Data & Analysis in Natural Sciences

[Data Analysis Nat Sci]

SYLLABUS

3 credits

FALL 2025
GLY6932/GLY4930 || ZOO6927/ZOO4926

Instructor: Michal Kowalewski (kowalewski@ufl.edu), Dickinson 254 (Tel: 352-273-1944)
Lectures: WM 210, MWF (3), 9:35am-10:25am
Labs: WM 214, W (7-8), 1:40pm-3:50pm
Prerequisites for Graduate Students: None
Prerequisites for Undergraduate Students: Consent of the instructor
Textbook Required: None (Readings will be assigned and provided in class)
Freeware: *R*
Hardware: Laptop is required for lab meetings

Synopsis: This course will combine lectures and hands-on lab activities with focus on practical applications of classic statistical methods in natural sciences. Examples will derive from natural sciences (primarily ecology, paleobiology, and geological sciences). Lab sessions will provide practical training in using *R* for data processing, analyses, and visualization. The course will consist of self-contained modules built around empirical examples. Although some of the topics are inherently biological, many aspects of the course should be transferable to other disciplines of natural sciences. This course will provide intuitive (rather than mathematical) introduction to common methods used in natural sciences to analyze empirical and experimental data.

Topical Overview

Segment	Content
S1: Introductory Materials	Data, variables, data reporting, data transformations and standardization, univariate descriptors, hypothesis testing
S2: Interactions between Two Variables	Bivariate plots, covariance, correlation, partial correlation, and regression
S3: Exploring and evaluating multivariate data in natural sciences	Exploratory methods: PCA, PCO, nMDS, CA, DCA, CCA, CVA, Cluster Analysis Confirmatory methods: MANOVA, MANCOVA, Permutation tests, Classificatory methods, Discriminant functions, Mantel test, Visualization of multivariate data
S4: Resampling strategies in natural sciences	Randomization, bootstrap, jackknife, subsampling, Monte Carlo models, visualizing resampling models
S5: Additional Topics	Additional topics may be covered time permitting.

Lecture Topics

1. Review of Basics
   - Scientific Methods ● Type of Research in Natural Sciences ● Types of Data
   - Hypothesis Testing (Frequentist Framework) ● Univariate Tests

2. Bivariate Methods
   - Covariance and correlation ● Simple Linear Regression ● Partial Correlation

3. Multivariate Methods
   - Multivariate Ordinations ● Canonical Multivariate Methods ● Multivariate Tests
   - Classificatory and Discriminatory Methods ● Cluster Analysis

4. Resampling Methods
   - Randomization ● Jackknife ● Bootstrapping ● Implicit Monte Carlo

5. Other Topics (Time permitting)
   - Scaling and Time Series ●Data Visualizations

POLICIES AND RESOURCES

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance is expected for lecture meetings and required for lab meetings. Assistance will be provided for students with excused absences.

Grading
Grades will be based on mandatory assignments. Students who will complete all assignments by due dates will receive A. Grades lower than A may result from missed, overdue, or incomplete assignments.

Evaluation of Grades

Assignments	Points	Total	% Grade
Lab Assignment 1-8	12.5 points (average score per assignment)	100 points	100%

Grading Policy

Percent (Points)	*Grade*	*Grade Points*
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Click here for guidance on how to give feedback in a professional and respectful manner. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students here.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations

are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the Notification to Students of FERPA Rights.

Campus Resources:

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or police.ufl.edu.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.

Library Support, Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints Campus

On-Line Students Complaints