

**DEPARTMENT OF RENEWABLE RESOURCES
UNIVERSITY OF ALBERTA**

RenR 480/580 - Applied Statistics for the Environmental Sciences

Fall 2019 Syllabus

Course Website – <https://sites.ualberta.ca/~zihaohan/>

Instructor	Zihaohan Sang Office: 815 General Services Building Email: zihaohan@ualberta.ca Office Hours: Thursday 2 – 5 PM or by appointment
Assistants	Dante Castellanos-Acuna Office: 815 General Services Building Email: dcastell@ualberta.ca Office Hours: by appointment
Term	Fall 2019 (Start: September 3, End: December 5)
Classes	Tu & Th 8:00 to 9:20am Rm 866 General Services Building Th 12:30 to 13:50 Rm 866 General Services Building
No classes	Nov 13 & 15 (Fall Term reading week), Dec 5 (only afternoon lab canceled)
No classes 480	Oct 24 (RenR 580 draft presentations), and Dec 3 (RenR 580 final presentation)
Credits	*3 credits

Course Description

The course focuses on problem formulation, method selection, and interpretation of statistical analysis. Covers data management and data visualization, statistical tests for parametric, non-parametric and binomial data, linear and non-linear regression approaches. Participants of the RENR 480 section will gain general statistical literacy and learn how to visualize and analyze data with open-source software packages. Participants in the RENR 580 section will also engage in problem-based learning by analyzing data from their thesis research project. **Pre-Requisites:** A minimum of *60 of university-level courses; *3 introductory statistics recommended.

Teaching Philosophy:

Beyond striving to ensure that students learn the fundamental content of the courses, my objectives of teaching includes: (1) to foster critical thinking skills; (2) to facilitate the acquisition of lifelong learning skills; (3) to help students develop evidence-based problem-solving strategies; and (4) to prepare students having effective oral and written scientific communication. These are skills that students can transfer to any career choice and help students become ready and able to utilize their knowledge in their studies and their future employment.

Furthermore, my overall teaching philosophy is based on two principles: (1) active student learning strongly influences student-learning outcomes; and (2) assessment procedures strongly influence student acquisition of knowledge. Regardless of content, I believe that students should leave their courses with skills that they will use in their everyday lives. Therefore, I use a combination of traditional lecture and problem-based learning formats in my teaching. All of my courses materials are available in UofA websites, giving students full accessibility to lecture notes, slides, reading materials

and complementary online activities including video case studies. To achieve the goal of student learning, I value the importance of a collaborative and safe atmosphere and encourage the application of knowledge to new situations. All students have an equal opportunity to contribute to discussions, activities, and evaluations.

The instructor's role is to guide, providing access to information rather than acting as the primary source of information, and the students are expected to search for related knowledge as they learn to find potential solutions to their questions. The course is student-centred learning, and the instructor will provide all necessary help for each student's research project.

Course Format

The course has three weekly timeslots that are used flexibly for lectures and labs. Lectures (at Tuesday and Thursday mornings) focus on more theory, and the lab (during Thursday afternoon) would mostly for a set of exercises to put concepts from lectures into practice. Usually, some time is reserved on Thursday afternoons to work on assignments (RenR 480) and individual projects (RenR 580), where students analyze their own dataset using the methods covered in class.

References and Readings

None required or recommended specifically for this course.

Student Learning Outcomes and Competencies

Introductory section:

1. Become familiar with the fundamental concepts of statistics and empirical research. Understand how statistics can effectively be used in science.
2. By planning an independent student project, practice how to tell a scientific story from beginning to end, aided by statistical analysis and graphical presentation of quantitative data.
3. Learn the basics of experimental and sampling designs, and be aware of common design pitfalls and misinterpretations of results.

Data management and exploratory graphical analysis:

4. Learn how to collect and organize your data so that it is most useful for subsequent analysis.
5. Gain some hands-on experience with data organization, data checking, data preparation through a set of exercises and a student project.
6. Be able to thoroughly understand the nature of your data through graphical display of raw data and summary statistics before applying any statistical tests.
7. Learn how to generate publication-quality scientific graphs, and how to use the correct type of graph for various objectives.

Inferential statistics:

8. Get an overview of statistical methods, and learn under what conditions and for what objectives each method is applicable.
9. Explore how organizing your data determines what statistical analysis you can do.
10. Learn how the type of variables (continuous, discrete-ordinal, discrete-nominal, and binary) determines what statistical method you should use.

11. Be aware of conditions that need to be met for particular methods, learn how to test assumptions, carry out data transformation, and deal with missing values.

12. Practice empirical research, application of statistical methods, and writing reports through the course project

Specific methods:

Learn how implement basic experimental and sampling designs (CRD, RCB) and analyze data with common statistical methods (T-test, F-test, single and multifactor ANOVA, multiple comparison methods, chi-square test, z-test for proportions, nonparametric methods, linear and non-linear regression and correlation analysis, mixed models) using a structured approach:

- Background
- When to use the method
- How the method works
- What to report
- Example program code

Software:

This course introduces you to R, a free, open source programming environment for statistical analysis, data management and graphics. You can download it here for your own computer: <https://cran.r-project.org> or <https://cran.r-project.org/bin/windows/base>. As an alternative front-end to the R software, we will use the open source edition of R Studio Desktop. You can get it here for your own computer: <https://www.rstudio.com/products/rstudio/download/#download>.

Course Requirements, Marking and Grading

For RENR 480 (undergrad level):

	Percent	Due Date
Participation (showing up in class, asking questions helping others, letting yourself be helped)	15	N/A
Assignments (3 * 10% each)	30	Oct 6, 31, & Nov19
Course notes for RENR 480 participants	15	Dec 5, 8am
Final Exam (on last day of class):	40	Dec 5, 8am

For RENR 580 (graduate level):

	Percent	Due Date
Participation (showing up in class, asking questions helping others, letting yourself be helped)	10	N/A
Assignments (3 * 5% each)	15	Oct 6, 31, & Nov19
Draft Project (5 min presentation and website for RenR 580)	20	Oct 24
Final Project (5 min presentation and website for RenR 580)	30	Dec 3
Final Exam (on last day of class):	25	Dec 5, 8am

These judgements are based on a combination of absolute achievement and relative performance in a class. Faculties may define acceptable grading practices in their disciplines. The process by which the term marks will be translated into a final letter grade for the course. The process must be consistent with the University of Alberta Assessment Policy and accompanying Grading Procedure, which are available online at the University of Alberta Policies and Procedures Online (UAPPOL) website (<https://policiesonline.ualberta.ca>).

Policy for late submissions or missed tests

A missed final exam will also require a Doctor's note, and in this case you will be allowed to re-take the exam at a later date. In case of late submissions for the course project or course notes, a Doctor's note is also required, otherwise 10% will be deducted for each day past the deadline.

Hard deadline for late submissions of any kind:
Dec 10, 8am

Previous years' projects & talks:
<http://tinyurl.com/renr480projects>

Past Evaluative Material

Students will be given access to past or representative evaluative course material. All comments and feedback will be sent to each student by email within two weeks after submitted. Students can check their final exam, and hard copies can be provided once they require.

Plagiarism and Cheating

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.governance.ualberta.ca) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. 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 at: [University Governance > Code of Student Behaviour](#). Please familiarize yourself with it and ensure that you do not participate in any inappropriate behavior as defined by the Code. Key components of the code include the following statements.

30.3.2(1) 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.

30.3.2(2)c. No Student shall represent another's substantial editorial or compositional assistance on an assignment as the Student's own work."

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.

Students with Species Need

Students who require accommodation in this course due to a disability are advised to discuss their needs with Specialized Support & Disability Services (2-800 Students' Union Building).

Academic Support Centre

Students who require additional help in developing strategies for better time management, study skills or examination skills should contact the Student Success Centre (2-300 Students' Union Building). Policy about course outlines can be found in section 23.4(2) of the University Calendar.

Family-friendly Policy

Finally, I understand that unexpected family issue often the largest barrier to completing your coursework once you become a parent. I hope that you will feel comfortable disclosing your student-parent status to me. This is the first step in my being able to accommodate any special needs that arise. While I maintain the same high expectations for all student in my classes regardless of parenting

status, I am happy to problem solve with you in a way that makes you feel supported as you strive for school-parenting balance.

Tentative schedule

The schedule below is for general orientation, please visit the course website for updates on when project presentation and exams take place, and when assignments and websites are due.

Approximate time	Topic	Due date
Sep 3	Course introduction	
Sep 5-19	Introduction to R and R studio Statistical vocabulary Data tables and data management Basic data visualization in R	
Sep 24-Oct 3	Descriptive Statistics Graphics in R	Assignment #1 due on Oct 6
Oct 8 - 17	Principles of inferential statistics	
Oct 22 - 31	Analysis of Variance Experimental design	Assignment #2 due on Oct 31
Nov 5 - 7	Non-parametric tests	
Nov 11-15	Reading week, no classes	
Nov 19 - 28	Linear and non-linear regression Test for proportions	Assignment #3 due on Nov 19
Dec 2	Review session, project support	Final exam & Notes for RENR480 : due on Dec 5

***Disclaimer:** Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this syllabus.*