NRM 5302 – Restoration Ecology

Dept. of Natural Resource Sciences
Sul Ross State University

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Office: 130A RAS
Office hours: Monday and Wednesday, 8:00 AM to 10:00 AM.

Lecture location: RAS 129
Tuesday & Thursday, 9:30 AM - 10:45 AM

"In the end, we will conserve only what we love; we will love only what we understand, and we will understand only what we are taught." — Baba Dioum

Course Description
This graduate seminar explores the theory, science, and practice of ecological restoration. Students will explore how ecological principles such as resilience, disturbance, and succession to inform restoration and how restoration is applied across ecosystems. The course emphasizes dryland systems, especially those in the Chihuahuan Desert, while integrating global debates such as novel ecosystems, restoration planning, and restoration ethics.

Course Objectives
- Understand the theoretical foundations of ecological restoration.
- Critique restoration projects using ecological and social criteria.
- Design and justify science-based restoration plans.
- Apply theory to practical restoration challenges.

Weekly Schedule

** Tentative to change **

Week 1: Foundations of Ecological Restoration
Introduction to Ecological Restoration & Global and Regional Case Studies
Readings:

- Clewell, A. F., & Aronson, J. (2006). Motivations for the restoration of ecosystems. Conservation Biology, 20(2), 420–428.
- Higgs, E. (1997). What is good ecological restoration? Conservation Biology, 11(2), 338–348.

Week 2: Historical Context and Ethics in Restoration
History and Ethics of Restoration& Debates over Goals and Values
Readings:

- Higgs, E. (2003). Nature by Design: People, Natural Process, and Ecological Restoration. MIT Press.
- Callicott, J. B. (2002). Choosing appropriate temporal and spatial scales for ecological restoration. Journal of Biosciences, 27(4), 409–420.

Week 3: Succession and Community Assembly
Succession and Community Assembly & Plant Community Recovery after Disturbance
Readings:

- Connell, J. H. (1978). Diversity in tropical rain forests and coral reefs. Science, 199(4335), 1302–1310.
- Egler, F. E. (1954). Vegetation science concepts I. Initial floristic composition, a factor in old-field vegetation development. Vegetatio, 4(6), 412–417.

Week 4: Disturbance and Intermediate Disturbance Hypothesis
Disturbance Ecology & Disturbance-based Management
Readings:

- Connell, J. H. (1978). Diversity in tropical rain forests and coral reefs. Science, 199(4335), 1302–1310.
- Sousa, W. P. (1984). The role of disturbance in natural communities. Annual Review of Ecology and Systematics, 15, 353–391.

Week 5: Resilience and Stability in Ecosystems
Resilience and Stability & Adaptive Management and Feedbacks
Readings:

- Holling, C. S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology and Systematics, 4(1), 1–23.
- Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social–ecological systems. Ecology and Society, 9(2), 5.

Week 6: Reference Conditions and Setting Goals
Reference Conditions and Setting Goals & Historical Baselines vs. Functional Targets
Readings:

- Jackson, S. T., & Hobbs, R. J. (2009). Ecological restoration in the light of ecological history. Science, 325(5940), 567–569.
- White, P. S., & Walker, J. L. (1997). Approximating nature's variation: Selecting reference sites for restoration. Restoration Ecology, 5(4), 338–349.
- Swetnam, T. W., Allen, C. D., & Betancourt, J. L. (1999). Applied historical ecology: Using the past to manage for the future. Ecological Applications, 9(4), 1189–1206.

Week 7: Invasive Species Ecology
Invasive Species Ecology & Management of Lehmann's Lovegrass and Similar Challenges
Readings:

- D'Antonio, C., & Meyerson, L. A. (2002). Exotic plant species as problems and solutions in ecological restoration: A synthesis. Restoration Ecology, 10(4), 703–713.
- Simberloff, D. (2005). Non-native species DO threaten the natural environment! Journal of Agricultural and Environmental Ethics, 18(6), 595–607.
- Pimentel, D., Zuniga, R., & Morrison, D. (2005). Update on the environmental and economic costs associated with alien-invasive species in the United States. Ecological Economics, 52(3), 273–288.

Week 8: Soil and Hydrology in Restoration
Soil and Hydrology in Restoration & Restoring Soil Function in Arid Lands
Readings:

- Herrick, J. E., et al. (2005). Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems. USDA-ARS Jornada Experimental Range.
- Harris, J. A. (2009). Soil microbial communities and restoration ecology: facilitators or followers? Science, 325(5940), 573–574.

Week 9: Animal Translocations in Restoration
Animal Translocations & Bighorn, Quail, Pronghorn Case Studies
Readings:

- Seddon, P. J., Armstrong, D. P., & Maloney, R. F. (2007). Developing the science of reintroduction biology. Conservation Biology, 21(2), 303–312.
- Armstrong, D. P., & Seddon, P. J. (2008). Directions in reintroduction biology. Trends in Ecology & Evolution, 23(1), 20–25.
- Fischer, J., & Lindenmayer, D. B. (2000). An assessment of the published results of animal relocations. Biological Conservation, 96(1), 1–11.

Week 10: Fire Ecology, Herbicide, and Mechanical Treatments in Restoration
Management in Desert Ecosystems
Readings:

- Allen, C. D., et al. (2002). Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. Ecological Applications, 12(5), 1418–1433.
- Keeley, J. E., & Fotheringham, C. J. (2001). Historic fire regime in southern California shrublands. Conservation Biology, 15(6), 1536–1548.

Week 11: Livestock Grazing in Restoration
Livestock Grazing in Restoration & Grazing Systems and Vegetation Recovery
Readings:

- Teague, W. R., et al. (2011). Grazing management impacts on vegetation, soil biota and soil chemical, physical and hydrological properties. Agriculture, Ecosystems & Environment, 141(3–4), 310–322.
- Briske, D. D., et al. (2008). Rotational grazing on rangelands: Reconciliation of perception and experimental evidence. Rangeland Ecology & Management, 61(1), 3–17.

Week 12: Stream and Wetlands Restoration
Restoration of streams (lotic) and wetlands/ponds (lentic) in arid and semi-arid landscapes.
Readings:

- Palmer, M. A., Bernhardt, E. S., et al. (2005). Standards for ecologically successful river restoration. Journal of Applied Ecology, 42(2), 208–217.
- Wohl, E. (2019). Forgotten rivers: Stream–groundwater interactions and restoration in arid landscapes. Frontiers in Environmental Science.

Week 13: Novel Ecosystems and Climate Change
Novel Ecosystems and Climate Adaptation & Limits and Possibilities of Restoration in a Changing World
Readings:

- Hobbs, R. J., et al. (2009). Navigating the course for ecological restoration. Restoration Ecology, 17(5), 713–719.
- Seastedt, T. R., et al. (2008). Management of novel ecosystems: are novel approaches required? Frontiers in Ecology and the Environment, 6(10), 547–553.
- Suding, K. N. (2011). Toward an era of restoration in ecology: successes, failures, and opportunities ahead. Annual Review of Ecology, Evolution, and Systematics, 42, 465–487.

Week 15: Student Presentations

Assessment and Grading

Assignment	Description	Weight
Participation	Engagement in discussion and submission of brief reading reflections	10%
Pop Quizzes	Covers foundational theory, concepts, and applied case studies	20%
Midterm Exam	Covers foundational theory, concepts, and applied case studies	20%
Final Exam	Covers foundational theory, concepts, and applied case studies	20%
Restoration Plan	Written plan for a real or hypothetical site including goals, expectations, study site, methods, and monitoring	10%
Final Presentation	Presentation and defense of restoration project plan	20%

Attendance in lectures is required as we will cover material in class that students will not be able to get from any other source.

Course material:
Lecture presentations and PDF files with the PowerPoint slides will be uploaded weekly to Blackboard.

Class etiquette:
Please turn cell phones off at the beginning of each class. Put away all computers during lectures and do not web surf or email during class. In this course, we value a positive and respectful learning environment. Please adhere to the following class etiquette guidelines to ensure a smooth and productive experience for everyone. Attend all classes regularly and arrive punctually, notifying the instructor in advance if you must miss a class. Actively participate in class discussions, respecting the opinions of your classmates. Use respectful language in all forms of communication, maintaining professionalism in emails. Keep the classroom clean and organized. If you bring an apple for the instructor on the second day of class, you will earn one extra point on your first exam. Uphold principles of academic honesty and integrity. Dress appropriately for the learning environment and provide constructive feedback to peers and the instructor. Your commitment to these guidelines contributes to a positive and enriching learning atmosphere.

Academic Dishonesty:
Academic dishonesty includes copying, sharing, or obtaining information from an unauthorized source, attempting to take credit for the intellectual work of another person, falsifying information, and giving or receiving information about a test, quiz, or assignment to other students. Any student involved in academic dishonesty will receive no credit (0) for work done and/or may be penalized in accordance with published University Rules.

Counseling and Accessibility Services:
Sul Ross State University is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartze, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8691. Email: mschwartze@sulross.edu.

Students with Special Needs:
Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the Student's responsibility to initiate a request. Please contact me, Ms. Rebecca Greathouse Wren, M.Ed., LPC-S, Director/Counselor, Accessibility Services Coordinator, Ferguson Hall (Suite 112) at 432.837.8203; mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Students should then contact the instructor as soon as possible to initiate the recommended accommodations.