



BIOL*4110 Ecological Methods

Fall 2019

Section(s): C01

Department of Integrative Biology

Credit Weight: 1.00

Version 1.00 - June 10, 2019

1 Course Details

1.1 Calendar Description

This course will examine the theoretical and practical aspects of research methods in ecology. Emphasis will be placed on experimental design, sampling, population estimation, statistical inference, and characteristics of producers and consumers. Students will participate in research projects of their own design, and will gain experience in preparing research proposals, research papers and posters, and making oral presentations.

Pre-Requisites: BIOL*3010, BIOL*3060, (STAT*2040 or STAT*2230)
Restrictions: Restricted to students in BSCH.WBC and Ecology majors/minors

1.2 Course Description

In this course you will examine the theoretical and practical aspects of ecological research. Emphasis will be placed on experimental design, sampling, taxon identification population estimation, statistical inference, data visualisation and scientific writing.

You will design and conduct a research project and in doing so gain experience in preparing a proposal, a research paper, poster, and oral presentation. In F19, the research projects will be coordinated around the natural areas on the University of Guelph campus.

1.3 Timetable

LEC Tues, Thur 01:00PM - 02:20PM SCIE, Room 2306

LAB Thur 02:30PM - 05:20PM SCIE, Room 2306

1.4 Final Exam

Exam time and location is subject to change. Please see WebAdvisor for the latest

information.

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Alex Smith M Alex Smith
Email:	salex@uoguelph.ca
Telephone:	519-824-44120 x 52007
Office:	SCIE 2464

3 Learning Resources

3.1 Required Resources

The Scientist's Guide to Writing: How to Write More Easily and Effectively throughout Your Scientific Career (Textbook)

Stephen B. Heard (2016) **The Scientist's Guide to Writing: How to Write More Easily and Effectively throughout Your Scientific Career**. Princeton University Press. 320 pages.

Experimental Design for the Life Sciences (Textbook)

Graeme D. Ruxton and Nick Colegrave (2016) **Experimental Design for the Life Sciences** Paperback 4th edition. Oxford University Press. 224 pages.

3.2 Recommended Resources

Field Notes on Science & Nature (Textbook)

An additional book that you may find helpful (and enjoyable) to read. You have digital access to the entire book via the Guelph library:

<https://subzero.lib.uoguelph.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&scope=sit>

"Covering disciplines as diverse as ornithology, entomology, ecology, paleontology, anthropology, botany, and animal behavior, Field Notes offers specific examples that professional naturalists can emulate to fine-tune their own field methods, along with practical advice that amateur naturalists and students can use to document their adventures."

Fundamentals of Data Visualization (Website)

<https://serialmentor.com/dataviz/>

Claus O. Wilke Fundamentals of Data

Visualization. <https://serialmentor.com/dataviz/>. This is the website for the book “

Fundamentals of Data Visualization,” published by O’Reilly Media, Inc. The website contains the complete author manuscript before final copy-editing and other quality control

R Graphics Cookbook (Website)

<https://r-graphics.org/index.html>

Winston Chang R Graphics Cookbook, 2nd edition. <https://r-graphics.org/index.html>. The **R Graphics Cookbook**, a practical guide that provides more than 150 recipes to help you generate high-quality graphs quickly, without having to comb through all the details of R’s graphing systems. Each recipe tackles a specific problem with a solution you can apply to your own project, and includes a discussion of how and why the recipe works. This URL is a free online copy.

Top 50 ggplot2 Visualizations (Website)

<http://r-statistics.co/Top50-Ggplot2-Visualizations-MasterList-R-Code.html>

Selva Pra bhakaran (2019). Top 50 ggplot2 Visualizations. <http://r-statistics.co/Top50-Ggplot2-Visualizations-MasterList-R-Code.html>. This tutorial helps you choose the right type of chart for your specific objectives and how to implement it in R using ggplot2.

3.3 Textbooks on Reserve

A copy of each required textbook has been placed on reserve at the Library in the Ares Course Reserves System.

<https://ares.lib.uoguelph.ca/ares/>

3.3 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:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/pdf/files/calendar.pdf>

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/programcounsellorshttps>

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/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/clinichttps>
- 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.

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/>

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Appreciated the diversity, beauty, intricacies and opportunities involved in conducting ecological research
2. Design a self-guided research question and project at the level necessary for a fourth-year research project within the constraints imposed by the course (one semester, available

resources etc).

3. Apply the scientific method to current ecology problems and evaluate the evidence for an ecological mechanism that demonstrates the use of logic, an evaluation of the literature, incorporation of information on multiple perspectives, and statistical analyses of data.
 4. Generate, interpret and develop comfort with abiotic and biotic inventory techniques.
 5. To efficiently conduct and record all the steps in Goals 1 and 2 to obtain unbiased and sufficient abiotic and biotic data.
 6. Accurately and effectively this scientific process to a range of audiences, in graphic, oral and written form
 7. To appreciate the unpredictable nature of field biology and have the opportunity to employ problem solving and improvisation.
 8. To develop a level of comfort with the complexity and uncertainty inherent in ecological science
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5 Teaching and Learning Activities

5.1 Lecture

Topics: course schedule
Thursday September 05 - First Class

Thursday September 12: First Group Presentation: "Research Proposal"

Thursday September 19: Written Proposal Due

Tuesday October 17: THANKSGIVING - NO CLASS

Thursday October 24: Second Group Presentation: "Progress Report as Infographic"

Thursday November 21: Third Group Presentation: "Final Research Seminar"

Thursday December 05: Field Notebook Due

Thursday December 05: Final Reflection Piece Due

Thursday December 05: Final Paper Due

6 Assessments

6.1 Assessment Details

Written Research Proposal (15%)

Date: Thu, Sep 19

Learning Outcome: 2, 3, 6, 8

Group work, adjusted by individual contribution as assessed by group members.

20%

Field Notebook/ Participation (20%)

Date: Thu, Dec 5

Learning Outcome: 5, 7, 8

20%

Written Final Research Report (40%)

Date: Thu, Dec 5

Learning Outcome: 2, 3, 4, 5, 6, 7, 8

Group work, adjusted by individual contribution as assessed by group members.

40%

Oral Presentation (20%)

Learning Outcome: 3, 6, 8

Per student, one oral presentation of either proposal, research progress, meta-analysis, final research.

See 'Important Dates'.

20%

Reflection Piece (5%)

Date: Thu, Dec 5

Learning Outcome: 1, 7, 8

Reflection Piece: A short essay (2-300 words) where you reflect on how your experience in this course has affected your worldview of how science is done and reported.

7 Course Statements

7.1 Course Content

Traditional lectures for this course will be used infrequently to introduce discussions regarding field safety, experimental design, statistics, principles of visualisation and scientific writing. Because it is a 1.0-credit course, students should expect to invest at least an

additional 14h/wk. Beyond the irregular lectures, scheduled class times are devoted to discussions and exercises supporting inquiry-based learning. Specifically, groups of students will develop and carry out a semester-long ecological study involving collection and analysis of original data, and scientific report writing.

7.2 Release and indemnification form

Students must understand the distribution of responsibilities when fieldwork is carried out. The University seeks to provide opportunities for an optimum training and educational experience, but it is the student's responsibility to effectively and safely exploit this opportunity. To this end, we (1) append to the course outline a list the kinds of field settings that might be encountered, and the attendant risks involved with these settings, as well as mandatory behaviours that will better ensure that field exercises are conducted safely; and (2) require students to fill out, sign and hand in at the first class, a Release and Indemnification Form (RIF), as a written agreement on your part to follow the behaviours and accept the responsibility for any deviations from them. Failure to hand in the RIF at the first class meeting will result in suspension of permission to conduct fieldwork until the form is handed in. The RIF will be available in class on the first day, and on Courselink thereafter.

7.3 Final Work

The last assignment is considered 'final work' in the course. Consistent with University policy, missed final work will result automatically in submission of a final grade of INC in the course, and the case referred to the Academic Review Sub-Committee. If the Sub-Committee receives documentation to warrant it, and if the completed term work comprises at least 65% of the final grade (that is, no term work was missed), the instructors will recommend a grade prorated on the basis of completed term work. If the Sub-Committee awards a deferred condition or privilege, the deferred condition or privilege will be to complete the final assignment. To the extent that non-participation could be considered obstruction and interference to learning by other students in the group, penalties may also be in order under University policy with regard to academic misconduct (see below).

7.4 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.

7.5 SAFETY IN ECOLOGY FIELD COURSES AT THE UNIVERSITY OF GUELPH

We expect you to read through and be familiar with the field safety section in the CBS Health and Safety Handbook (2019 edition). https://www.uoguelph.ca/cbs/sites/uoguelph.ca.cbs/files/CBS_SAFETY_HANDBOOK-2019.pdf#page=33

Many of the courses at this University involve field work in natural or semi-natural settings.

Students must understand the distribution of responsibilities when this work is carried out. The University seeks to provide opportunities for an optimum training and educational experience, but it is the student's responsibility to effectively and safely exploit this opportunity. To this end, here we list the kinds of field settings to be encountered, and the attendant risks involved with these settings. We also list a series of mandatory behaviours that will ensure that the field exercises are conducted safely. Lastly, we include a requirement to sign and return the last page to us, as a written agreement on your part to follow the mandatory behaviours and accept the responsibility for any deviations from them.

Location Risks and measures to avoid them

Forest -meeting cars while walking on road. Stay to side.

-poison ivy. Learn what it looks like and avoid. If contact is made, wash skin and clothing as soon as possible.

-bees. If you are stung, contact one of the course staff immediately. This is especially important if you have disturbed a colony! If you are allergic to bee stings, contact the staff at the beginning of the course.

-tree branches, twigs, logs, dead snags. All of these can fall on you, cause you to trip and fall, or otherwise injure you. Do not pull on dead trees, or dead snags. Do not disturb coarse woody debris. Do not climb trees.

-glass on ground or in soil can cut you badly. Do not dig through soil with your hands. If you get cut, contact the staff immediately and seek appropriate medical attention.

-lightning. Do not conduct field work if there is lightning.

-other people. **Assaults have been reported in the Dairy Bush, Arboretum, and other University Properties. Always travel with another person. Never conduct field work alone.**

-animal bites. No not encourage any vertebrate to approach you. This includes both wild and domestic animals.

-sunstroke. Wear a hat and sunblock if long periods of time are to be spent

in the open. Bring water to drink.

River -any body of water can cause drowning. Always wear hip waders if so instructed. Never enter water alone. Respect powerful currents and slippery surfaces.

-cold. Even in the absence of a drowning risk, falling into cold water in the fall or winter can result in hypothermia. Do not fall into cold water. Do not enter cold water alone. If you do get wet, exit the water immediately and seek assistance from the staff.

-infections. The rivers of the Grand River watershed are not as clean as they used to be. Who knows what lurks in the water? Do not allow the water to get in your mouth. Do not allow open wounds to contact the water. Any illness associated with contact with the water should be reported to medical personnel.

-slippery rocks. Avoid stepping on uneven rocks. Walk slowly and carefully. If you have a fall that causes an injury, let the staff know immediately.

Field -farm equipment. Do not sample close to the ground in active or abandoned agricultural fields without making your presence known to people using farm machinery. Be alert to approaching machinery.

- you may NOT enter any private land without permission from the landowner.

https://www.uoguelph.ca/cbs/sites/uoguelph.ca.cbs/files/CBS_SAFETY_HANDBOOK-2019.pdf

8 Department of Integrative Biology Statements

8.1 Academic Advisors

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

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: 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/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

8.3 Wellness

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/>

9 University Statements

9.1 Email Communication

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

9.2 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. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for course registration are available in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

9.4 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.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

More information can be found on the SAS website

<https://www.uoguelph.ca/sas>

9.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

9.7 Recording of Materials

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

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>
