

**University of Guelph  
College of Biological Science**

**Integrative Biology**

**Course Outline**

**Populations, Communities and Ecosystems, BIOL\*3060**

**Winter 2015**

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. John Fryxell (SCIE 2461, email: jfryxell@uoguelph.ca)

Dr. Merritt Turetsky (SCIE 2469, email: mrt@uoguelph.ca)

**Course schedule**

Lectures

Mon, Wed, Fri 09:30AM - 10:20AM

Tutorials/Labs

0101		TH 10:30-11:20
0102		TH 11:30-12:20
0103		TH 12:30-1:20
0104		F 10:30-11:20
0105		F 11:30-12:20
0106		F 12:30-1:20
0107		F 1:30-2:20
0108		F 2:30-3:20

**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 Resources**

TBA

#### **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 three units described below are examples of the questions that will be addressed using lectures, guided class discussions, and tutorial/lab exercises. Specific content in each unit may be subject to change.

##### 1. Causes of variation in population abundance and spatial distribution:

- A. How can the causes of population dynamics be analyzed? Students will learn how to estimate demographic rates and practice translating biological hypotheses into quantitative models, so as to formally assess factors influencing population increase or decrease.
- B. How do ecological constraints influence the evolution of life history characteristics? Students will integrate information on how organisms allocate energy to various life history functions (growth, reproduction, defense against predation) into quantitative models to refine predictions of adaptive life histories.
- C. 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.

D. 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 1A-C to consider how migration among sub-populations influences population dynamics in a case study.

## 2. Explanations for the abundance, number and identity of species in communities:

A. 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.

B. 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 1 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.

C. 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 2A and 2B.

## 3. Regulation of nutrient cycling and energy flows within ecosystems:

A. 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.

B. How do the functional characteristics of organisms influence ecosystem functioning? The transfer of energy through food webs depends on the physiological characteristics of organisms. Therefore, changes in ecosystem functions can depend on the shifts in the species composition of species. Students will explore hypotheses that relate physiological and ecosystem processes, and test predictions from these hypotheses with data in associated lab exercises.

Week	Topics Covered in Lecture*	Lab/Seminar Topic*	Readings
1	Population growth and regulation	Regression lab	TBD
2	Life history evolution	Selection coefficient lab	TBD
3	Resource use and behavioral ecology	Functional response lab	TBD
4	Climate, conditions, and resources	Nitrogen deposition lab	TBD
5	Predator-prey dynamics	Predator-prey model lab	TBD
6	Movement and spatial dynamics	Resource selection lab	TBD
7	Introduction to communities and metacommunity theory	Metacommunity lab part 1	TBD
8	Metacommunity theory continued	Metacommunity lab part 2	TBD
9	Competition and mutualism	Succession & diversity lab	TBD
10	Ecological succession	Stability-diversity lab part 1	TBD
11	Nutrient cycling and energy flow	Stability-diversity lab part 2	TBD
12	Link between community structure and ecosystem function	Ecosystem function with declining diversity lab	TBD

\*May be subject to change

### Methods of Assessment

Assessment				
Form of Assessment	Weight of Assessment	Due Date of Assessment	Course Content /Activity	Learning Outcome Addressed
Lab participation and case study reports	40%			4,5,6,7
Midterm Exam	25%			1 -3; 5
Cumulative Final Exam	35%			1-3; 5

### Important Dates

TBD

### 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 business day.

In the case of missed 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.

#### 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](mailto: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 advisor.

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 40<sup>th</sup> 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.

### Grading

Indicate all course policies regarding in-semester tests and assignment submissions, including time and place for submission of assignments and explicit penalties for late submissions.

### **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/>