ALS 6500 Multivariate Statistics for Agricultural and Life Sciences (3 credits)

Fall 2025
Tuesday: Period 3, 9:35am-10:25am (McCarty B **3096**),
Thursday: Periods 3 and 4, 9:35am-11:30 (McCarty B **3086**)

Instructor:
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Office hours: Tuesday 10:30-11:30, CALS Print Lab - McCarty Hall B 3082

Course Description:
This course provides students with a conceptual and practical understanding of the application of multivariate statistics in the life sciences. This course consists of a one period lecture and a two-period computer lab (which may also contain a lecture) where students will put to use the techniques learned in lecture using R, the open-source language for statistical computing and graphics. The **prerequisites** are an introductory statistics course and some experience with the R language (although the latter is not strictly necessary).

Course Objectives:
The overarching goal of this course is for students to gain proficiency in selecting, implementing, interpreting, and disseminating results from multivariate analyses. Specifically, students will **1)** learn the appropriate application of ordination, clustering, and discrimination techniques for different multivariate data structures and questions, **2)** learn how to import, manipulate, and analyze multivariate data in R, **3)** learn how to interpret and present results from multivariate analysis through figures and text.

Course Schedule:

Course Schedule is subject to change

***Lecture #**	**Topic**	**Readings**
1	Intro to multivariate statistics	McGarigal et al., Ch. 1
2	Multivariate Data: screening, transformations, distance measures	Borcard et al., Ch. 2 & 3 (pgs. 31-45)
3	**Ordination 1**: Principal Components Analysis (PCA)	McGarigal et al., Ch. 2 (pgs.19-55) Peres-Neto et al. 2003
4	**Ordination 2**: Principal Coordinates Analysis (PCoA) and Correspondence	Borcard et al., Ch. 5 (pgs. 132-145)

	Analysis, Non-Metric Multidimensional Scaling (NMDS)	
5 *Project Due*	**Cluster Analysis 1:** Clustering Methods	McGarigal et al., Ch. 3 (pgs. 81-104)
6	**Cluster Analysis 2:** Choosing Clustering Methods and Visualization	Borcard et al., Ch. 4 (pgs. 53-79)
7 **No class Oct 2nd**	**Testing for groups:** perMANOVA, Mantel's test	McCune and Grace, Ch.24 & 27
8 *Project Due*	Discriminant Analysis/MANOVA	McGarigal et al., Ch. 4
9	Classification and Regression Trees (Cart)	De'ath & Fabricius 2000
10	Constrained Ordination	Borcard et al., Ch. 6
11	Constrained Ordination continued/Variance partitioning	Borcard et al., Ch. 6 Cushman & McGarigal 2002
12	Final Project Discussion	
13	Advanced Topics: TBD	TBD
14	Comparison of Techniques	McGarigal et al. Ch. 6

*each lecture has an associated lab

Important Dates:

Thursday, October 2nd: No class

Friday, September 18th: Project 1 is due.

Friday, October 10th: Project 2 is due.

Monday, December 8th: Final Project is due.

Course Readings:

Required:

*Borcard, D., Gillet, F., & Legendre, P. (2011). *Numerical ecology with R*. Springer.

Recommended:

McGarigal, K., Cushman, S., & Stafford, S. (2000). *Multivariate statistics for wildlife and ecology research*. Springer, New York.

*online version available for free from UF Library

Grading:

	# of points	% of Grade
Class attendance and participation	30	25%
In-lab assignments	30	25%
Projects (2)	30	25%
Final Project	30	25%
Total Points	**120**	**100%**

Grading Scale: A ≥ 92%, A- = 90-91.9%, B+ = 87-89.9%, B = 82-86.9%, B- = 80-81.9%; C+ =77-79.9%, C =72-76.9%, C- = 70-71.9%; D+ = 67-69.9%, D = 62-66.9%, D- =60-61.9%, E<60%

For information on current UF policies for assigning grade points, see https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Class attendance and participation: You are required to attend all classes. Please let me know in an email if there is an issue that will keep you from attending class. You are expected to participate in class by answering and asking questions and participating in course discussions. You will receive 1 point per class for participating (total of 2 points per week).

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx.

Instructional lecture assignments: Each instructional lecture session will consist of a data set that the instructor will lead the students through and a set of questions to be answered through the application of the given week's statistical method.

Projects: Two projects will assess your skills in ordination (project 1) and clustering (project 2) techniques.

Project 1 – Ordination: The objective of this project is to apply Principal Component Analysis (PCA) and Non-metric multidimensional scaling (NMDS) to two data sets in the programming language R. Students will answer a set of questions related to the application and interpretation of these analyses.

Project 2 – Cluster Analyses: The objective of this project is to apply k-means and hierarchical clustering techniques and test the significance of groups/clusters recovered from these cluster analyses using the programming language R. Students will answer a set of questions related to the application and interpretation of these analyses.

Final Project: The objective of the final project is for students to ask a question of their own data, select the appropriate multivariate analysis, conduct the analysis in *R*, and interpret your results. Students will present the project in a paper that will hopefully be a precursor to a dissertation chapter and/or manuscript. The format of the paper will follow that of a journal article. Papers should be 5 pages (not including figures, tables, and work cited) double spaced using size 12 font. In addition to the paper, students will include annotated code and the data file used in the analysis.

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx.

UF webpage where all the policies and resources are located:
https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/