

New Course Proposal

Changes saved but not submitted

Viewing: **EVPP 585 : Quantitative Data Analysis for Environmental Scientists**

Last edit: 03/20/24 11:15 am

Programs
referencing this
course

SC-PHD-EVPP: Environmental Science and Public Policy, PhD

Are you completing this form on someone else's behalf?

Yes

Requestor:

Name	Extension	Email
Thomas Reid Nelson	4480	tnelso3@gmu.edu

Effective Term: Spring 2024

Subject Code: EVPP - Environmental Science & Policy

Course Number: 585

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Quantitative Data Analysis for Environmental Scientists

Banner Title: Quant Data Analysis Env Sci

Will section titles
vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per
week: 3

Repeatable: May only be taken once for credit (NR)
GRADUATE ONLY

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

BIOL 214, or STAT 250, or CDS 101 and CDS 102, or any introductory undergraduate statistics course

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(Course/Test Code	Min Grade/Score	Academic Level)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

This course introduces processing, visualizing, and interpreting data using scientific computing techniques widely used in environmental science and natural resources management fields. Students will gain experience with data manipulation, plotting and exporting publication-worthy plots, multiple types of regression analyses, and hypothesis testing. During the course, students will also learn how to create or automate a reproducible workflow for all your data analysis and plotting needs. As science and the publication process become more transparent, this reproducible record becomes more critical and sometimes necessary to the rigorous research process and robust scientific evidence.

Justification:

What: Creating a new course.

Why: Proper data management and analysis is essential to good science and having students trained in applied statistics is a must for them to succeed in their degree programs and future careers. An applied statistics course is also needed given that many students get bogged down by theory and do not actually learn how to analyze their data. Finally, coding-based statistics and provides many benefits over an Excel or other GUI-driven program for analyses. For example, you can easily manipulate your data without changing the raw files, create a reproducible workflow for data analysis and plotting needs, and automate many analyses letting the computer take the burden of the work. As science and the publication process becomes more transparent, this reproducible record is becoming more important and sometimes a necessary step in the publication process.

Does this course cover material which crosses into another department? Yes

Impacted Departments:

Department
STAT - Statistics

Learning Outcomes:

Will this course be scheduled as a cross-level cross listed section? Yes

Please use the Additional Attachments button to attach two syllabi for review, one undergraduate and one graduate, preferably as separate documents. These should be provided in order to demonstrate the difference in expectations and assessments for undergraduates and graduates taking the course.

Attach Syllabus

[EVPP 585_Spring 2024.pdf](#)

Additional Attachments

[EVPP 485_Spring 2024.pdf](#)

Staffing:

Thomas Reid Nelson, PhD

Relationship to Existing Programs:

To be added to the Environmental Science and Policy, MS and Environmental Science and Public Policy, PhD.

Relationship to Existing Courses:

To be cross listed at the undergraduate level.

Additional Comments:

Reviewer**Comments**

Esther Peters (epeters2) (09/02/23 3:34 pm): Rollback: Although the 585 course syllabus is clearly for graduate students and requires a project based on student data, writing methods and results sections like a journal paper, and a final conference-style presentation, the 485 syllabus includes this same sentence about the project using graduate student thesis or dissertation data is in the course information. That needs to be removed. The two syllabi will then have appropriately separated undergraduate and graduate levels; the grading criteria are correct in the syllabi.

Yellia Seanor (yseanor) (11/10/23 12:02 pm): Rollback: I have rolled this course proposal back to the SC Assistant Dean as requested.

Jennifer Bazaz Gettys (jbazaz) (11/17/23 10:10 am): Rollback: Sending this back for revision, if needed, as discussions ensue.

Key: 18277

EVPP 585 Quantitative Data Analysis for Environmental Scientists

Meeting Time: Thursday 4:30 - 7:10 PM

Location: Innovation Hall 205

Instructors: Dr. T. Reid Nelson, tnelso3@gmu.edu

Assistant Professor, Environmental Science and Policy

Phone: (703) 993-4480

Office: Potomac Science Center 3115

Office hours: Monday 1:00 – 3:00 pm and by appointment

Course Description and Goals: This course introduces processing, visualizing, and interpreting data using scientific computing techniques widely used in environmental science and natural resources management fields. Students will gain experience with data manipulation, plotting and exporting publication-worthy plots, multiple types of regression analyses, and hypothesis testing. During the course, students will also learn how to create or automate a reproducible workflow for all your data analysis and plotting needs. As science and the publication process become more transparent, this reproducible record becomes more critical and sometimes necessary to the rigorous research process and robust scientific evidence.

Learning Outcomes:

- Familiarity with coding-based statistics and realized benefits over GUI statistics programs, including an inherent understanding of coding and the ability to create your own functions
- Automation of data manipulation and analysis, letting the computer work for you
- Gain good data management and manipulation practices
- Applied understanding of common statistical analyses used in environmental science
- Gain the background and framework needed to implement complex analyses
- Apply tools learned in class to answer your own research questions, with considerations for design and analysis

Course Content and Instructional Methods: Each week (see the weekly breakdown below), our course will consist of a brief lecture followed by in-class coding exercises where you all will work along with me. Most weeks there will also be a homework assignment for you to complete on your own time reinforcing the skills gained during each week's class period. Each of you will also complete a project for this class analyzing your own dataset. Ideally, this will be data from your graduate work and this project will help with your dissertation or thesis research. During the last two class periods, you will present your projects in a conference style talk (~20 minutes), highlighting your research question/hypotheses, methods and data analysis, results, and conclusions. As part of this project, you will also write a manuscript style methods and results section with accompanying figures (code generated) and tables.

Grading: Your grade will come from the weekly assignments (50%) which will all be graded on a 100-point scale, your final project presentation (20%), your final project code (15%), and a paper mimicking journal style methods and results sections including accompanying figures (15%). The weekly assignments will all be weighted the same and based on the below rubric and the course is graded on the graduate regular scale.

- 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: 75%
- Answer demonstrates a lack of understanding of the core concept: 50%
- No effort was made: 0%

Percentage Breakdown		Graduate Scale	
Assignments	Percentage	Grade	Score
Weekly Assignments	50%	A+	97 - 100
Final Project Presentation	20%	A	93 - 96
Final Project Code	15%	A-	90 - 92
Final Project Paper	15%	B+	87 - 89
		B	83 - 86
		B-	80 - 82
		C	70 - 79
		F	< 70

Weekly Lecture Topics and Assignments

Week	Date	Topic	Assignment
1	1/26	Introduction to class, syllabus	
2	2/2	Data types, reading and writing data, data manipulation, for loops, functions	Read/write, Manipulation
3	2/9	Plotting	Publication Quality Plots
4	2/16	Simple statistics, correlations, and Linear Regression	Regression
5	2/23	Single Factor ANOVA, ANCOVA, non-parametric alternatives, and Post-hoc	ANOVA1
6	3/2	Statistics Review, Sampling, Experimental design, Final Project Discussion (have a topic by this point!)	Pseudoreplication readings (Hulbert, Oksanen)
7	3/9	Multiple Regression & AIC Model Selection	Multiple Regression
8	3/16	Spring Break	
9	3/23	Multiple Factor ANOVAs, BACI, Introduction to random effects	ANOVA2
10	3/30	GLMs, GLMMs	GLM & "ANOVA-like" framework

11	4/6	Non-linear regression (nls function)	growth and decay
12	4/13	GAM, and GAMMs (mgcv package)	
13	4/20	Biodiversity and Community analysis (vegan package)	Community Analysis
14	4/27	Project Presentation	
15	5/4	Project Presentation	

Great textbook for applied environmental statistics

Quinn, G. P. and M. J. Keough. 2002. Experimental design and data analysis for biologists. Cambridge University Press, Cambridge, U.K.

****Can be found for free online if you google it****

Honor Code: Mason is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process (see below for the student pledge). In this course the honor code applies as follows, when you are responsible for a task, you will perform that task. When you rely on someone else's work in presentations or papers, you will give proper citation to that work.

Student Pledge: To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University Community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set for this Honor Code: Student Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

Gender identity and pronoun use: If you wish, please share your name and gender pronouns with me and how best to address you in class and via email. I use he/him/his for myself and you may address me as Reid or Dr. Nelson in email and verbally.

Safe Return to Campus Statement: First of all, I want to address that these are new and uncertain times for everyone. Over the course of the pandemic, I have dealt with my own anxiety and stress management issues and strongly encourage everyone to practice good self-care and try to consciously maintain a healthy mental state. For anyone that is feeling anxious or overwhelmed by the return to campus, the state of the world in general, or any other issues, please reach out to the Counseling and Psychological Services (CAPS) center and seek help as needed <https://caps.gmu.edu/covid19/>. Speaking from personal experience, talking to someone and getting strategies to maintain good mental health can be paramount to our well-being, happiness, and intellectual pursuits.

All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www2.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check

daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a “green” notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class. Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, all community members are required to wear a facemask in all indoor settings, including classrooms. An appropriate facemask must cover your nose and mouth at all times in our classroom. If this policy changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.

Absenteeism Policy: I believe that being in the classroom is a valuable experience where a free exchange of ideas and healthy academic debate can flourish. In person presentations and discussions are also paramount to the learning process and building a sense of community. Therefore, I hope that everyone can make plans to be in class as frequently as possible. However, I understand that personal issues arise and will try to accommodate absences if they are discussed with me prior to class, or when unforeseen illnesses occur.

Disability Accommodations: Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <http://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence: George Mason University is committed to providing a learning, living and working environment that is free from discrimination and a campus that is free of sexual misconduct and other acts of interpersonal violence in order to promote community well-being and student success. We encourage students and employees who believe that they have been sexually harassed, sexually assaulted or subjected to sexual or interpersonal misconduct to seek assistance and support. University Policy 1202: Sexual Harassment and Misconduct speaks to the specifics of Mason’s process, the resources, and the options available to students and employees.

Notice of mandatory reporting of sexual or interpersonal misconduct: As a faculty member, I am designated as a “Non-Confidential Employee,” and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason’s Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason’s confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychological Services

(CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu. Unforeseen personal issues may arise and if these occur please contact me as soon as possible and we will work together to accommodate absences as needed.

EVPP 485 Quantitative Data Analysis for Environmental Scientists

Meeting Time: Thursday 4:30 - 7:10 PM

Location: Innovation Hall 205

Instructors: Dr. T. Reid Nelson, tnelso3@gmu.edu
Assistant Professor, Environmental Science and Policy
Phone: (703) 993-4480
Office: Potomac Science Center 3115
Office hours: Monday 1:00 – 3:00 pm and by appointment

Course Description and Goals: This course introduces processing, visualizing, and interpreting data using scientific computing techniques widely used in environmental science and natural resources management fields. Students will gain experience with data manipulation, plotting and exporting publication-worthy plots, multiple types of regression analyses, and hypothesis testing. During the course, students will also learn how to create or automate a reproducible workflow for all your data analysis and plotting needs. As science and the publication process become more transparent, this reproducible record becomes more critical and sometimes necessary to the rigorous research process and robust scientific evidence.

Prerequisites: BIOL214, STAT250, or CDS 101 and CDS 102

Learning Outcomes:

- Familiarity with coding-based data analysis and realized benefits over GUI statistics programs
- Automation of data manipulation and analysis, letting the computer work for you
- Gain good data management and manipulation practices
- Applied understanding of common statistical analyses used in environmental science
- Apply tools learned in class to analyze environmental datasets

Course Content and Instructional Methods: Each week (see the weekly breakdown below), our course will consist of a brief lecture followed by in-class coding exercises where you all will work along with me. Most weeks there will also be a homework assignment for you to complete on your own time reinforcing the skills gained during each week's class period. Each of you will also complete a project for this class analyzing your own dataset. If you are involved in undergraduate research then ideally this data will come from your own work. If not, we will work together and find a dataset for you to run analyses with. During the last two class periods, you will present your projects in a conference style talk (~20 minutes), highlighting your research question/hypotheses, methods and data analysis, results, and conclusions.

Grading: Your grade will come from the weekly assignments (60%) which will all be graded on a 100- point scale, your final project presentation (25%), and the code used for your project analysis (15%). The weekly assignments will all be weighted the same and based on the below rubric and the course is graded on the undergraduate regular scale.

- 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: 75%
- Answer demonstrates a lack of understanding of the core concept: 50%
- No effort was made: 0%

Percentage Breakdown		Undergraduate Scale	
Assignment	Percentage	Grade	Score
Weekly Assignments	60%	A+	97 - 100
Final Project Presentation	25%	A	93 - 96
Final Project Code	15%	A-	90 - 92
		B+	87 - 89
		B	83 - 86
		B-	80 - 82
		C+	77 - 79
		C	73 - 76
		C-	70 - 72
		D	60 - 69
		F	< 60

Weekly Lecture Topics and Assignments

Week	Date	Topic	Assignment
1	1/26	Introduction to class, syllabus	
2	2/2	Data types, reading and writing data, data manipulation, for loops, functions	Read/write, Manipulation
3	2/9	Plotting	Publication Quality Plots
4	2/16	Simple statistics, correlations, and Linear Regression	Regression
5	2/23	Single Factor ANOVA, ANCOVA, non-parametric alternatives, and Post-hoc	ANOVA1
6	3/2	Statistics Review, Sampling, Experimental design, Final Project Discussion (have a topic by this point!)	Pseudoreplication readings (Hulbert, Oksanen)
7	3/9	Multiple Regression & AIC Model Selection	Multiple Regression
8	3/16	Spring Break	
9	3/23	Multiple Factor ANOVAs, BACI, Introduction to random effects	ANOVA2
10	3/30	GLMs, GLMMs	GLM & "ANOVA-like" framework
11	4/6	Non-linear regression (nls function)	growth and decay
12	4/13	GAM, and GAMMs (mgcv package)	
13	4/20	Biodiversity and Community analysis (vegan package)	Community Analysis
14	4/27	Project Presentation	
15	5/4	Project Presentation	

Great textbook for applied environmental statistics.

Quinn, G. P. and M. J. Keough. 2002. Experimental design and data analysis for biologists. Cambridge University Press, Cambridge, U.K.

****Can be found for free online if you google it****

Honor Code: Mason is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process (see below for the student pledge). In this course the honor code applies as follows, when you are responsible for a task, you will perform that task. When you rely on someone else's work in presentations or papers, you will give proper citation to that work.

Student Pledge: To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University Community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set for this Honor Code: Student Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

Gender identity and pronoun use: If you wish, please share your name and gender pronouns with me and how best to address you in class and via email. I use he/him/his for myself and you may address me as Reid or Dr. Nelson in email and verbally.

Safe Return to Campus Statement: First of all, I want to address that these are new and uncertain times for everyone. Over the course of the pandemic, I have dealt with my own anxiety and stress management issues and strongly encourage everyone to practice good self-care and try to consciously

maintain a healthy mental state. For anyone that is feeling anxious or overwhelmed by the return to campus, the state of the world in general, or any other issues, please reach out to the Counseling and Psychological Services (CAPS) center and seek help as needed <https://caps.gmu.edu/covid19/>. Speaking from personal experience, talking to someone and getting strategies to maintain good mental health can be paramount to our well-being, happiness, and intellectual pursuits.

All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www2.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face- to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class. Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, all community members are required to wear a facemask in all indoor settings, including classrooms. An appropriate facemask must cover your nose and mouth at all times in our classroom. If this policy changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.

Absenteeism Policy: I believe that being in the classroom is a valuable experience where a free exchange of ideas and healthy academic debate can flourish. In person presentations and discussions are also paramount to the learning process and building a sense of community. Therefore, I hope that everyone can make plans to be in class as frequently as possible. However, I understand that personal issues arise and will try to accommodate absences if they are discussed with me prior to class, or when unforeseen illnesses occur.

Disability Accommodations: Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <http://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence: George Mason University is committed to providing a learning, living and working environment that is free from discrimination and a campus that is free of sexual misconduct and other acts of interpersonal violence in order to promote community well-being and student success. We encourage students and employees who believe that they have been sexually harassed, sexually assaulted or subjected to sexual or interpersonal misconduct to seek assistance and support. University Policy 1202: Sexual Harassment and Misconduct speaks to the specifics of Mason's process, the resources, and the options available to students and employees.

Notice of mandatory reporting of sexual or interpersonal misconduct: As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason's

Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu. Unforeseen personal issues may arise and if these occur please contact me as soon as possible and we will work together to accommodate absences as needed.