

NRM5413/ANSC5403/BIOL5407 - Biostatistical Analysis Applications

Course Syllabus – Spring 2021

Instructor

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Office Hours: MTWRF | 2:00-2:50 | Virtually OR face-to-face (RAS 113)
MWR | 3:30-4:50 | Virtually OR face-to-face (RAS 113)
Appointments (face-to-face or virtual) can always be made via e-mail or text. For those needed to meet on main campus, we can do so via appointment.
I also have "Open Door Office Hours". Feel free to come in anytime you see me in my office.

Teaching Assistant

Name: Joshua Coward
Office: RAS 117
Office Hours: M-F 9:00-10:00 (Josh has "open door office hours" as well.)
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Course Description

An advanced course in statistical concepts and models applied to agricultural and biological systems. Emphasis will be placed on data analysis and interpretation using computer statistical applications. The course applies all null hypotheses significance testing (NHST) procedures taught in NRM 5412, first in Program SPSS, then in Program R after the thorough overview of R programming. NHST theory for these advanced scenarios will also be introduced and applied in R; Generalized Linear Models (GLMs) including Poisson regression, dichotomous variables, binomial distribution, and proportion testing and logistic regression: Generalized Linear Mixed Models (GLMMs); and circular distributions.

Enhanced Course Description

H. G. Wells argued that "statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write." Due to its importance to the everyday person, some (a.g. Arthur Benjamin) are currently advocating for courses in statistics to replace algebra courses in high school.

Statistical proficiency is even more important to the scientist, as good science employs statistical knowledge in *every* step of the scientific method. Statistics is *the* tool used to discern truth from fiction, and science is all about finding the truth. Statistics is so fundamental to sound science, that Karl Pearson described statistics as the "grammar of science." Whether you go on to be a technician, a researcher, a manager, or a professor, the knowledge you gain in this course will be critical to your success.

In the short term, statistical knowledge will inform most decision you make in every stage of your graduate research, and will in large part affect the success of your research. Then you will be going to job interviews, where a chief complaint from hiring managers of new hires concerns their lack of statistical ability. So please take this course very seriously. Your graduate committee and future employers *will* want to know if you know your statistics!

Let's be frank. Statistics can be an intimidating subject. My promise is to *walk with you every step of the way*. I have been teaching graduate statistics and helping students with their research at Sul Ross since 2015. Prior to coming to Sul Ross, I had 20-years of experience applying statistical principles as an aerospace engineer at NASA for our nation's human spaceflight programs. Life then brought me to West Texas, and I couldn't be happier. I LOVE teaching statistics, and plan to help each of you become statistically competent by the end of this semester.

Now, let's go delve in and tackle some statistics!

Objectives and Outline

Course Objectives

This course addresses Program Learning Outcome 1 for the M.S. and 1 for the M.Ag. programs, which states that students should be able to: Apply statistical concepts and procedures to natural resource data.

Specific student outcomes will include the following:

1. Assess and review experimental designs, paired-sample hypotheses, multi-sample hypotheses, multiple comparisons, factorial and nested ANOVA, data transformations, linear regression, correlation, multiple regression and correlation, polynomial regression, and the binomial distribution.
2. Understand and interpret advanced statistical analyses in published research literature.
3. Interpretation and application of analytical results to research projects.
4. Application and interpretation of statistical data analysis using SPSS software.

Course Outline - SPSS Track (Names are of sections in Laerd Statistics (unless *ed), parenthetical numbers are the associated chapters in the Zar textbook from our prior course)

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| 1. Getting Started (Basics) | 15. Two-way ANOVA (Zar Ch 12) |
| 2. Types of Variables (Zar Ch 1) | 16. One-way Repeated Measures ANOVA (Zar Ch 12) |
| 3. Charts & Graphs | 17. *Randomized Block ANOVA (Zar Ch 12) |
| 4. Descriptive Statistics (Zar Ch 3&4) | 18. Three-way ANOVA (Zar Ch 14) |
| 5. Testing for Normality | 19. *Nested ANOVA (Zar Ch 15) |
| 6. Transforming Data (Zar Ch 13) | 20. One-way MANOVA (Zar Ch 16) |
| 7. Chi-square Goodness of Fit Test (Zar Ch 22) | 21. Linear Regression (Zar Ch 17) |
| 8. Chi-square Test of Independence (Zar Ch 23) | 22. Pearson's Correlation (Zar Ch 19) |
| 9. One-sample t-Test (Zar Ch 7) | 23. Standard Multiple Regression (Zar Ch 20, 21) |
| 10. Independent-samples t-Test (Zar Ch 8) | 24. *Dichotomous Variables (Zar Ch 24) |
| 11. Mann-Whitney U-Test (Zar Ch 8) | 25. Logistic Regression (Zar Ch 24) |
| 12. Paired-samples t-Test (Zar Ch 9) | 26. Poisson Regression |
| 13. One-way ANOVA (Zar Ch 10, 11) | 27. *Model Selection and AIC |
| 14. Kruskal Wallis H Test (Zar Ch 10) | |

Course Outline - R Track (Numbers given are the associated chapters in the Davies textbook)

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| 1. Getting Started | 12. Exceptions, Timings, and Visibility |
| 2. Numerics, Arithmetic, Assignment, and Vectors | 13. Elementary Statistics |
| 3. Matrices and Arrays | 14. Basic Data Visualization |
| 4. Non-Numeric Values | 15. Probability |
| 5. Lists and Data Frames | 16. Common Probability Distributions |
| 6. Special Values, Classes, and Coercion | 17. Sampling Distributions and Confidence |
| 7. Basic Plotting | 18. Hypothesis Testing |
| 8. Reading and Writing Files | 19. Analysis of Variance |
| 9. Calling Functions | 20. Simple Linear Regression |
| 10. Conditions and Loops | 21. Multiple Linear Regression |
| 11. Writing Functions | 22. Linear Model Selection and Diagnostics |

Student Learning Objectives for the M.Ag. in Range and Wildlife Management

The graduating student will demonstrate that he/she is able to:

1. Apply statistical concepts and procedures to natural resource data
2. Evaluate literature and references as they apply to the natural resource field
3. Demonstrate their knowledge of the fundamentals and advanced concepts of range and wildlife management.

Student Learning Objectives for the M.S. in Range and Wildlife Management

The graduating student will demonstrate that he/she is able to:

1. Apply statistical concepts and procedures to natural resource data
2. Evaluate literature and references to substantiate an applied research project.

3. Examine, select, and utilize appropriate resources, materials, and data collection instruments to implement research projects.
4. Justify and defend the research questions and design.

Logistics / Materials / Grading Information / Course Policies

Class Meeting Time/Place

Times: Monday, Wednesday, Friday 10:00 am -11:50 am

Place: Blackboard Collaborate Ultra (online) and RAS 126 (when face-to-face)

Text and Supplies

1. Davies, T. M. 2016. *The Book of R, A First Course in Programming and Statistics*. No Starch Press. San Francisco, CA. (**Required**)
2. Subscription to Laerd Statistics (<https://statistics.laerd.com/>) (**Required**).
NOTE: Each student is required to purchase their own, individual subscription to Laerd Statistics before our fourth class day. In doing so, all students must agree to the Laerd Statistics Terms & Conditions. All students **MUST** subscribe individually and sign a statement of agreement to the Terms & Conditions; **failure to subscribe and sign the statement of agreement will result in a grade of "F" for this class**. Both the instructor and Laerd will verify your subscription. NOTE: from Laerd Statistics FAQ: "We do not allow the downloading or printing of any Laerd Statistics material (Premium or otherwise). This is to prevent any unauthorized spreading of the content to non-paying members."

Course Grade

Homework 25%

Exam I 25%

Exam II 25%

Exam III 25%

Grade Assignment

<60 = F, 60-69 = D, 70-79 = C, 80-89 =B, 90-100 = A.

Readings

The course and its material are organized by chapter. Each chapter has a reading assignment that explains the material. ***The assigned readings are essential; completing 100% of the assigned readings is expected.***

Homework

Late assignments will be accepted at the instructor's discretion, with a **10% penalty per day late** (i.e. 10% for 0-24 hours late, 20% for 24-48 hours late, etc.) Late assignments are not accepted after 7 days.

Exams

Three take-home examinations will be given during the semester:

- Exams will consist of a variety of questions, including multiple-choice, fill-in-the-blank, short-answer, and essay.
- No make-up exams will be given for an unexcused absence. You must notify me of an excused absence from an exam **PRIOR** to the start day and time of the exam you will miss; i.e. arrangements for make-up exams must be made **BEFORE** the exam is given.
- Exams will be completed outside of class, online in Blackboard, **using a strict honor code**. The following statement must be e-mailed to your instructor *after* you submit *each* exam for you to earn a grade other than zero:

"I have neither given nor received any unauthorized aid on this exam."

Participation

- I expect a high level of engagement to enhance everyone's learning. This includes interacting with the instructor and other students, asking questions during class, posting in the Blackboard discussion forums, writing entries in Blackboard journals, attending office hours (in-person and/or online), completing outside of class assignments and readings, and being prepared to participate in class discussions.
- Online participation: Any time you attend class online (via Blackboard Collaborate Ultra), you are required to be properly dressed, avoid video distractions, and keep your microphone muted except to ask questions or request clarification. **Anyone causing distractions may be muted, have their video shut off, and/or removed from the session without warning, at the instructor's discretion.**

Due Dates/Times/Extensions

All graded work, including exams, are expected to be on-time. **No due dates for ANY graded work, including exams, will be extended without PRIOR e-mail arrangements** initiated by the student, and only for valid reasons.

Academic Integrity

Academic dishonesty hurts everyone and reduces the value of college degrees. Doing someone else's work, presenting the ideas and work of others as your own, submitting the same paper for multiple classes, and/or failing to cite your sources when you utilize the ideas of others, are all examples of academic dishonesty. It is your responsibility to read and understand the university's policy on academic dishonesty in the SRSU Student Handbook, as all violations will be taken seriously and handled through the appropriate university process. The Student Handbook can be found at: <https://www.sulross.edu/page/2454/student-handbook> (page 80). In addition, please note that plagiarism detection software will be used in this class for written assignments, as well as monitoring software for any online exams. **Any student shown to violate academic integrity will receive no credit (0) for work done and/or may be penalized in accordance with published University Rules.**

Communication

You are required to check your *Sul Ross e-mail and Blackboard announcements several times per week*. I do not use the personal or preferred e-mail addresses that you may have on record with the University.

Attendance

- Students are expected to make every effort to attend class live (as it happens) either online OR in person (when available and if comfortable doing so). All lectures will be recorded and posted in Blackboard. If live class must be missed, the student is expected to watch the recorded lecture as soon as practical.
- Roll will be taken every lecture for the face-to-face students, attendance will be automatically recorded for those joining live lecture online, and viewing of recorded lectures will also be automatically recorded by Blackboard.
- It is policy of this class to **drop a student with a grade of ``F" if 9 hours or more of class are missed**. Any time class is missed, for any reason, it will be recorded as an absence. Any time class is missed, for any reason, it will be recorded as an absence, unless an absence can be shown to be due to a college-related event.
- Students are expected to arrive to class on time. If a student is perpetually late, they will be asked to not attend class unless they can arrive on time. If tardiness becomes a problem for the class as a whole, people who arrive late will not be permitted to enter the class. If this stricter policy becomes necessary, there will be an announcement made in class.

Electronics in the Classroom

The use of personal laptops, cell phones, iPads, and other electronic devices can create distractions for learning, both for yourself and others. However, such devices can also be great tools to aid learning. Therefore, using electronic devices for class purposes (e.g. taking notes, working out problems, searching the internet) is allowed in silent mode. If you choose to use electronic devices in class, do so in a professional manner that does not impede others' learning. **The use of internet-capable devices (e.g. smartphones) is not allowed for exams. Headphones will not be allowed in class for any reason.**

General Expectations

Statistics can be a very intimidating subject. However, you cannot survive in the biological sciences without knowing statistics. To maximize learning in this course, we should have some expectations of each other.

I expect from you:

- ASK whenever something is unclear. Preferably in class, as it is likely that others have the same question. **THIS IS YOUR MOST IMPORTANT JOB!**
- ATTEND lecture; be on time as a courtesy to others.
- PARTICIPATE in class.
- READ the required sections from the text. If you come to me with a question and it is clear that you haven't read the book or the lecture notes, I will direct you to the reading first.
- DO all assignments, do them in a timely manner, and ensure I can read them! Parts of assignments that I can't read will not be graded. If you are late with assignments, it prevents me from returning others' assignments until I have yours in-hand.
- BE HONEST in all of your work.

What you can expect from me:

- GIVE 100% effort in teaching you the best I can.
- Make myself AVAILABLE to help outside of class.
- ANSWER all of your questions to the best of my knowledge, and if I don't know the answer I will find out.
- Be FAIR in all grading.
- Provide you with timely, constructive FEEDBACK regarding your work.

Resources and Assistance

SRSU Library Services

The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu. Appointments to access the building are required (see <https://sulross.libguides.com/covid19/building>). The library also offers curbside delivery of physical resources (see <https://sulross.libguides.com/covid19/curbside>). Off-campus access requires your LoboID and password. Check out materials using your photo ID. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).

Tutoring

Since the library can be visited by appointment only, there will be no drop-in tutoring, nor can face-to-face tutoring be done safely during COVID-19. So, all tutoring will be online. Tutoring will be available starting on August 31. Contact Anita Banegas (432-837-8992, abanegas@sulross.edu) or Mabel Garcia 432-837-8629, mag15bf@sulross.edu) to get an e-mail invitation for either group or individual tutoring, or to request an appointment.

Blackboard's Support Desk

SR has moved its Blackboard site to the Texas State University System's (TSUS) Blackboard Environment. Sul Ross' Blackboard login page will take you straight into the new TSUS Blackboard environment from the Sul Ross website. It may look slightly different to you, and may want to tweak some of your settings that you had previously. If you have any technical issues with the new system or Blackboard itself, e.g. if you are having issues submitting a document, getting videos to play, or you are dealing with a technical error in the course, then the Blackboard Support Desk is ready to help you. The support desk is open 24 hours a day, 7 days a week. You can reach the support desk by calling 888-837-6055, emailing blackboardsupport@sulross.edu, using resources from the Technology Support tab within Blackboard, or clicking the Support Desk graphic on the course homepage. As always, academic questions about course assignments, due dates, and general course questions should be directed to your instructor.

Americans With Disabilities Act

Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Students seeking accessibility / accommodations services must contact Rebecca Greathouse Wren, LPC-S, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a message and someone will get back to you as soon as possible during working hours), or email rebecca.wren@sulross.edu. The office is located on the first floor of Ferguson Hall (Suite 112), and the mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas, 79832.

Tentative Course Schedule (Subject to Change)

Week	Dates	SPSS (Laerd) Topic(s) Laerd Topic Titles (unless *) (Zar Chapters)	R Topic(s) Chapters from Davies
1	01/11-01/15	Getting Started (Basics) Types of Variables (Ch 1)	Course Introduction Ch 1. Getting Started
2	01/18-01/22	Charts & Graphs Descriptive Statistics (Chs 3&4) Testing for Normality Transforming Data (Ch 13)	Ch 1. Getting Started Ch 2. Numerics, Arithmetic, Assignment, and Vectors
3	01/25-01/29	Chi-square Goodness of Fit Test (Ch 22) Chi-square Test of Independence (Ch 23) One-sample t-Test (Ch 7)	Ch 3. Matrices and Arrays
4	02/01-02/05	Independent-samples t-Test (Ch 8) Mann-Whitney U-Test (Ch 8) Paired-samples t-Test (Ch 9) Wilcoxon Signed-Rank Test (Ch 9)	Ch 4. Non-Numeric Values Ch 5. Lists and Data Frames
5	02/08-02/12	One-way ANOVA (Ch 10, 11) Post-Hoc Testing (Ch 11) Multiple Comparisons (Scheffé Test) (Ch 11) Kruskal Wallis H Test (Ch 10)	Ch 6. Special Values, Classes, and Coercion Ch 7. Basic Plotting
6	02/15-02/19	Two-way ANOVA (Ch 12) Two-way mixed ANOVA (Ch 12)	Ch 7. Basic Plotting Ch 8. Reading and Writing Files
7	02/22-02/26	Randomized Block ANOVA (Ch 12) One-way Repeated Measures ANOVA (Ch 12)	Ch 9. Calling Functions
8	03/01-03/05	Three-way ANOVA (Ch 14) Nested ANOVA* (Ch 15)	Ch 10. Conditions and Loops
9	03/08-03/12	SPRING BREAK HOLIDAY WEEK	
10	03/15-03/19	One-way MANOVA (Ch 16)	Ch 11. Writing Functions Ch 12. Exceptions, Timings, and Visibility
11	03/22-03/26	Linear Regression (Ch 17) Pearson's Correlation (Ch 19)	Ch 13. Elementary Statistics Ch 14. Basic Data Visualization Ch 15. Probability Ch 16. Common Probability Distributions
12	03/29-04/02	Standard Multiple Regression (Ch 20, 21)	Ch 16. Common Probability Distributions Ch 17. Sampling Distributions and Confidence
13	04/05-04/09	Poisson Regression	Ch 18. Hypothesis Testing Ch 19. Analysis of Variance
14	04/12-04/16	Dichotomous Variables (Ch 24) Logistic Regression (Ch 24)	Ch 19. Analysis of Variance Ch 20. Simple Linear Regression
15	04/19-04/23	General GLMMs Model Selection & AIC (Burnham & Anderson)	Ch 21. Multiple Linear Regression Ch 22. Linear Model Selection and Diagnostics
16	04/26-04/28	Model Selection & AIC (Burnham & Anderson)	Ch 22. Linear Model Selection and Diagnostics App B. Working with RStudio

Holidays

Mon	01/18	MLK holiday (no classes)
Mon-Fri	03/08-12	Spring Break (no classes)
Fri	04/02	Good Friday Holiday (no classes)

Exam Schedule

Exam I Due (Blue Content)	Friday, February 19 (tentative)
Exam II Due (Orange Content)	Friday, April 02 (tentative)
Exam III Due (Green Content)	Friday, April 30 (per SRSU schedule)

COVID-19 Safety Pledge - One University/One Community

As a partner in each campus community the faculty, staff, and students agree to the following statements in relation to the COVID-19 virus:

- I will wear a face covering, wash my hands, and disinfect my workspaces to protect others from the potential spread of this virus.
- I promise to follow social distancing guidelines as a way to mitigate the risk of transmission to others both professionally and personally.
- I will monitor my health and report any potential COVID-19 illness and agree to follow the guidelines set forth in the *Sul Ross State University Return to Campus Plan* or as described by Sul Ross State University to protect the public health.
- I understand that my actions may impact the larger community and could affect my academic progress or professional attainment at Sul Ross State University.

Additionally:

- Between classes, incoming and outgoing faculty members and students are expected to sanitize their desks, chairs or other areas they have occupied. Cleaning by both outgoing and incoming individuals minimize the risk of any contagion.
- Students and faculty entering buildings will be asked to respect the flow of foot traffic and to enter and exit buildings and classrooms through designated areas.
- Only two people may ride an elevator at one time. Students are encouraged to take the stairs when possible.
- Students and faculty are **REQUIRED TO WEAR FACE MASKS** while in enclosed spaces for classes and lab.

Furthermore, University employees and students are expected to help monitor COVID-19 as a way to prevent the spread of the virus and protect each other. To accomplish the required data collection, the University asks its community members to take three actions:

1. Keep keep track of their health and track any potential symptoms;
2. Test for the virus when you have potential symptoms or have been in contact with someone who has symptoms; and
3. Trace your steps and keep accurate track of your interactions with others so that contact tracing can, if necessary, be done quickly and efficiently.

If you have been exposed to COVID-19 or think you might have been exposed, then you must quarantine for 14 days before you return to class.

If a student attends class without a face mask, the instructor will ask the student to wear one, and if necessary, leave to get one, advising the student where some disposable masks might be available in the building. If the student refuses to wear a mask, they will be required to leave the lecture and join online. If an unmasked student refuses to leave, the instructor will call UDPS to have the student removed and/or cancel the class to be resumed later online or recorded without students. The violating student will be reported to the appropriate department chair(s) and the Office of Student Life for potential disciplinary action, as described below.

Failing to meet these expectations may be subject to corrective action under University disciplinary policies.

Changes or recommendations to the guidelines based on evolving guidance from federal, state, or local agencies will be communicated to the university community.