

## WFSC 496B/596B: Data Wrangling in R for Ecologists (3 units)

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## Course Description:

Data are essential to the study of ecology and the environment. Big data (such as data generated by satellites orbiting Earth, billions of biological specimens in natural history museums, and thousands of wildlife camera photographs, to name a few) are disrupting a wide range of industries from human health and environmental monitoring to conservation and government policy. The explosion of data is providing unprecedented opportunities for new discovery and applications. As a result, computational skills to work with data are in high demand: entering data without errors, storing it in a usable and transparent way, extracting key aspects of the data for analysis, and creating accessible visual representations of large and complex datasets. This course will provide an introduction to fundamental data skills with an emphasis on environmental and ecological datasets. Class will typically consist of short introductions or question and answer sessions, followed by hands on exercises. The course will be taught using R (a popular programming language) and other data tools. No background in programming or data skills is required.

In this course you will learn fundamental data skills for research, for management and policy decisions, and for general data management in a variety of career settings. By the end of the course you will be able to develop a well-structured database, import data into R, use logical thinking to write computer programs to analyze data, and produce well designed data visualizations.

## Instructor:

Ellen Bledsoe, PhD (she/her; they/them)

Assistant Professor of Practice in Data Science

School of Natural Resources and the Environment

Office: ENR2 N257

Email: [ebledsoe@arizona.edu](mailto:ebledsoe@arizona.edu)

#### Student Hours

Wednesdays 12:30-2:00 pm and by appointment at <https://calendly.com/ebledsoe/office-hours>

*Student hours (also called “office hours”) are times I set aside weekly specifically to meet with students about course material (or whatever else you want to chat about). You are not imposing or wasting my time! Please come talk to me if you have any questions, concerns, etc.*

## 

## Course Details

### Classroom and Meeting Times

Tuesdays, Thursdays from 9:30 am – 10:45 pm

ENR2 Bldg., Room N250

### Course Format

Mini-lectures, live coding, small group activities, experiential learning, and assessment

### Student Learning Outcomes

By the end of this course, you will be able to do the following:

* Apply best practices with spreadsheets to reduce potential data entry errors and create “tidy” data
* Execute R code to extract information from 1- and 2-dimensional data
* Communicate information effectively through descriptive statistics and data visualizations
* Implement skills to produce tidy data and combine relational datasets
* Use iteration in code for repetitive tasks
* Create a computationally reproducible research project

### Course Overview

|  |  |  |
| --- | --- | --- |
| **Week** | **Dates** | **Topics** |
| 0 | Jan 11 | Welcome and Introduction |
| 1 | Jan 16, 18 | Data Entry and Storage |
| 2 | Jan 23, 25 | Introduction to R/RStudio |
| 3 | Jan 30, Feb 1 | Introduction to the `tidyverse` |
| 4 | Feb 6, 8 | Grouping and Joining Data |
| 5 | Feb 13, 15 | Data Visualization |
| 6 | Feb 20, 22 | Making Untidy Data Tidy |
| 7 | Feb 27, 29 | Working with Strings and Dates |
| SPRING BREAK | | |
| 8 | Mar 12, 14 | Solving Bigger Problems |
| 9 | Mar 19, 21 | Reproducibility and Version Control |
| 10 | Mar 26, 28 | Functions |
| 11 | Apr 2, 4 | Making Choices |
| 12 | Apr 9, 11 | Iteration 1 |
| 13 | Apr 16, 18 | Iteration 2 |
| 14 | Apr 23, 25 | TBD (spatial data?) |
| 15 | Apr 30 | Final Project Wrap-up |

### Evaluation and Grading

Your grade in this course will be determined by ~ 14 evenly weighted assignments (graded at 100 points each), 4 short reflections, and a final project that synthesizes the material.

#### Evaluation

**Activity Value**

Assignments (14 x 100 points) 1400

Reflections (4 x 25) 100

Final Project (1 x 300 or 1 x 500) 300 or 500

**Total 1800 or 2000 pts**

#### Grades

**Score Grade**

90-100% A

80-89.9% B

70-79.9% C

60-69.9% D

0-59.9% E

### Graded Assessments

Do your best to respect due dates; it helps those of us who are grading your assignments to allocate our time appropriately. However, unforeseen circumstances happen!

**If you need an extension, please ask!** I would rather you turn in better work a day or two late than shoddy work at the deadline because something happened in your life beyond your control. That said, you need to ask for an extension *before* the deadline.

Late work will be penalized by 5% total points per day until the highest percentage you can earn is 60%.

There is no formal attendance policy. There are multiple ways for students to engage with each other and the instructor in lectures and outside of lectures.

Incomplete grades will be given only in special circumstances as outlined in university policy as stated in the University of Arizona General Catalog (<http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete>)

#### Assignments:

There are ~14 assignments for this course, all worth the same amount. Assignments will be made available each Tuesday and are due by Monday at midnight the following week. This allows you to wrap up the material from the previous week before starting new material.

Exercises in assignments will be graded as follows:

* Produces the correct answer using the requested approach: 100%
* Generally uses the right approach, but a minor mistake results in an incorrect answer: 90%
* Attempts to solve the problem and makes some progress using the core concept, but returns the wrong answer and does not demonstrate comfort with the core concept: 50%
* Answer demonstrates a lack of understanding of the core concept: 0%

Students are responsible for making sure their files open correctly after submitting them; any files that are corrupt or in the wrong format will be counted as late (minus 5% total points per day) until an acceptable file is submitted.

#### Reflections:

Intermittently throughout the course, you will be asked to write a short reflection about your learning process with the material. These will be added onto your assignments for the given week and are worth 25 points each.

#### Final Project:

The final project for this course is worth 300 points (WFSC 496B) or 500 points (WFSC 596B).

This project will need to include core concepts covered in a certain number of weeks (6 for undergraduate, 10 for graduate), bring together many aspects of what we will have learned through the course of the semester. Guidelines will be provided later in the semester.

## Course Policies

### Course Communication:

You are responsible for participating in these lectures and learning the material presented. Interactions outside of face-to-face class time will take place via Brightspace Desire To Learn (D2L; <http://d2l.arizona.edu>). Please check the course D2L site daily for any announcements related to this course. Students should anticipate spending ***135 hours*** (3 unit course) on activities related to this course. These hours break down as follows: 50 hours on lectures, reading materials, and videos; 20 hours in lab not working on assignments; 50 hours on assignments and activities; 5 hours on quizzes; 10 hours on communication with the instructor and other students.

### Generative AI Guidelines

In this course, you are allowed to use generative AI models (e.g., ChatGPT) for assignments with appropriate acknowledgement. However, use of generative AI models is *not allowed* during quizzes.

If you choose to use generative AI on an assignment, you are required to follow these guidelines:

1. Copy and paste the answer from the generative AI and cite the source (e.g., ChatGPT)
2. Below, provide the edited version of the text and/or code. This will be the graded portion of your answer.

If you use generative AI without following the guidelines above or during a test/exam, it will be considered cheating. Any text written by a student on an assignment, reflection, test, or exam may be shared with one or more AI-detection tools at any time.

### Required Texts, Readings, and Videos:

Students will not have to purchase additional texts, readings, or videos for this course. All material will be available on D2L as open source material (AKA free).

### Required Materials:

Students are highly encouraged to have their own computer. Many of the in class activities will involve a computer and many of the online interactions are too complex for a smartphone. Students without access to a laptop or equivalent computational resources should contact the instructor immediately to arrange one to borrow for the entire semester.

### Course Behavior Policy:

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

## 

## University Policies

### University Land Acknowledgement Statement

We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O’odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

### Absence and Course Participation Policy:

The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available [here](http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop). The [UA policy](http://policy.arizona.edu/human-resources/religious-%20accommodation-policy.) regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable. Absences [preapproved by the UA Dean of Students](http://policy.arizona.edu/employmenthuman-resources/attendance) (or dean’s designee) will be honored.

### Make-Up Policy for Late Enrollment:

Students who enroll late for this course should contact the instructor immediately to negotiate a schedule to complete missed activities and assignments.

### Threatening Behavior Policy:

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See

<http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

### Accessibility and Accommodations:

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the *Disability Resource Center* (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

### Code of Academic Integrity:

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

University standards for plagiarism will apply to grading. The UA Student Code of Conduct states: "All forms of student academic dishonesty, including but not limited to cheating, fabrication, facilitating academic dishonesty, and plagiarism, are prohibited."

"Plagiarism" means representing the words or ideas of another as one's own. Check out U Arizona Libraries quick guide to help you discern between plagiarism and not plagiarism (<http://new.library.arizona.edu/research/citing/plagiarism>).

Any written assignment found to be previously or concurrently submitted for evaluation in another course will receive a failing grade. We use software which checks your work against a database. It’s really easy for any instructor to figure out if your writing is actually someone else’s, we mean ridiculously easy. **Please use your own words.**

Students are advised that all notes, lectures, study guides, and other course materials disseminated by the instructor to the students, whether in class or online, are original materials and as such reflect intellectual property of the instructor or author of those works. All readings, study guides, lecture notes, and handouts are intended for individual use by the student, not for commercial gain. Students may not distribute or reproduce these materials for commercial purposes without the express written consent of the instructor and university. Students who sell or distribute these materials for any use other than their own are in violation of the University’s Intellectual Property Policy (available at <http://www.ott.arizona.edu/uploads/ip_policy.pdf>). Violations of the instructor's copyright may result in course sanctions and violate the Code of Academic Integrity.

### UA Non-Discrimination and Anti-Harassment Policy:

The University is committed to creating and maintaining an environment free of discrimination; see [http://policy.arizona.edu/human-resources/nondiscrimination-and-anti- harassment-policy](http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-)

Discrimination includes any form of unequal treatment such as denial of opportunities, harassment, and violence. Violence includes sex-based violence such as rape, sexual assault, unwanted touching, stalking, dating/interpersonal violence, and sexual exploitation.

If you experience discrimination by faculty or staff, you are encouraged (but not required) to report the incident to the Office of Institutional Equity (520-621-9449). If you experience discrimination by another undergraduate, graduate, or professional student, please feel free to report the incident to the Dean of Students (520-621-7057).

Learn more about your rights and options at <http://equity.arizona.edu> or call 520-621-9449 or email equity@email.arizona.edu. Students may also contact the Oasis Program (520-626-2051), the Tucson Rape Crisis Center (520-327-1171) and Campus Health Counseling and Psych Services (520-621-3334) as confidential resources for advocacy and other support related to power-based personal violence such as rape and sexual assault.

### Confidentiality of Student Records:

Students should know the federal regulations regarding the privacy of their academic records <http://www.registrar.arizona.edu/ferpa/default.htm>

### Additional Resources for Students:

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

#### Campus Health

<http://www.health.arizona.edu/>

Campus Health provides quality medical and mental health care services through virtual and in-person care.

Phone: 520-621-9202

#### Counseling and Psych Services (CAPS)

<https://health.arizona.edu/counseling-psych-services>

CAPS provides mental health care, including short-term counseling services.

Phone: 520-621-3334

#### The Dean of Students Office’s Student Assistance Program

<http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Student Assistance helps students manage crises, life traumas, and other barriers that impede success. The staff addresses the needs of students who experience issues related to social adjustment, academic challenges, psychological health, physical health, victimization, and relationship issues, through a variety of interventions, referrals, and follow up services.

Email: [DOS-deanofstudents@email.arizona.edu](mailto:DOS-deanofstudents@email.arizona.edu)

Phone: 520-621-7057

#### Survivor Advocacy Program

<https://survivoradvocacy.arizona.edu/>

The Survivor Advocacy Program provides confidential support and advocacy services to student survivors of sexual and gender-based violence. The Program can also advise students about relevant non-UA resources available within the local community for support.

Email: [survivoradvocacy@email.arizona.edu](mailto:survivoradvocacy@email.arizona.edu)

Phone: 520-621-5767

#### Campus Pantry

[campuspantry.arizona.edu](http://campuspantry.arizona.edu/)/

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. In addition, the University of Arizona Campus Pantry is open for students to receive supplemental groceries at no cost. Please see their website for open times.

### Subject to Change Statement:

Information contained in the course syllabus, other than the grade policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.