Paradigms of Integrative Ecology

ALS 5932(3 credits)– Fall 2025

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Course Meeting Time and Place:
Thursday 12:50 – 3:50pm| Room TBD

Course Description

Through this course, students will achieve a rigorous understanding of the ecological principles and paradigms that shape the natural world and inform it's conservation. This course will outline how both foundational ecological principles and modern advancements in interdisciplinary ecology combine to describe how nature is structured and predict how ecosystems will respond to global change. We will deal with theoretical, empirical, and applied examples throughout the course, emphasizing how each can form ecological paradigms. Students will interact with course material through an interdisciplinary, conservation lens as we synthesize the trinity of ecological approaches (field observations, controlled experiments, and mathematical exploration) to understand how ecology, natural sciences, social sciences, sustainability, and data science are connected.

Course Objectives

Obj I. Throughout the course, students will learn how to evaluate new scientific information, synthesize new concepts, and identify key ecological principles. Given classic studies and cutting-edge research from the primary literature, students will evaluate how different ecological approaches are used to create and overturn paradigms throughout the course.

Obj II. Throughout the course, students will compare and contrast how different approaches yield similar or different inferences across multiple fields of study

Obj III. At the completion of the course, students will be able to evaluate the usefulness and applicability of interdisciplinary ecological concepts for conservation, restoration, and management.

Obj IV. At the end of the course, students will effectively convey scientific thoughts and conceptual analyses in their writing, class discussions, and oral presentations.

Prerequisites and Student Expectations

I expect that you will have had instruction in ecology with experience in related disciplines such as evolution, statistics, or biomathematics. Because this is a graduate course, I expect a high level of intellectual engagement with the material. Other intangible prerequisites include intellectual curiosity, and enthusiasm.

Class participation is crucial for success in this course. Students are expected to pay close attention and contribute to paper discussions in every class. Students will be graded on participation and should not be checking email, surfing the web, or otherwise electronically (dis)engaged. Keep phones off please.

Course Design

Paradigms in Interdisciplinary Ecology aims to facilitate engagement through student-led and instructor-led paper discussions. A typical class lesson will consist of a discussion of ~3 papers related to the topic. Each meeting will consist of an instructor-led paper discussion and then two student-led discussions, with a short concluding summary discussion that instructor and student work on together. Student-discussion leaders are expected to meet with the instructor before the class to plan these short concluding discussions. In the second half of the courses, classes will have a similar structure but will involve slightly different themes. Theory Month will focus on ecological theories and how they apply to conservation and restoration. Ecology Fights will cover famous controversies in interdisciplinary ecology. Both will mostly involve paper discussion, but with a larger focus on syntheses across topics and papers.

Interdisciplinary Ecology Modules: Student-led Discussions (two-three times/semester/student)

For each class meeting, one student will be responsible for leading a discussion on two papers selected by the instructor. For each paper, the student will give a 10-15 minute detailed overview of the paper. This discussion leader will also provide a written summary of the paper and at least four discussion questions to be brought up during class. These summaries and questions should be posted to eLearning two days prior to the discussion. The student may facilitate discussions by creating a small presentation and/or visualization for the paper. For example, the most important figures can be extracted, enlarged, and projected upon the whiteboard/on the virtual board for annotation and pointing out important aspects. Other aspects of these visual aids could include pictures of the study system and organisms, or depictions of the patterns and processes described in the paper.
The student discussion leader and the instructor will meet during office hours to plan a end-of-class summary discussion on that week's topic.

Theory Week

Towards the end of the course, we will begin Theory Week (actually two weeks), a set of classes focused on ecological theories and how they are applicable to the conservation, restoration, and management of terrestrial and marine ecosystems. Each student or small groups of students will tackle one ecological theory and create a short presentation that: a) describes and depicts the ecological theory, b) shows examples of empirical evidence for the theory, and c) outlines how the ecological theory could be used by scientists or managers focused on conservation issues. For c) the rest of the class will act as the managers of a specific Florida ecosystem who are interested but skeptical of the applicability of ecological theory in their area. The presenting student(s) will provide specific examples and predicted outcomes of new, theory-focused ecosystem conservation strategies. The students will be graded on their presentation and participation.

Course Schedule

Each Lesson will consist of one paper led by the instructor and about two papers for the student led paper discussion. At the beginning of the semester, we will conduct a pre-assessment of student's knowledge of ecological principles and paradigms, so I know the incoming level of understanding for the class. Some modules may be added or removed based on the pre-assessment.

Module 1: Biodiversity
Exploring how biodiversity is changing, what it means for ecosystems, and how biodiversity affects humans

Week 1: Class Outline | Approaches to Studying Ecology | Measuring Biodiversity
Readings:
How to lead a good paper discussion
Colwell & Coddington 1994 (Phil. Trans. R. Soc. B) – estimating terrestrial biodiversity; Chao *et al.* 2014 (Ecological Monographs) – modern approaches to species richness estimation.

Week 2: Biodiversity Effects on Ecosystems
Readings:
Dornelas et al 2018 – Is local biodiversity being lost?
Wagg *et al.* 2014 (PNAS) – soil biodiversity loss reduces multifunctionality;
Cardinale *et al.* 2011 (Am. J. Bot.) – producer diversity effects on nutrient cycling
Cardinale *et al.* 2006 (Nature) – meta-analysis on diversity and functioning across trophic groups;
Balvanera *et al.* 2006 (Ecology) – quantitative synthesis of BEF experiments.

Week 3: Diversity and Disease | Phylogenetic Diversity
Readings:
Keesing *et al.* 2010 (Nature) – review of biodiversity and infectious disease; Ostfeld & Keesing 2012 (Proc. R. Soc. B) – empirical tests of the dilution effect.
Cadotte et al 2008 (PNAS) phylo diversity as a BEF predictor.

Week 4: Biodiversity and Ecosystem Services and Climate Adaptation
Readings:
Letourneau *et al.* 2011 (Ecol. Lett.) – meta-analysis of natural enemy biodiversity reducing crop pests.

Mace et al 2012 (Nature) – linking biodiversity to ecosystem services
Seddon *et al.* 2020 (Phil. Trans. B) – using biodiversity in climate adaptation.
Planetary Health

Module 2: Ecological Networks and Species Interactions
Understanding how ecosystems are structured and the consequences of complex species interactions across space and time

Week 5: Top-Down Control
Readings:
Paine 1966 (American Naturalist) – keystone predation in intertidal food webs Estes *et al.* 2011 (Science) – trophic cascades from terrestrial to marine systems.
Pauly *et al.* 1998 (Science) – fishing down marine food webs
Treves & Karanth 2003 (BioScience) – human-carnivore conflict worldwide; Ripple *et al.* 2014 (Science) – status and ecological roles of the world's large carnivores.

Week 6: Food Webs
Readings:
May 1973 (Stability and Complexity in Model Ecosystems) – theory of food web stability; Dunne *et al.* 2002 (PNAS) – food web robustness to species loss.
Parasites in Food Webs
Svenning *et al.* 2016 (PNAS) – trophic rewilding for functional restoration; Donlan *et al.* 2006 (Nature) – bold rewilding plan for Pleistocene megafauna surrogates.

Week 7: Positive Interaction Networks
Readings:
Janzen 1966 (Evolution) – coevolution of ant-acacia mutualism; Bronstein 1994 (Am. Zool.) – overview of mutualism ecology and evolution.
Facilitation Cascades
Garibaldi *et al.* 2013 (Ecol Lett) – strategies to enhance crop pollination services;

Module 3: Global Change
Exploring foundational ecological principles within the context of global change

Week 8: Invasions and Range Shifts
Readings:
Parmesan & Yohe 2003 (Nature) – global meta-analysis of phenology/range shifts
Mack *et al.* 2000 (Ecological Applications) – overview of biotic invasions; Simberloff *et al.* 2013 (Biol Invasions) – invasive species, resilience, and management.
Climate Velocity

Week 9: Extinction Drivers | Alternate Stable States
Readings:
Pimm *et al.* 2014 (Science) – rates of modern extinctions vs. background.

Haddad *et al.* 2015 (Science) – habitat fragmentation experiments over 35 years; Holling 1973 (Ann. Rev. Ecol. Syst.) – resilience of ecological systems; Scheffer *et al.* 2001 (Nature) – catastrophic shifts and early-warning signals of tipping points.

Week 10: Novel Ecosystems | Planetary Boundaries
Readings:
Steffen *et al.* 2007 (AMBIO) – Anthropocene definition and changes; Hobbs *et al.* 2006 (Global Ecol. Biogeogr.) – novel ecosystems theory.
Rockström *et al.* 2009 (Nature) – planetary boundaries proposal; Steffen *et al.* 2015 (Science) – update showing which boundaries (like biodiversity) are crossed.
Griscom *et al.* 2017 (PNAS) – potential of natural climate solutions; Adger *et al.* 2005 (Science) – social dimensions of adaptation;

Module 4: Spatial Ecology
Applying ecological principles across spatial scales

Week 11: Island Biogeography | Metapopulations
Readings:
MacArthur & Wilson 1967 – The Theory of Island Biogeography**;** Rosenzweig 1995 (Species Diversity in Space and Time) – species-area and diversity scaling.
Levins 1969 (American Naturalist) – metapopulation framework; Hanski 1998 (Nature) – empirical metapopulation research and the core-satellite species idea.

Week 12: Connectivity
Readings:
Haddad *et al.* 2015 (Science) – habitat fragmentation experiments over 35 years;
Beier & Noss 1998 (Conservation Biology) – do corridors work? (review of evidence); Tewksbury *et al.* 2002 (PNAS) – field experiment showing corridors increasing plant biodiversity.
Fagan 2002 (Ecology) – effects of river network fragmentation on fish; Nilsson *et al.* 2005 (Science) – status of river fragmentation and flow regulation globally.
Hewitt *et al.* 2011 (Conservation Biology) – guiding principles for climate corridors; Pedlar *et al.* 2012 (Forestry) – assisted migration of trees as climate adaption strategy.

Week 13: Biogeographical Gradients
Readings:
Brown 2014 (Macroecology: Concepts and Consequences) – overview of large-scale patterns; Mittelbach *et al.* 2007 (Ecol. Letters) – review of theories for latitudinal diversity gradient.

Module 5: Conservation and Restoration
Applying ecological principles to rebuild and conserve ecosystems

Week 14: Indigenous Knowledge | Nature Based Solutions
Readings:

Berkes *et al.* 2000 (Ecological Applications) – traditional knowledge in ecosystem management; Moomaw *et al.* 2018 (Frontiers) – managing peatlands for climate mitigation.
Kabisch *et al.* 2016 (Ambio) – nature-based solutions in urban planning; Elmqvist *et al.* 2015 (Solutions) – urban ecology for sustainable cities (examples from around the world).

THEORY WEEK

Week 15-16: Applying Ecological Theories to Conservation and Restoration
Readings:
Silliman et al 2023 (Current Biology)- Harnessing Ecological Theory for Restoration

Each student will tackle one ecological theory and create a short presentation that: a) describes and depicts the ecological theory, b) shows examples of empirical evidence for the theory, and c) outlines how the ecological theory could be used by scientists or managers focused on conservation issues.

Assessments and Grading

Class Participation (30%): Active participation in class discussions.
Paper Summaries (35%): Weekly assignment to summarize the gaps in knowledge and take home message of each paper we read in class.
Theory Week Presentation (20%): Quality of Theory Week presentation
Theory Week Management Plan (15%): Written management plan using ecological theories to enhance the restoration, management, or conservation of a Florida ecosystem.

Final course grades will be assigned based on the following:

Percent of total points	Letter Grade
93-100%	A
90-92%	A-
87-89%	B+
83-86%	B
80-82%	B-
77-79%	C+
73-76%	C
70-72%	C-
67-69%	D+
63-66%	D
60-63%	D-
<60%	F

Resources and Policies

No Required Textbooks

Papers will be made available. Any relevant book chapters will be scanned and uploaded

Attendance and Make-Up Work
All students are expected to attend every class and are responsible for the materials and information presented.

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. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online *via* GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or *via* https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at: .

Academic Honesty
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*." You will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (i.e., independent project presentations). Even if you completed your independent project in a small group, final papers are expected to be done separately. 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: .

In-Class Recording
In-class recording is allowed by University policy. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal education use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited, and in-class recording is discouraged in this course. Specifically, students may not publish recorded lectures without the written consent of the instructor. A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and deliver by an instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless, of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Software Use

All UF faculty, staff and students 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.

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,

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,* Counseling Services, Groups and Workshops, Outreach and Consultation, Self-Help Library, Wellness Coaching
- U Matter We Care, **www.umatter.ufl.edu/**
- *Career Connections Center,* First Floor JWRU, 392-1601, https://career.ufl.edu/.
- Student Success Initiative, .

Student Complaints

- Residential Course: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/.
- Online Course: https://pfs.tnt.aa.ufl.edu/state-authorization-status/#student-complaint

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TBD