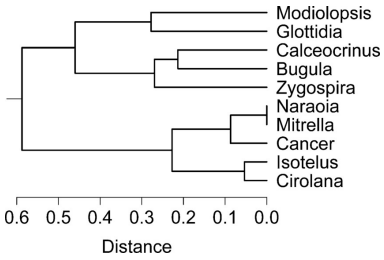
Multivariate Data Analysis for Ecology and Environmental Science

EVPP 651

3 credits

Spring Semester, 2020



Source: Philip M. Novack-Gottshall

INSTRUCTOR: Diego Valderrama.
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CLASSROOM: Robinson Hall, room B105.

CLASS MEETINGS: Mondays, 7:20 PM to 10:00 PM.

OFFICE HOURS: Fridays, 2 to 4 PM, or by appointment.

COURSE DESCRIPTION AND GOALS:

This course provides graduate students in ecology and environmental science with tools needed to analyze multivariate data sets. These data sets often arise from field studies of biological communities and suites of environmental factors like water quality. Similar tools are needed in biosystematics and molecular biology and these students should also find the course helpful.

This course assumes a basic knowledge of ecology and statistics. Students will learn the basic techniques for data exploration and preparation and specific techniques of classification and ordination as well as gaining practice in interpretation and presentation of results of these analyses. A hands-on approach will be taken with students working and conducting a thorough analysis of ecological datasets. After completion of the course, students will be competent to conduct multivariate analyses of their own data and to critically evaluate research papers utilizing a range of multivariate analyses.

COURSE CONTENT AND INSTRUCTIONAL METHODS:

The subject matter of this course is delivered in the form of lectures and practice problem sets. The class will meet weekly for 2 h 40 minutes in a computer classroom. The first hour will involve presentations by the instructor; the remainder of class will be devoted to working problems. On some dates lab time will be devoted to working on exams.

The course is divided into three sections: i) Intro and Cluster Analysis; ii) Principal Component Analysis; and iii) Other Ordination techniques. In each section we will learn the theory behind the analytical approach

and work problems allowing you hands-on learning of each approach.

Textbooks:

Legendre, P. and L. Legendre. 2012. *Numerical Ecology, Third English Edition*. Elsevier, Amsterdam (No need to purchase).

Borcard, D., F. Gillet and P. Legende. 2018. *Numerical Ecology with R, Second Edition.* Springer International Publishing, Cham, Switzerland. Companion book to L&L (2012). Available online through the George Mason University Libraries website.

Software: R, freely available at The R Project for Statistical Computing (https://www.r-project.org/). RStudio (https://www.rstudio.com/) is strongly recommended as script manager.

Exams: There will be four exams during the course. Most of content in these exams will be take-home. If you have any questions while working on the exam, contact the instructor by e-mail.

COURSE GRADING: Weighting of the activities undertaken in class will be as follows:

Exam 1	30%
Exam 2	25%
Exam 3	20%
Final Exam	25%
TOTAL	100%

Your final score in the course will be calculated based on the percentage grade earned on each of the course activities listed above, multiplied by the weighting listed for each activity. Letter grades will be assigned based on your final course score as follows:

- A+ = 97 - 100%
- A = 93 - 96%
- A- = 90 - 92%
- B+ = 87 - 89%
- B = 83 - 86%
- B- = 80 - 82%
- C = 70 - 79%
- F = 0 - 69%

PLEASE NOTE THAT I DO NOT ROUND UP. FOR EXAMPLE, AN 89.99 IS A B+ AND IT WILL NOT BE ROUNDED UP TO AN A-.

ACADEMIC INTEGRITY: GMU students, faculty and staff are bound by the GMU Honor Code. Adherence to the GMU Honor Code is expected of all students, specifically:

Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

In all assignments and communications, plagiarism will not be tolerated. This applies equally to oral and written communications in the context of any evaluated (graded) course assignments. As stated in the Honor Code, infractions may result in invalidated credit for dishonorable work and lowered grade, including failure from the class, suspension or dismissal. Inquiries for clarification from the professor are welcome. For more information see the complete Honor Code in the university catalog.

ACCOMMODATIONS FOR DISABILITIES: If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with the Office of Disability Services (SUB I, Rm. 4205; 993-2474; http://ds.gmu.edu) to determine the accommodations you need; and 2) give copies of your disability documentation to your instructors so we may discuss your accommodation needs.

DIGITAL COMMUNICATION: Students must use their MasonLive email account to receive important University information, including communications related to this class. I will not respond to messages sent from or send messages to a non-Mason email address.

DIVERSITY STATEMENT: George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth. An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected.

TENTATIVE CLASS SCHEDULE: Subject to changes.

Week	Date	Topic	Textbook Chapters	
			Borcard *et al.* (2018)	**Legendre & Legendre (2012)**
1	Jan 27	Introduction to the course and R		
2	Feb 3	Exploratory Data Analysis	2	
3	Feb 10	Coefficients of Association	3	7
4	Feb 17	Cluster Analysis	4	8
5	Feb 24	Cluster Analysis continued (lab practice)	4	8
6	Mar 2	Exam 1		
7	Mar 9	**SPRING BREAK (NO CLASSES)**		
8	Mar 16	**INSTRUCTOR'S FIELD TRIP (NO CLASSES)**		
9	Mar 23	Principal Component Analysis (PCA) - Theory		9
10	Mar 30	Principal Component Analysis (PCA) - Practice	5	9
11	Apr 6	Exam 2 (Take Home) given out		
12	Apr 13	Other Ordination Techniques: Correspondence Analysis (CA) and Principal Coordinate Analysis (PCoA)	5	9
13	Apr 20	Other Ordination Techniques: Non-metric Multidimensional Scaling (nMDS)	5	9
14	Apr 27	Exam 3 (Take Home) given out		
15	May 4	Final Exam (Take Home) given out		
16	May 11	Final Exam Due		