Ecology and Restoration of Invaded Ecosystems

FOR 6934 (3 credits)
Spring 2014

Course Description

This advanced ecosystem management course will begin with an overview of the ecological basis for plant invasions in managed forests and terrestrial ecosystems, and then focus on methods for restoration of invaded and formerly invaded systems. Management tools and techniques for prevention, control, and restoration will be discussed, and plant invasions from Florida and around the U.S. will be used as case studies. This course will follow on an online discussion format, with recorded lectures and relevant assigned readings from textbooks and primary literature. The course is a mixed graduate/undergraduate level course and is designed for upper-level undergraduate students with a strong interest and background in ecology and applied plant science, graduate students in the Masters of Science, Ecological Restoration concentration, or other graduate students with an interest in invasive species ecology and management. *Previous coursework in biology, ecology, or other relevant plant science courses in strongly recommended*.

Instructor

Kimberly Bohn
Associate Professor, Forest Ecology and Silviculture
kkbohn@ufl.edu
(850) 983-7129

Learning Outcomes

At the end of this course, each student will:

- Be able to interpret and critically assess theories related to invasion mechanisms, biotic interactions and ecological succession
- Identify major invasive plant species of concern and their ecological and economic impacts in managed forests and natural, terrestrial ecosystems
- Understand how to use modern tools and methods to prevent and control plant invasions and to restore formerly invaded ecosystems
- Demonstrate how to integrate ecological concepts into management efforts
- Be able to critically assess scientific literature and implications of results for practical management

Readings

1. Invasion Ecology 2nd ed. JL Lockwood, MF Hoopes and MP Marchetti. 2013. Blackwell Publishing, 303 p. (**Required**).

2. Conceptual Ecology and Invasion Biology: Reciprocal Approaches to Nature. MW Cadotte, SM McMahon and T Fukami. 2006. Springer, 507 p. (**Optional**).

3. A list of full citations and links to required journal article readings will be posted in the within the Sakai site.

Class Format and Policies
The course will consist of one week modules focused on specific topics related to invasion ecology, management, and restoration. The format will consist primarily of readings and discussion threads. To accommodate students with full-time employment, modules will follow a **Tuesday-Monday** schedule to allow time for adequate discussion over the weekend period as needed. For each module, students will be assigned 2 readings, including chapter(s) from one of the required texts, relevant peer-reviewed journal articles, or other materials. A short (approximately 20 minute) "primer" lecture to introduce the topic will be provided by the instructor, who will also facilitate a weeklong discussion thread(s) on that topic. The lecture and instructor-led discussion threads will be posted each **Tuesday.** Discussions will be asynchronous, that is, they will use a message board format (as opposed to a live "chat room"). **C**omments/responses from the students can be posted until **Sunday** evening. Wrap-up discussion and conclusions will be provided by the instructor on **Monday,** at the end of the module.

A separate discussion thread, focusing on a single journal article, will be led by a different graduate student(s) each week and posted by **Thursday** of that week. Typically these additional readings will build on topics introduced in the lectures and/or present a case study of relevant invasive plant ecology and management. All students (graduate and undergraduate) are expected to read these articles and participate in the additional discussion. **C**omments/responses from the students can be posted until **Sunday** evening. Throughout the semester, some additional guest lectures and video podcasts will be provided as a supplement.

NOTE: *Discussion questions are intended to stimulate conversation and debate and encourage you to explore more deeply into the topics covered in the week's readings. In many cases, there will not be a clear "right" or "wrong" answer. In some cases, the questions will be contextual (eg. "Describe an example of a species that exhibits invasive traits"), others questions will be more conceptual, and some questions may ask to merely express an opinion. Towards the end of the semester the discussion threads will be used to practice developing management recommendations for particular invaded ecosystem scenarios.*

Assignment and attendance policy: "Attendance" for this course will be based on participation in the discussion forum. In the event of an illness or other emergency, students will be excused from one week of participation contingent upon arrangement with the instructors. Written assignments are due electronically by noon (Eastern time) on the due date and will lose 10% of the grade for each day they are late (weekends count too). In cases of extended illness or emergencies, arrangements to turn in late exams or other written assignments must be made with the instructor prior to the due date.

Assignments and Evaluation of Student Learning
Participation in weekly discussion sessions will constitute a significant portion of the final grade. Students will be expected to contribute **two** unique comments and/or responses to other students (typically several sentences to about a paragraph in length which demonstrate thought and/or research into the topic area.) One post should appear in one of the instructor-led discussion threads and 1 should appear in the graduate student-led discussion threads. Note that you are welcome to post and respond more than the minimum.

For the graduate student-led discussions, the discussion leader will be expected to read the article (and supporting literature, as necessary) and lead a discussion on the most important topics

covered in it. This will involve providing a brief 1-2 paragraph summary, posing at least 3 questions for the other students, and *facilitating* a productive online dialogue between students. The discussion leader should initiate the discussion no later than Thursday at noon (Eastern).

The remainder of the grade will come from the two 'take-home' essay exams. For these exams, students will be held responsible for all material covered in lectures, assigned readings, discussions and supplemental materials. The mid-term will include short-answer questions in which you will synthesize information learned in the course as well as essay questions (typically 1-2 page response) in which you may be asked to find and present additional information through literature searches. The final 'exam' will focus on restoration and management recommendations for several scenarios using ecological concepts and applied methods learned in class. Exams will be take home/open book. You will be given 5 days to complete them.

The grading breakdown will be as follows:

36 points Participation in weekly discussion sessions (3 points/week *x* 12 weeks w/discussions)
14 points Graduate students: Presentation of one weekly article and moderation of discussion
25 points Mid-term Exam
25 points Final exam (comprehensive)
Total: 100 points

Grading Scale (http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html)
Letter grades will be assigned as follows: A (93-100), A^- (90-92), B^+ (86-89), B (83-85), B^- (80-82), C^+(76-79), C (73-75), C^-(70-72), D^+(66-69), D (63-65), D- (60-62), E (<60)

Schedule of Class Topics and Readings

Introduction

Module 1: Introduction
A. *Article*: Richardson et. al. 2000. Naturalization and invasion of alien plants: concepts and definitions. Diversity and Distributions 6: 93-107
B: *Article*: Davis et al. 2011. Don't judge species based on their origins. Nature 474: 153-154.

I. Theories and Mechanisms for Invasion

Module 2: Dispersal Mechanisms
A. *Required Text:* Lockwood et al, Chapter 2, Vectors and Pathways
B. *Required Text:* Lockwood et al, Chapter 4, Propagules
C. Graduate student-led *article*: Gosper et al. 2005. Seed dispersal of fleshy-fruited invasive plants by birds. Biodiversity Research 11: 549-558.

Module 3: Role of Disturbance
A. *Required Text:* Chapter 5, Lockwood et al. D*isturbance ecology*:
B. *Required Article*: Davis, Grime and Thomason. 2000. Fluctuating resources in plant communities: a general theory of invasibility. Journal of Ecology 88: 528-534.
C. *Supplemental (optional) article*: Hobbs and Huenneke. 1992. Disturbance, diversity, and invasion: Implications for conservation. Conservation Biology 6: 324-337.
D. Graduate student-led *article*: McGlone et al. 2011. Invasion resistance and persistence: Established plants win, even with disturbance and high propagule pressure. Biol Invasions 13: 291-304.

Module 4: Biotic interactions (competition, facilitation, mutualism)

A. *Required text* Lockwood et al. Chapter 6, *Influence of Biotic interactions*
B. *Article:* Levine et al. 1999. Elton Revisited: a review of evidence linking diversity and invasibility. Oikos 87: 15-26.
C. Graduate student-led *article:* Callaway et al 2011. Effect of soil biota from different range on *Robinia* invasion: acquiring mutalists and escaping pathogens. Ecology: 92: 1027-1035.

II. Ecological Impacts following Invasion

Module 5: Impacts to ecological processes (nutrient cycling)

A. *Optional reading:* Cadotte et al Ch. 15 Interactions between plants and soil ecosystems
B. *Article*: Ehrenfeld et al 2001. Changes in soil functions following invasions of exotic understory plants in deciduous forests. Ecol Apps 11: 1287-1300
C. Graduate student-led *article*: Simberloff. 2011. How common are invasion-induced ecosystem impacts? Biol Invasions 13: 1255-1268.

Module 6: Impacts to ecological processes (fire and water)

A. *Article:* Brooks et al. 2004. Effects of Invasive Alien Plants on Fire Regimes. Bioscience 54: 677-688
B. *Article:* Moore and Owens. 2012. Transpirational water loss in invaded and restored semiarid riparian forests. Restoration Ecology: 20(3): 346-351
C. Graduate student-led *article*: Gordon. D. 1998. Effects of invasive, non-indigenous plant species on ecosystem processes: lessons from Florida. Ecological Applications 8: 975-989.

Module 7: Impacts to plant communities (biodiversity vs saturation)

A. *Article*: Stohlgren et al 2008. The myth of plant species saturation. Ecology Letters 11: 313-326.
B. *Article*: Gurevitch and Padilla. 2004. Are invasive species a major cause of extinctions? Trends in Ecology and Evolution 19: 470-476
C. Graduate student-led *article*: Lonsdale 1999. Global patterns of plant invasions and the concept of invisibility. Ecology 80: 1522-1536. (this paper reviews previous concepts to prepare for the exam

MIDTERM EXAM (*Assigned February 25, Due 10am Monday March 3)*

Spring Break 

III. Management and Restoration of Invaded Ecosystems

Module 8: Prediction, Risk Assessment, and Prevention

A. *Required Text*: Chapter 12, Lockwood et al. *Prediction, Risk Assessment and Mngt*
B. *Activity*: Practice with IFAS Risk Assesment Tool and EddMaps/EDRR
C. Graduate student-led *article*: : Renz et al. 2009. Land Manager and Researcher perspectives on invasive plant research need in the Midwestern United States. Invasive Plant Science and Mngt 2: 83-91.

Module 9: Techniques for control I- *Integrating plant biology into control*

A *Article:* Cuneo et al. 2010. Seed ecology of the invasive African Olive: implications for management and restoration. Australian Journal of botany 58: 342-348.
B. Article: Guo et al. 2009. Influences of herbicides, uprooting and use as cut flowers on sexual reproduction of Solidago candadensis. Weed Research 49: 291-299.
C. *Video podcast: Japanese Climbing fern control*
D. Graduate student-led *article*: Ewel and Putz. 2004. A place for alien species in ecosystem restoration? Frontiers in Ecology 2: 354-360.

Module 10: Restoration of invaded ecosystem I- *restoring plant communities*

A. A*rticle:* Sheley et al. 1996. A theoretical framework for developing successional weed management strategies on rangeland. Weed Technology 10(4): 766-773.

A2. *Suggested supplemental*: Krueger-Mangold and Sheley. 2006. Toward ecologically-based invasive plant management on rangeland. Weed Science 54: 597-605.

B. A*rticle:* Funk et al. Restoration through reassembly: plant traits and invasion resistance. Trends in Ecology and Evolution 23: 695-703.

C. Video podcast- coral ardesia

D. Graduate student-led *article*: Hildebrand. 2005. The myths of restoration ecology. Ecol and Society 10: 1-11.

Module 11: Restoration of invaded systems II- *restoring ecosystem function*

A. *Article:* Corbin and D'Antonio. 2012. Gone but not forgotten? Invasive plant's legacies on community and ecosystem properties. Invasive Plant Sci and Mngt 5: 117-124

B. *Article:* Brown and Bedford. 1997. Restoration of wetland vegetation with transplanted wetland soil. Wetlands 17: 424-437.

C. Video podcast- Cogongrass

D. Graduate student-led article: Gosper and Vivian-Smith. 2006. Selecting replacements for invasive plants to support frugivores in highly modified sites: A case study. Ecol Management and Restoration 7: 197-203.

Module 12: Restoration of invaded systems II- *case studies and efficacy*

A. *Article: TBD*

B. *Article: TBD*

C. Graduate student-led article: TBD

Module 13: Invasive species management and restoration in a changing environment

A. *Article:* Hellmann et al. 2007. Five potential consequences of climate change for invasive species. Conservation Biology 22: 534-543.

B. *Article:* Clements and Ditommaso. 2011. Climate change and weed adaptation: range expansion. Weed Research 51: 227-240.

B. *Article*- Hobbs et al. 2006. Novel Ecosystems: theoretical and management aspects of the new ecological world order. Global Ecol and Biogeography 15: 1- 7.

Wrap-up and Review (April 21-23); FINAL EXAM (Assigned 4/26, Due 5/1 by 10am)

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at https://evaluations.ufl.edu. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. You will have an opportunity during one of the last class periods to fill these out. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results.

UF Distance Education Policy

Should you have any complaints with your experience in this course which cannot be addressed by the instructor, please visit http://www.distance.ufl.edu/student-complaints to submit a complaint."

Academic Honesty
The University of Florida requires all members of its community to be honest in all endeavors. Cheating, plagiarism, and other acts diminish the process of learning. When students enroll at UF they commit themselves to honesty and integrity. Your instructor fully expects you to adhere to the academic honesty guidelines you signed when you were admitted to UF.

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment*."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see:
http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

Software Use:
All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

14. A statement related to accommodations for students with disabilities. A standard statement is provided below.

Services for Students with Disabilities
The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

0001 Reid Hall, 352-392-8565, **www.dso.ufl.edu/drc/**

Campus Helping Resources
Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling& Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

• *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, *
www.counseling.ufl.edu/cwc/
Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching
• *Career Resource Center,* First Floor JWRU, 392-1601, **www.crc.ufl.edu**