060. At the beginning of each module in this course, we will provide a brief review of the concepts we expect you to already know from your previous coursework. If you do not believe that you have mastered these concepts, we recommend that you revisit your notes from BIOL2060 or read the appropriate sections of the electronic textbook that was required in BIOL2060. There are many alternative ways that you can acquire this basic information (other general ecology textbooks, additional readings). In all cases, it is up to you to critically evaluate your understanding of the basic concepts we outline at the beginning of each module, and brush up on knowledge of these concepts if required.

Required Resources

Regularly, we will distribute additional resources as pdfs on Courselink. This material will include primary literature and case studies that support lecture or tutorial content. It is your responsibility to read and fully understand the material in these pdfs prior to class.

Course Content

The emphasis will be on experiential skill development through hypothesis testing, interpretation of quantitative results, and the use of quantitative methods to increase ecological knowledge and solve conservation and management problems.

Because of the emphasis on experiential learning, the major topics will be organized around specific questions at each level of ecological organization. The four units described below are examples of the questions that will be addressed using lectures, guided class discussions, and tutorial/lab exercises. However, in BIOL3060 we will be highlighting research questions that integrate across these levels of biological hierarchy. Specific content in each unit may be subject to change.

Unit 1. Environmental physiology of organisms and allometry
What are the mechanisms by which organisms sense and respond to environmental change? Students will integrate information on the key resources structuring organismal ecology in terrestrial and aquatic ecosystems, and how biological scaling of traits can improve our understanding of both ecological and evolutionary questions.

Unit 2. Causes of variation in population abundance and spatial distribution:
How can the causes of population dynamics be analyzed? Students will learn to interpret ecological models in terms that form testable hypotheses/predictions for empirical results. Students will see that energy, or ecosystem level processes, can be used to integrate results across the ecological hierarchy from population level dynamics, to consumer-resource dynamics all the way to whole food webs. Specifically, we will see that the conditions that alters stability, biomass relationships and trophic cascades can be well understood from an energetic perspective.

How does local and regional variation in ecological conditions and resources influence the spatial distribution of organisms? Organisms must find ways to meet their physiological and ecological requirements in a highly heterogeneous world. Students will develop a clearer understanding of underlying sources of variation in fitness constraints (climatic conditions, resource use in relation to resource abundance, and quality) and a variety of behavioral strategies (foraging, home range use, social systems, movement patterns) that provide adaptive ways to cope with these constraints. Lab exercises will focus on evaluating behavioral decision-making.

How does spatial connectivity among populations (meta-populations) influence projections of population dynamics? In the final phase of the population unit, students will expand on the quantitative framework established in UNITS 2A-C to consider how migration among sub-populations influences population dynamics in a case study.

Unit 3. Explanations for the abundance, number and identity of species in communities:
What are the causes of species composition at the level of the community, the region and the continent? Students will explore species inventory data across different spatial scales to test hypotheses about how species pools and larger scales influence community composition at local scales.

Which processes are the strongest determinants of species co-existence within communities? Students will explore how competitive, consumer-resource and mutualistic interactions determine whether species are able to persist or go extinct within communities. Students will apply the quantitative models developed in UNIT 2 to predict when species are likely to co-exist, and when they are likely to be regulated by the abundance of their food sources or their consumers.

How does spatial connectivity among communities influence projections of community composition? Like populations, aggregations of species exist as meta-communities, with migrants travelling between communities. Students will explore how this connectivity influences species composition, again building on the quantitative foundations explored in UNITS 3A and 3B.

Unit 4. Regulation of nutrient cycling and energy flows within ecosystems and scaling from genes-to-ecosystems:
How does species composition influence the ecosystem processes such as nutrient cycling and energy flow? The aggregation of species in space and time has consequences for ecosystems because nutrients and energy are transferred through consumer-resource interactions. Students will explore hypotheses for a relationship between species diversity, food web structure, and ecosystem function, and test predictions from these hypotheses with data in associated lab exercises. We also will explore several examples of studies that are attempting to scale across levels of biological function from genes to ecosystems.

Methods of Assessment

Assessment				
Form of Assessment	Weight of Assessment	Due Date of Assessment	Learning Outcome	Additional Comments
In-Class Top Hat Questions	10%	Daily	1-5	We will use Top Hat during most lecture periods. The majority of these are based on participation. We will drop your lowest 10% of question responses to account for the need to occasionally miss lectures (illness, etc.).
Paper Discussions	15%	Periodically	1-5	Periodically we will assign papers from the literature on key topics, and will expect you to answer a few questions about your readings.
Lab/Tutorial Exercises	25%	Weekly	4,5,6,7	See Courselink and lecture notes for details
Midterm Exam	20%	February 26 in class	1 -3; 5	
Cumulative Final Exam	30%	April 20 19:00-21:00	1-3; 5	

Important Dates

Deadlines will be posted on Courselink and also will be discussed during lecture. Be sure to attend lectures regularly or you may miss important updates to the curriculum.

Course and University Policies

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact, and be prepared to provide supporting documentation. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Late assignments will be penalized 10% for each 24 hour period.

If you miss the midterm exam due to illness or for other reasons officially recognized by the university, your final grade will be reweighted towards the final exam. In the case of missed final exam, a term paper (typed, 8-12 pages text not including references, double-spaced, 12 point font) will be assigned on a mutually-agreed topic closely linked to the course content. We will not offer makeup exams in this class.

Top Hat Questions

We will use the Top Hat system to assess your understanding of the lecture material, which will allow us to have better insight into how students are retaining information as we move through the curriculum. Quizzes will not be announced and can take place at any time during the lecture period.

The appropriate timing for these quizzes may not always be at the start of class. You must be on time and present during lecture to participate in the in-class quizzes. We will post the results of quizzes periodically during the semester - you are responsible for ensuring that your responses are properly reflected on the Top Hat system.

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities (soon to be re-named Student Accessibility Services) as soon as possible.

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.csd.uoguelph.ca/csd/

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students

need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisort.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

E-mail Communication
As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Drop Date
The last date to drop one-semester courses, without academic penalty, is the 40th class day. To confirm the actual date please see the schedule of dates in the Undergraduate Calendar. For regulations and procedures for Dropping Courses, see the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Copies of out-of-class assignments
Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Recording of Materials
Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Campus Resources

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
http://www.uoguelph.ca/registrar/calendars/index.cfm?index

If you are concerned about any aspect of your academic program:

- make an appointment with a program counsellor in your degree program. http://www.bsc.uoguelph.ca/index.shtml or https://www.uoguelph.ca/uaic/programcounsellors

If you are struggling to succeed academically:

- There are numerous academic resources offered by the Learning Commons, including Supported Learning Groups for a variety of courses, workshops related to time management, taking

multiple-choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. http://www.learningcommons.uoguelph.ca/

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high-performance situations. http://www.uoguelph.ca/~ksomers/

If you have a documented disability or think you may have a disability:

- The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability. For more information, including how to register with the centre please see: https://www.uoguelph.ca/csd/