NR 5021 Syllabus (Fall 2017)
Statistics for Agricultural and Natural Resource Professionals (3 cr)

**Background:** This course is designed for graduate students in the agricultural, environmental, natural resources, and other related programs that require an understanding of statistics and applied quantitative research. Course content focuses on data analysis approaches using common statistical methods, e.g., probability and distributions, simple linear, multiple, and logistic regression, linear models, and ANOVA.

**Time/location:** Mon/Weds 8:45 a.m. to 10:00 a.m., room 203 Green Hall

**Prerequisite:** College algebra and/or consent of instructor.

**Attendance:** Attendance is mandatory at all sessions. In the event of an absence (e.g., conference travel, illness), please email the instructor ahead of time.

**Format:** Lecture and lab exercises

**Web access:** Moodle site: [https://ay17.moodle.umn.edu/course/view.php?id=1234](https://ay17.moodle.umn.edu/course/view.php?id=1234)

**Study group:** Time and location TBD

**Instructor:** Matt Russell (russellm@umn.edu), room 220E Green Hall
ph: 612-626-4280, cell/txt: 845-705-4572;
Office hours: Mondays 1:00 p.m. to 2:00 p.m.; Fridays 11:00 a.m to noon. Other hours by appointment

**Teaching Assistant:** Brian Anderson (and03662@umn.edu), room 330A Green Hall
Office Hours: Tues 11:30 a.m. to 1:00 p.m.

1. **Course description**
NR 5021 introduces graduate students to statistical concepts in the agricultural, environmental, and natural resources disciplines. The course encompasses applied and theoretical techniques commonly used in these disciplines. A key component of the course is learning how to analyze diverse data sources using the R programming language.

To manage our environment sustainably, professionals must understand the quality and quantity of our resources. Statistical analysis provides information that supports management decisions and is universally used across scientific disciplines. Although the general topic of the course focuses on applied statistical analyses in the environmental, agricultural, and natural resources disciplines, we will spend considerable time and effort on the theoretical methods common to these areas of study.

2. **Student audience**
Graduate students in the agricultural, environmental, natural resources, and other related programs that require an understanding of statistics and applied quantitative research.

3. **Course learning outcomes**
After completing this course, you will:

1) Appreciate probability concepts as they apply to environmental problems.
2) Understand and use standard distributions in statistical applications and inference.
3) Summarize data effectively and efficiently for reporting purposes.
4) Perform a variety of statistical hypothesis tests.
5) Develop and interpret correlation and regression analyses.
6) Design an analysis for single factor experiments and analysis of variance.
7) Develop analytical skills for investigating the behavior of agricultural and natural resources data.
8) Identify practical problems and their solutions in sampling, experimental design, and modeling.
9) Be competent in importing, analyzing, and visualizing complex datasets in the RStudio environment.
10) Recode, combine, and restructure datasets for statistical analysis and visualization.
11) Write basic functions and code to supplement data analyses.
12) Critically review statistical analyses on data collected in your field.
13) Find statistical literature relevant to quantitative problems you may encounter.

4. Course format
The course will use diverse learning formats, including formal lectures, lab exercises, full class and small group discussions, student presentations, and problem assignments. Students will be expected to participate in class discussions, and be respectful of all views and perspectives presented.

5. Course materials
5.1 Required texts

Additional materials and readings as assigned.

5.2 Optional texts, which may be appropriate within your field:


…and many more.

5.3 Software
R is freely available at http://cran.us.r-project.org. Instructions are provided for downloading R onto your desktop. RStudio is an integrated development environment that provides an interface to the R program. You can download it the RStudio Desktop version on your laptop for free at http://www.rstudio.com/products/RStudio/.

The instructor assumes you will bring your own laptop to class sessions and will have both R and R Studio downloaded on your laptop prior to the first class.

5.4 Datasets
A variety of datasets will be made available in lecture and lab sessions. For final projects, students are strongly encouraged to use data from their research project, if they are familiar with its design.
6. Course topics and schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture (Monday)</th>
<th>Date</th>
<th>Lab (Wednesday)</th>
<th>Textbook readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept 4</td>
<td>-No class (Labor Day)-</td>
<td>Sept 6</td>
<td>Course overview and introduction to the R environment</td>
<td>Dalgaard Ch. 1 and 2</td>
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<tr>
<td>2</td>
<td>Sept 11</td>
<td>Summary statistics and distributions</td>
<td>Sept 13</td>
<td>Probability</td>
<td>Dalgaard Ch. 3 and 4</td>
</tr>
<tr>
<td>3</td>
<td>Sept 18</td>
<td>Statistical inference</td>
<td>Sept 20</td>
<td>Lab 1: Probability, summary statistics and visualizing data</td>
<td>Dalgaard Ch. 5</td>
</tr>
<tr>
<td>4</td>
<td>Sept 25</td>
<td>Power and sample sizes</td>
<td>Sept 27</td>
<td>Lab 2: Functions and data wrangling in R</td>
<td>Dalgaard Ch. 9 and 10</td>
</tr>
<tr>
<td>5</td>
<td>Oct 2</td>
<td>Tests of hypotheses</td>
<td>Oct 4</td>
<td>Lab 3: One sample t-tests and power</td>
<td>Dalgaard Ch. 5</td>
</tr>
<tr>
<td>6</td>
<td>Oct 9</td>
<td>Simple linear regression and correlation</td>
<td>Oct 11</td>
<td>Lab 4: Contrasting means</td>
<td>Dalgaard Ch. 6</td>
</tr>
<tr>
<td>7</td>
<td>Oct 16</td>
<td>Inference in regression</td>
<td>Oct 18</td>
<td>Lab 5: Simple linear regression: no R allowed *Group assignment due</td>
<td>Dalgaard Ch. 6</td>
</tr>
<tr>
<td>8</td>
<td>Oct 23</td>
<td>Model diagnostics in regression</td>
<td>Oct 25</td>
<td>Lab 6: Regression in R</td>
<td>Dalgaard Ch. 6</td>
</tr>
<tr>
<td>9</td>
<td>Oct 30</td>
<td>Multiple regression *Midterm due</td>
<td>Nov 1</td>
<td>Lab 6 cont.</td>
<td>Dalgaard Ch. 11</td>
</tr>
<tr>
<td>10</td>
<td>Nov 6</td>
<td>Ordination (guest lecture)</td>
<td>Nov 8</td>
<td>Lab 7: Multiple regression</td>
<td>Dalgaard Ch. 7</td>
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<tr>
<td>11</td>
<td>Nov 13</td>
<td>Analysis of variance: one-way</td>
<td>Nov 15</td>
<td>Lab 8: ANOVA in R</td>
<td>Dalgaard Ch. 7</td>
</tr>
<tr>
<td>12</td>
<td>Nov 20</td>
<td>Multiple comparisons and ANOVA</td>
<td>Nov 22</td>
<td>Lab 9: Does treatment have an effect?</td>
<td>Dalgaard Ch. 7</td>
</tr>
<tr>
<td>13</td>
<td>Nov 27</td>
<td>Analysis of covariance</td>
<td>Nov 29</td>
<td>Lab 10: ANCOVA in R</td>
<td>Dalgaard Ch. 12</td>
</tr>
<tr>
<td>14</td>
<td>Dec 4</td>
<td>Generalized linear models</td>
<td>Dec 6</td>
<td>Lightning talks: Final projects</td>
<td>Dalgaard Ch. 12; Ch. 15</td>
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<tr>
<td>15</td>
<td>Dec 11</td>
<td>Course wrap-up</td>
<td>Dec 13</td>
<td>Lightning talks: Final projects</td>
<td>Dalgaard -</td>
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7. Grading
Grading will be based on laboratory assignments, one-midterm exam, a group assignment, and a final project. Laboratory assignments are due one week following their assignment date (i.e., by 8:45 a.m. the following Wednesday). The relative weights of the course components are:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Lab exercises (n=10)</td>
<td>40%</td>
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<tr>
<td>Midterm exam</td>
<td>25%</td>
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<tr>
<td>Final project</td>
<td>20%</td>
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<tr>
<td>Group assignment</td>
<td>10%</td>
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<tr>
<td>Participation</td>
<td>5%</td>
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The course is offered with A-F grading:
- A 90 < 100
- B 80 < 90
- C 70 < 80
- D 60 < 70
- F < 60

8. Course concept map
9. Policy on students with disabilities
The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide access and assist with reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DRC at 612-626-1333 or drc@umn.edu to arrange a confidential discussion regarding equitable access and reasonable accommodations. Any student with a documented disability condition who needs to arrange reasonable accommodations must contact me within one week of the beginning of the semester. You should also contact Disability Services on campus if you haven’t already done so: https://diversity.umn.edu/disability/home.

10. Honor system and academic integrity
As a member of the University community you are expected to engage in the highest level of academic integrity. Academic dishonesty or plagiarism will not be tolerated. Please visit the University’s site on academic integrity: http://www.oscai.umn.edu/. The UMN library recommends this guide on plagiarism: https://www.indiana.edu/~istd/examples.html. Anyone or any team who copies all or part of the work of others in this class (or the work of others from previous classes) will receive a grade of ‘F’ for the class.

11. Student mental health and stress management
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via http://www.mentalhealth.umn.edu/.