EVPP 692/991: Theory and Applications of Restoration Ecology Graduate Seminar

Spring 2025
Thursdays 7:20-10 pm
Peterson Hall Room 2408 (In-person)
1 or 2 Credit(s)

Instructor: Dr. Emily E. Conway
Office: 3048 David King Hall
E-mail: econway6@gmu.edu
Office Hours: in-person or virtual by appointment

Course Description:

The destruction and degradation of natural ecosystems through human land uses and climate change threatens biodiversity globally. However, ecological restoration has the potential to halt or reverse this destruction and degradation by employing a rich and diverse body of theory to address these challenges. The field of restoration ecology draws from all branches of ecological theory, from genes to landscapes, to study the relationships among organisms and their environments within the experimental space of applied ecosystem restoration. Throughout this course we will discuss the theoretical roots of restoration ecology and discuss how this theory is tested through real-world test cases and applications.

Learning Outcomes:

These learning outcomes are designed to help students master the skills needed to have a working knowledge about the foundations of the field of restoration ecology, the real-world applications of ecological restoration, and an understanding of the limitations and/or gaps in our knowledge of how to move from theory to application within the field of ecological restoration. By the end of this course students will:

- Understand the foundations of the field of restoration ecology and how the field has evolved from its inception
- Have sufficient knowledge of the ecological theory which underpins the field of restoration ecology
- Have a baseline understanding of the theories, models, and tools that are used across the field of restoration ecology to model ecological outcomes of restoration

- Be able to read and critically evaluate peer-reviewed literature so that one can keep abreast of emerging problems, new techniques, and modern controversies that will form the foundation for extended learning throughout one's career.

Assigned and Optional Readings:

Course materials include articles from the primary literature, textbooks, and occasionally from other media sources. All readings will be posted on Canvas.

Textbook (optional):

Palmer, M. A., Zedler, J., & Falk, D. (Eds.). (2006). *Foundations of Restoration Ecology*. Island Press.

Palmer, M. A., Zedler, J., & Falk, D. (Eds.). (2017). *Foundations of Restoration Ecology: Second Edition*. Island Press. https://doi.org/10.5822/978-1-61091-698-1

Course Structure:

Lectures: Each week lectures will center on the topics outlined in the course schedule. The **lectures will be the main learning content of the course**, and I will endeavor to post the lecture slides prior to the start of each class. However, please note that this may not always happen, and that portions of the lecture slides may be missing information that can be filled in during lecture. **Attendance is required** and will count towards your final grade. However, if you are unable to attend a lecture, or if you need accommodations, please contact me as soon as possible.

Discussions: Each week there will be **at least one required reading** posted as well as additional readings if you would like to explore the topic more. Readings will pertain to the topic(s) that we are discussing during lecture each week and will help to both build knowledge on the selected topic(s) and to help build proficiency with reading and understanding of primary literature. Each week, **1 student will lead** the discussion of the assigned reading, and all other students are expected to come equally prepared to discuss the paper. Discussions will take place at the end of the class and should last 40-60 minutes. Discussions will consist of a summary overview of the paper during which the discussion lead will: 1) review majors points of the paper, 2) highlight novel methods/results/conclusions, 3) relate the paper to the topics covered previously in the course or to your own knowledge, 4) raise any questions or objections you have with the methods/results/conclusion. Following the summary, the lead student will generate and facilitate discussion with the rest of the class for the remaining time. **Credit will be earned for both leading and participating in the discussions.**

Paper: Each student will be required to **write a 2–4-page paper** on the topic of your choice as it relates to the topics covered during the course detailing progress made and challenges remaining in one aspect of the field of restoration ecology. Students enrolled in EVPP 991 will then **present their paper** to the class during the final class meeting. More details on this assignment will follow.

Grading:

	Points:
Attendance	70 points (5 points/class, 14 class meetings)
Discussion Lead	50 points/ per lead (2-4 discussion leads)
Discussion Participation	120 points (10 points/discussion, 12 paper discussions)
Paper (written report)	100 points
Paper (presentation)	100 points (EVPP 991 only)
Total	**490-690 points**

Grading Policies: Grades will be awarded using the following grade cut-offs: 100-90 = A; 89-80 = B; 79-70 = C; 69-60 = D; ≤ 59 = F.

Course Schedule:

Date	Lecture Topic	Required Readings	Supplemental Readings
Thursday 1/23 Week 1	Introduction to Course and Field of Restoration Ecology		Bradshaw, A. D. (1996). Underlying principles of restoration. *Canadian Journal of Fisheries and Aquatic Sciences*, *53*(S1), 3-9. Bradshaw, A. D. (1993). Restoration ecology as a science. *Restoration ecology*, *1*(2).
Thursday 1/30 Week 2	Ecological Theoretical Underpinnings of Restoration Ecology Paper Discussion	Chapter 1 of Foundations of Restoration Ecology (1st edition) Chapter 1 of Foundations of Restoration Ecology (2nd edition) Perring, M. P., R. J. Standish, J. N. Price, M. D. Craig, T. E.	

		Erickson, K. X. Ruthrof, A. S. Whiteley, L. E. Valentine, and R. J. Hobbs. 2015. Advances in restoration ecology: rising to the challenges of the coming decades. Ecosphere 6(8):131. http://dx.doi.org/10.1890/ES15-00121.1	
Thursday 2/6 Week 3	Population and Ecological Genetics in Restoration Ecology Paper Discussion	Chapter 2 of Foundations of Restoration Ecology (1st edition) Chapter 5 of Foundations of Restoration Ecology (2nd edition) Hughes, A. R., Inouye, B. D., Johnson, M. T., Underwood, N., & Vellend, M. (2008). Ecological consequences of genetic diversity. *Ecology letters*, *11*(6), 609-623.	Vellend, M., & Geber, M. A. (2005). Connections between species diversity and genetic diversity. *Ecology letters*, *8*(7), 767-781. Kettenring, K. M., Mercer, K. L., Reinhardt Adams, C., & Hines, J. (2014). EDITOR'S CHOICE: Application of genetic diversity–ecosystem function research to ecological restoration. *Journal of applied ecology*, *51*(2), 339-348. Avolio, M. L., Beaulieu, J. M., Lo, E. Y., & Smith, M. D. (2012). Measuring genetic diversity in ecological studies. *Plant Ecology*, *213*, 1105-1115.
Thursday 2/13 Week 4	Metapopulation Theory and Restoration Ecology Paper Discussion	Chapter 4 of Foundations of Restoration Ecology (1st edition) Chapter 7 of Foundations of Restoration Ecology (2nd edition) Hanski, I., & Gilpin, M. (1991). Metapopulation dynamics: brief history and conceptual domain. *Biological journal of the Linnean Society*, *42*(1-2), 3-16. Leibold, M. A., Holyoak, M., Mouquet, N., Amarasekare, P., Chase, J. M., Hoopes, M. F., ... & Gonzalez, A. (2004). The	Chase, J. M., Jeliazkov, A., Ladouceur, E., & Viana, D. S. (2020). Biodiversity conservation through the lens of metacommunity ecology. *Annals of the New York Academy of Sciences*, *1469*(1), 86-104. Wilcox, K. R., Tredennick, A. T., Koerner, S. E., Grman, E., Hallett, L. M., Avolio, M. L., ... & Zhang, Y. (2017). Asynchrony among local communities stabilises ecosystem function of metacommunities. *Ecology letters*, *20*(12), 1534-1545.

		metacommunity concept: a framework for multi-scale community ecology. *Ecology letters*, *7*(7), 601-613.	
Thursday 2/20 Week 5	Assembly Theory for Restoring Ecosystem Structure and Function Paper Discussion	Chapter 9 of Foundations of Restoration Ecology (2nd edition) Keddy, P. A. (1992). Assembly and response rules: two goals for predictive community ecology. *Journal of vegetation science*, *3*(2), 157-164. Weiher, E., Freund, D., Bunton, T., Stefanski, A., Lee, T., & Bentivenga, S. (2011). Advances, challenges and a developing synthesis of ecological community assembly theory. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1576), 2403-2413.	HilleRisLambers, J., Adler, P. B., Harpole, W. S., Levine, J. M., & Mayfield, M. M. (2012). Rethinking community assembly through the lens of coexistence theory. *Annual review of ecology, evolution, and systematics*, *43*(1), 227-248. Kraft, N. J., Adler, P. B., Godoy, O., James, E. C., Fuller, S., & Levine, J. M. (2015). Community assembly, coexistence and the environmental filtering metaphor. *Functional ecology*, *29*(5), 592-599. Fukami, T. (2015). Historical contingency in community assembly: integrating niches, species pools, and priority effects. *Annual review of ecology, evolution, and systematics*, *46*(1), 1-23.
Thursday 2/27 Week 6	Nutrient Dynamics and the Recovery of Ecosystem Processes Paper Discussion	Chapter 3 of Foundations of Restoration Ecology (1st edition) Chapter 12 of Foundations of Restoration Ecology (2nd edition) Harpole, W. S., Sullivan, L. L., Lind, E. M., Firn, J., Adler, P. B., Borer, E. T., ... & Stevens, C. J. (2017). Out of the shadows: multiple nutrient limitations drive relationships among biomass, light and plant diversity. *Functional Ecology*, *31*(9), 1839-1846.	https://nutnet.org/

Thursday 3/6 Week 7	Watershed Processes as Drivers for Aquatic Ecosystem Restoration Paper Discussion	Chapter 14 of Foundations of Restoration Ecology (2nd edition) Bohn, B. A., & Kershner, J. L. (2002). Establishing aquatic restoration priorities using a watershed approach. *Journal of Environmental Management*, *64*(4), 355-363. Richardson, C. J., Flanagan, N. E., Ho, M., & Pahl, J. W. (2011). Integrated stream and wetland restoration: A watershed approach to improved water quality on the landscape. *Ecological Engineering*, *37*(1), 25-39.	
Thursday 3/13 Week 8	Spring Break		
Thursday 3/20 Week 9	Evolutionary Restoration Ecology Paper Discussion	Chapter 6 of Foundations of Restoration Ecology (1st edition) Chapter 15 of Foundations of Restoration Ecology (2nd edition) Carlson, S. M., Cunningham, C. J., & Westley, P. A. (2014). Evolutionary rescue in a changing world. *Trends in ecology & evolution*, *29*(9), 521-530.	LaRue, E. A., Chambers, S. M., & Emery, N. C. (2017). Eco-evolutionary dynamics in restored communities and ecosystems. *Restoration Ecology*, *25*(1), 19-26. Williams, A. V., Nevill, P. G., & Krauss, S. L. (2014). Next generation restoration genetics: applications and opportunities. *Trends in Plant Science*, *19*(8), 529-537. Barak, R. S., Hipp, A. L., Cavender-Bares, J., Pearse, W. D., Hotchkiss, S. C., Lynch, E. A., ... & Larkin, D. J. (2016). Taking the long view: integrating recorded, archeological, paleoecological, and evolutionary data into ecological restoration. *International*

			Journal of Plant Sciences, *177*(1), 90-102.
Thursday 3/27 Week 10	The Influence of Climate Variability and Change on the Science and Practice of Restoration Ecology Paper Discussion	Chapter 15 of Foundations of Restoration Ecology (1st edition) Chapter 17 of Foundations of Restoration Ecology (2nd edition) Timpane-Padgham, B. L., Beechie, T., & Klinger, T. (2017). A systematic review of ecological attributes that confer resilience to climate change in environmental restoration. *PLoS One*, *12*(3), e0173812.	Harris, J. A., Hobbs, R. J., Higgs, E., & Aronson, J. (2006). Ecological restoration and global climate change. *Restoration Ecology*, *14*(2), 170-176. Erwin, K. L. (2009). Wetlands and global climate change: the role of wetland restoration in a changing world. *Wetlands Ecology and management*, *17*(1), 71-84. Wilsey, B. (2021). Restoration in the face of changing climate: importance of persistence, priority effects, and species diversity. *Restoration Ecology*, *29*, e13132.
Thursday 4/3 Week 11	The Dynamic Nature of Ecological Systems: Multiple States and Restoration Trajectories Paper Discussion	Chapter 9 of Foundations of Restoration Ecology (1st edition) Chapter 2 of Foundations of Restoration Ecology (2nd edition) Suding, K. N., Gross, K. L., & Houseman, G. R. (2004). Alternative states and positive feedbacks in restoration ecology. *Trends in ecology & evolution*, *19*(1), 46-53.	
Thursday 4/10 Week 12	Using Heterogeneity Theory and Food Web Theory to Study Dynamic Systems Paper Discussion	Chapter 7 & 8 of Foundations of Restoration Ecology (1st edition) Chapter 10 & 11 of Foundations of Restoration Ecology (2nd edition)	
Thursday 4/17 Week 13	Applications of Ecological Restoration in Terrestrial Ecosystems	TBD – let's discuss together which systems we'd like to focus on	

	Paper Discussion		
Thursday 4/24 Week 14	Application of Ecological Restoration in Aquatic Ecosystems Paper Discussion	TBD – let's discuss together which systems we'd like to focus on	
Thursday 5/1 Week 15	Synthesis and Challenges to Application		

Additional GMU Policies:

Academic Standards

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to

written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

Accommodations for Students with Disabilities

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 https://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.

Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor *in advance* of any relevant class meeting, assignment, or exam.

FERPA and Use of GMU Email Addresses for Course Communication

The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. **Students must use their GMU email account** to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility: Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.

Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, **all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct** (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

*** Please note, as a faculty member I am a mandatory reporter and must report all disclosures ***

Student opportunity: If you prefer to speak to someone ***confidentially***, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.