

BIO 4490 / 6490 – Applied Biological Data Analysis
Course Syllabus and Schedule
Kennesaw State University – Fall 2021
Instructor: Nicholas S. Green, Ph.D.

1. Communication

1.1. Contact info

- **E-mail:** ngreen62@kennesaw.edu (best contact method)
- **Phone:** (470) 578-6546
- **Office:** Science Building (SC) 331. We can also meet virtually using Microsoft Teams.
- **Office hours:** Monday 1-3 pm; Wednesday 9-11 am; other times by appointment

1.2. Course communication

- The best way to get in touch with me is by KSU e-mail: ngreen62@kennesaw.edu. Please allow 1 business day for a response.
- You can also contact me using Microsoft Teams.
- Use your KSU e-mail for all course-related communication—not a personal or non-KSU account.
- We will use **D2L** extensively for content delivery.

2. Class meetings

- Class meeting time: TR 12:30 PM to 1:45 PM
- Course modality: Face to face
- Meeting location: Social Sciences Building 3025

3. Course description

Prerequisites: *Statistical Methods I (STAT 3120) (3 hours) or Biostatistics (STAT 3125) (3 hours) or equivalent.*

Cross-leveling: *This course is cross-leveled as BIOL 4490 and BIOL 6490.*

This course is a survey of data analysis skills and statistical methods that are essential for modern biology. The course takes a holistic approach to the data analysis workflow in biology using the open-source environment R, including data management, exploratory data analysis, data modeling, and reproducible science practices. Statistical topics covered include generalized linear models, mixed effects models, non-linear models, and ordination. Students are required to apply techniques learned in class to real or simulated biological datasets as a course project.

4. Course objectives

1. Explain the role of statistics in the biological sciences and the ways in which analytical results are communicated.
2. Manipulate, summarize, display, and analyze data using the open-source environment and language R.
3. Use probability distributions to model and think about biological phenomena. Students should come away from the course able to translate biological hypotheses and ideas into statistical statements and vice versa.

4. Conduct exploratory data analyses in support of scientific investigations, particularly to detect and diagnose common problems with biological datasets.
5. Employ modern statistical methods to answer biological questions.
6. Communicate data and analytical results to audiences who may or may not have statistical backgrounds.

5. Textbooks and other materials

5.1. Required texts

Bolker BM. 2008. Ecological models and data in R. Princeton University Press, Princeton, New Jersey, USA. *General statistics textbook for biologists. Applications are focused on ecology, but the statistical exposition is relevant to any area of biology.*

5.2. Technology requirements

Access to a computer or laptop capable of running R version $\geq 3.0.1$ and RStudio version $\geq 1.4.1106$. A 64-bit system is highly recommended.

5.3. Recommended texts

The following books are not required for this course, but are provided here as recommendations for references on R or statistics.

Dalgaard P. 2008. Introductory statistics with R. Springer Science+Business Media, New York. *General purpose introduction to statistics and to R. Suitable for an introductory stats course, but also useful as a reference for R users of many levels.*

Illowsky B, Dean S. 2018. Introductory statistics. Rice University, Houston, Texas, USA. (Available free online: <https://openstax.org/details/books/statistics>). *Textbook designed for a college-level introductory statistics course.*

James G, Witten D, Hastie T, Tibshirani R. 2013. An introduction to statistical learning with applications in R. Springer Science+Business Media, New York. (7th edition available free online: <http://faculty.marshall.usc.edu/gareth-james/ISL/>). *An advanced general statistics textbook that includes both classical statistics methods and more modern techniques such as machine learning.*

Spector P. 2008. Data manipulation with R. Springer Science+Business Media, New York. *Short but thorough introduction to data management in R. Part of the Springer "Use R!" series of domain-specific R books.*

Wickham H, Grolemund G. 2017. R for data science. O'Reilly Media, Inc., Sebastopol, California, USA. *Introduction to R and the "tidyverse" ecosystem of packages. Geared more toward "data science" than traditional statistics, this text is a step-by-step guide to practical data management and analysis in R. All book content is available free on the author's website: <https://r4ds.had.co.nz/>*

Zuur AF, Ieno EN, Smith GM. 2007. *Analysing ecological data*. Springer Science+Business Media, New York. *An advanced statistics textbook that, while focused on ecological applications, is suitable for any biologist.*

6. Evaluation and grading

6.1. General information

- Course grades are determined by the number of points that ***you*** earn. Neither course grades nor grades on individual assignments will be curved.
- There is no extra credit available in this course.
- All exams are cumulative. Later exams will emphasize more recent material but all course material up to that point is considered fair game for an exam.
- Grading and feedback expectations:
 - Homework assignments, course project milestones, and exams will be graded within 7 calendar days from the assignment deadline. Scores will be posted to D2L within this time frame.
 - The course project final deliverable will be graded before the Registrar's deadline for turning in grades. Scores will be posted to D2L within this time frame.

6.2. Grade calculation

6.2.1. Grade composition

Undergraduate students (BIOL 4490)		Graduate students (BIOL 6490)	
Item	% of grade	Item	% of grade
Homework	20	Midterm exam	20
Midterm exam	20	Final exam	20
Final exam	20	Course project	60
Course project	40		

6.2.2. Letter grade ranges

Grade	Range (%)
A	≥89.5
B	79.5 – 89.4
C	69.5 – 79.4
D	59.5 – 69.4
F	≤59.4

6.3. Assignment descriptions

- **Homework:** Periodic homework assignments (approximately biweekly) are used to assess student comprehension and to provide opportunity for practicing key concepts and procedures. Homework is graded on a completion basis. Collaboration between students is allowed and encouraged. Homework is made available to all students but is only graded for undergraduates registered for BIOL 4490.
- **Midterm exam:** This exam is used to evaluate student understanding and progress at the midway point in the semester. Exam is take-home, open book, and open note. Collaboration between students is ***not*** permitted.

- **Final exam:** This exam is used to evaluate student understanding and progress at the end of the semester. Exam is take-home, open book, and open note. Collaboration between students is **not** permitted.
- **Course project:** The most important assignment of the course is a project where students must apply one or more of the statistical methods learned in class to a research question and dataset of their own choosing.
 - If a student does not have a research question or dataset then they can be provided one by the instructor or the student's advisor.
 - Alternatively, students can work with the instructor and their advisor to simulate a suitable dataset so they can perform a "dry run" of the analysis for their anticipated thesis research projects.
 - Formal project milestones are staged throughout the semester to facilitate feedback as work on the project progresses. The components of the project are:
 - Identification of a topic
 - Identification (or simulation) of a suitable dataset (or datasets)
 - Exploratory analysis of the data
 - Analysis of the data
 - Interpretation of the analysis
 - Presentation to the class of the student's work, including question-and-answer with the audience
 - A final paper that describes the topic, the data, the analysis strategy and why it was appropriate, the analysis and interpretation, and conclusions drawn from the analysis.
 - A copy of all data and R code used in the project, for instructor review. Data will be kept confidential.
 - A detailed assignment guide with project requirements and grading rubric will be provided early in the semester.

6.4. Letter grade point ranges

Grade	Range (%)
A	≥89.5
B	79.5 – 89.4
C	69.5 – 79.4
D	59.5 – 69.4
F	≤59.4

6.5. Attendance and grading policies

6.5.1. Attendance

- Attendance is not required but will be taken at each class meeting. This means that "excused absences" apply to assignment deadlines rather than routine class meetings.
- Excused absences as referred to in this syllabus include the following reasons:
 - Serious illness of self or a close loved one
 - Death of a close loved one
 - Travel or other commitment related to official KSU business (including another course)
 - Interviews for graduate or professional programs
 - Military service

- Jury duty
- Closure of the university
- Appropriate documentation of an excused absence must be provided upon request.
- If you can foresee an absence, please contact me as soon as possible ahead of time so we can make arrangements for assignments, exams, or activities you might miss.

6.5.2. Missed exams and assignments

- Assignments must be turned in on time to be eligible for full credit. Late assignments will be accepted but with a score penalty: 20% for up to 24 hours late; 40% for up to 48 hours late, and so on. The late penalty is waived if you miss the deadline for an excused reason (see 6.5.1).
- If you miss an assignment deadline for an excused reason and provide acceptable written documentation for the absence, the assignment will be due at 5:00 PM on the day you return to class (virtually or in person).

6.5.3. Exam review

- The review period for an exam, during which you can request score corrections related to question content, is 7 calendar days from the time that exam grades are posted to D2L. After this period no further changes related to question content will be made.
- Challenges to the content of exam questions must be made during the 7-day review period described above. Any challenge should be accompanied by a written explanation of the issue with the question. The explanation should include appropriate documentation (e.g., a recent textbook or journal article citation). One to three sentences per question is usually enough explanation.
- Score corrections for reasons not related to exam content (e.g., arithmetic error in grading) can be requested at any time up until 5:00 PM on the day before the Final Exam.

7. Other course policies (instructor-specific)

- Students must abide by the KSU Student Code of Conduct at all times (https://scai.kennesaw.edu/KSU_Codes_of_Conduct_2019-2020.pdf).
- **Collegial and respectful behavior towards all people is expected.** This does not mean you cannot express your opinions; it means you must be respectful of others.
- Children may not accompany parents into the classroom without the explicit permission of the instructor. Disruptive children will not be allowed to remain in the classroom.
- If the University officially cancels classes on a day or time when we are scheduled to meet, everything will shift back one class meeting (including exams). If that happens, an updated schedule will be posted on D2L.

8. Institutional policies

Please review the statements found at this link: [Federal, BOR, & KSU Course Syllabus Policies](#)

8.1. KSU Academic Integrity Statement

Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the university's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials,

malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an “informal” resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct’s minimum one semester suspension requirement.

8.2. Other institutional policies (found at: [Federal, BOR, & KSU Course Syllabus Policies](#))

- KSU Disruption of Campus Life Policy
- KSU Web Accessibility Policy Statement
- KSU Reasonable Accommodations Policy
- KSU Enrollment Management/Course Attendance Policy
- KSU Military Withdrawals Policy
- Copyright Law
- Protecting Students’ Privacy (FERPA)
- KSU Sexual Misconduct Policy
- KSU Course Withdrawal Policy
- KSU Graduate Course Auditing Policy
- Academic feedback
- Netiquette: Communication Courtesy
- Inclement Weather Policy

8.3. KSU Student Resources

This link contains information on help and resources available to students: [KSU Student Syllabus Resources](#)

9. CSM Academic Integrity Statement

The Kennesaw State University College of Science and Mathematics encourages our students to use technology to help them learn. However, it is important for students to understand the difference between appropriate collaboration and inappropriate uses of technology for plagiarism and cheating. Students who participate in group texts or other group conversations through mobile apps such as GroupMe or WhatsApp are subject to consequences if any member of that group is found to plagiarize material or facilitate cheating. By virtue of membership in the conversation or participation in the group, any student who is part of a group conversation where cheating or plagiarism occurs may receive the same penalty as students who actively cheat within the group. Additionally, any students who are found to purchase, sell, or otherwise distribute or collect existing course material are also subject to academic dishonesty hearings. This includes the use of Quizlet, Hero, and student organization test files.

10. Useful KSU sites

- Fall 2021 academic calendar: <https://registrar.kennesaw.edu/academic-calendars/fall-2021-academic-calendar.php>

11. Policies related to COVID-19

11.1. Course delivery

KSU may shift the method of course delivery at any time during the semester in compliance with **University System of Georgia** health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

11.2. COVID-19 illness

If you are feeling ill, please stay home and contact your health professional. In addition, please email your instructor to say you are missing class due to illness. Signs of COVID-19 illness include, but are not limited to, the following:

- Cough
- Fever of 100.4 °F or higher
- Runny nose or new sinus congestion
- Shortness of breath or difficulty breathing
- Chills
- Sore Throat
- New loss of taste and/or smell

COVID-19 vaccines are a critical tool in “Protecting the Nest.” If you have not already, you are strongly encouraged to get vaccinated immediately to advance the health and safety of our campus community. As an enrolled KSU student, you are eligible to receive the vaccine on campus. Please call (470) 578-6644 to schedule your vaccination appointment or you may walk into one of our student health clinics.

For more information regarding COVID-19 (including testing, vaccines, extended illness procedures and accommodations), see KSU’s official [Covid-19 website](#).

11.3. Face coverings

Based on guidance from the University System of Georgia (USG), all vaccinated and unvaccinated individuals are encouraged to wear a face covering while inside campus facilities. Unvaccinated individuals are also strongly encouraged to continue to socially distance while inside campus facilities, when possible.

12. Course schedule (tentative)

Week	Days	Topic (Bolker chapters in parentheses)	Assignments and Exams
1	Aug 17, 19	Statistics in biology (1)	
2	Aug 24, 26	Introduction to R (2)	
3	Aug 31, Sept 1	Introduction to R (2)	
4	Sept 7, 9	Data manipulation, cleaning, and management	Course project: topic selection
5	Sept 14, 16	Data manipulation, cleaning, and management	
6	Sept 21, 23	Exploratory data analysis (2)	
7	Sept 28, 30	Exploratory data analysis (3)	Course project: analysis plan
8	Oct 5, 7	Exploratory data analysis (4)	
9	Oct 12, 14	GLM and non-linear models (6, 9)	Midterm exam due Monday Oct 11
10	Oct 19, 21	GLM and non-linear models (6, 9)	
11	Oct 26, 28	GLM and non-linear models (7, 9)	Course project: preliminary results
12	Nov 2, 4	Mixed effects models (10)	
13	Nov 9, 11	Ordination and multivariate methods	
14	Nov 16, 18	Ordination and multivariate methods	Course project: progress check/discussion
15	Nov 23, 25	<i>No class – Thanksgiving Break</i>	
16	Nov 30, Dec 2	Course project presentations	
17		Course project final deliverable due: Sunday Dec 5 11:59 PM Course project presentations (if needed): Thursday Dec 9 1:00 – 3:00 PM Final exam due: Thursday Dec 9 11:59 PM	
18		Final grades due to Registrar: Thursday Dec 16 12:00 PM	