



UNIVERSITY OF
ALBERTA



REN R 480

EXPERIMENTAL DESIGN AND DATA ANALYSIS FOR ENVIRONMENTAL SCIENCES

In Fall 2014, REN R 480, *Experimental Design and Data Analysis for Environmental Sciences*, is being offered at Yukon College as part of the Northern Environmental and Conservation Sciences Program. All students registered in REN R 480 must adhere to the requirements outlined in this course syllabus. University of Alberta students must also be aware of, and adhere to, the University's Code of Student Behaviour, referenced in the outline.

INSTRUCTOR: DR. KATHRYN AITKEN
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OFFICE HOURS: Thursdays 10:00-11:30, or by appointment

OFFICE LOCATION: A2509

E-MAIL: kaitken@yukoncollege.yk.ca

DAYS & TIMES: **Lectures:** Tuesday & Thursday, 2:30-4:00, A2206 (Lecture Hall)

Labs: Tuesday & Thursday, 4:00-5:30, A2702 (student computer lab)

COURSE DESCRIPTION:

Introduction to the scientific method; presentation of quantitative data in ecology, conservation and environmental sciences; common research approaches and experimental designs; fundamental concepts of statistics; classical hypothesis testing; parametric and non-parametric statistical tests; tests for binomial data; linear, non-linear, and multiple regression.

STUDENT LEARNING OUTCOMES AND COMPETENCIES:

On successful completion of this course, students will:

- 1) Understand the fundamental concepts of statistics and empirical research.
- 2) Understand the basics of experimental and sampling designs, and recognize common design pitfalls and misinterpretation of results.
- 3) Be able to use basic statistical methods to analyze ecological data, and understand the conditions and objectives under which each method is applicable.
- 4) Be able to formulate an experimental or sampling design to examine a research question, and organize and analyze a set of ecological data.

COURSE FORMAT (3-0-3):

The course consists of two 1.5-hour lectures and two 1.5-hour computer labs each week. Labs will consist of a short written assignment, or hands-on data summaries and analyses using the statistical methods discussed

during the lectures. Most labs will include completion of a short assignment to be handed in at the end of the lab; larger lab assignments may be completed over the two weekly lab sessions.

COURSE PREREQUISITES:

Successful completion of U of A STAT 151, Yukon College MATH 105 or RRMT 202, or an equivalent introductory statistics course, and registration in Yukon College/University of Alberta B.Sc. in Environmental and Conservation Sciences degree program or permission of instructor.

REQUIRED TEXTBOOKS/MATERIALS:

Gotelli NJ and Ellison AM. 2013. A Primer of Ecological Statistics. 2nd Ed. Sunderland (MA): Sinauer Associates, Inc. 613 p. ISBN-13: 978-1-60535-064-6

*Note: students may choose to purchase the 1st edition of this text. The 2nd edition contains new chapters in estimating species diversity and estimating species abundance; however, we will not cover these chapters in RENR 480. If students choose to purchase the 1st edition, please be aware that the 1st edition contains errata that have been corrected in the 2nd edition. Students using the 1st edition will need to check the list of errata available on the authors' webpage (<http://harvardforest.fas.harvard.edu/ellison/publications/primer/errata1e>).

MyYC, E-CLASS, OR COURSE WEBSITE:

Much of the material for the course will be available on the RENR 480 class site on MyYC. Assignments, marks, lectures (when applicable), announcements, additional reading, and other material will be available there for download or viewing. Students must ensure that they have a valid Yukon College student computing account. Information on setting up a MyYC account is available at: http://www.yukoncollege.yk.ca/student_info/pages/computing_services.

UNIVERSITY OF ALBERTA ACADEMIC INTEGRITY AND CODE OF STUDENT BEHAVIOUR:

Plagiarism and Cheating

The University of Alberta is committed to highest standards of academic integrity and honesty. Students must be familiar with standards regarding academic honesty and uphold policies of the University. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students at the University of Alberta are subject to the Code of Student Behaviour, as outlined in the 2014/2015 University Calendar. Students should familiarize themselves with the current version of the code and ensure they do not participate in any inappropriate behaviour as defined by it. Key components of the code specific to this course include the following statements. Plagiarism: no student shall submit the words, ideas, images or data of another person as the student's own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study. Cheating: no student shall represent another's substantial editorial or compositional assistance on an assignment as the student's own work. The most recent version of the Code of Student Behaviour can be found on line on the University of Alberta web site.

Students should speak with the course instructor about any questions or concerns about the code. Students should be particularly aware of the code as it pertains to internet and library research, use of previous class notes, reclamation plans of former students and interviews or discussions with others.

PROFESSIONALISM AND CLASSROOM RULES OF ENGAGEMENT:

Students are expected to attend all lectures and labs, be engaged and courteous in all course activities, and to

be on time for class. Please do not use cellular phones during class. Laptops are permitted for note taking and in-class work; however, please do not use laptops in class for non-class-related activities. While in computer labs, students are expected to refrain from using the computers to engage in non-class-related activities (e.g. Facebook, etc.).

COURSE REQUIREMENTS/EVALUATION:

Assignments

There will be several in-lab exercises and take-home assignments that involve a short written assignment and/or analysing or summarizing a set of data (provided by the instructor). The assignments and exercises will integrate methods and topics discussed during the lectures and will enable the student to gain hands-on experience working with real ecological data, conducting statistical analyses, and writing up results.

Exams

There will be one midterm examination and a final examination. The midterm will be held during class time on Oct 21. The final will be held at the end of term, during the scheduled College exam period. It will cover lecture and lab material from the entire course.

Evaluation

The course grade will be determined as follows:

Assignments	50%
Midterm exam	20%
Final exam	30%

Due Dates

Late assignments will lose 5% of their value per day that they are late, to a maximum of 1 week late, unless the student has received a written extension from the instructor. Assignments are due (unless otherwise specified) by 11:59 pm PST on the date that they are due.

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 College Academic Regulations (available on the Yukon College 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) at (867) 668-8785 or lassist@yukoncollege.yk.ca.

YUKON COLLEGE WRITING CENTRE:

All students are encouraged to make the Writing Centre a regular part of the writing process for coursework. Located in C2231 (adjacent the College Library), the Writing Centre offers half-hour writing coaching sessions to students of all writing abilities. Coaching sessions are available in person and through distance technologies (e.g., email plus Skype or phone). For further information or to book an appointment, visit the Centre's website: www.yukoncollege.yk.ca/student_info/pages/writing_centre.

LECTURE AND LAB TOPIC SCHEDULE (subject to change)

Week	Date	Topic(s)
1	4 Sept	Introduction & course overview
2	9 Sept	Framing and testing hypotheses; Manipulative vs correlational approaches
	11 Sept	Replication, pseudoreplication and randomization
3	16 Sept	Pseudoreplication, cont'd; Intro to R
	18 Sept	Types of experimental designs; Intro to R, cont'd
4	23 Sept	Types of experimental designs, cont'd
	25 Sept	Taking measurements and recording data
5	30 Sept	Selecting the appropriate number of replicates (power, Type I and Type II errors)
	2 Oct	Power, cont'd
6	7 Oct	Exploratory analysis
	9 Oct	Summary statistics – measures of location and spread (mean, standard error, confidence intervals)
7	14 Oct	Summary statistics, cont'd
	16 Oct	Three frameworks for statistical analysis (Monte Carlo analysis, Parametric analysis, Bayesian analysis); Midterm review
8	21 Oct	MIDTERM
	23 Oct	Data transformation
9	28 Oct	Review of correlation
	30 Oct	Regression (simple linear regression, least squares method)
10	4 Nov	Regression, cont'd (variance components, ANOVA tables, assumptions of regression)
	6 Nov	Regression, cont'd (diagnostic tests)
11	11 Nov	REMEMBRANCE DAY (no lecture or lab)
	13 Nov	Regression, cont'd (other kinds of regression)
12	18 Nov	Analysis of Variance (one-way, assumptions)
	20 Nov	ANOVA cont'd (ANOVA for randomized block, nested, two-way, repeated measures designs)
13	25 Nov	ANOVA cont'd (plotting ANOVA results, understanding interaction terms, multiple comparisons and Bonferroni corrections)
	27 Nov	Analysis of categorical data
14	2 Dec	Analysis of categorical data, cont'd
	4 Dec	Review for final exam
	TBD	FINAL EXAM – during Yukon College exam period