FORS 540: Fire and Disturbance Ecology

WA Franke College of Forestry and Conservation
University of Montana

*Listed as "Disturbance Ecology" in UM Course Catalog / Cyberbear

LOGISTICS

Time: Tuesday, Thursday, 1:00-2:20 pm.
Classroom: Schreiber 303
Web Site: Moodle – https://moodle.umt.edu/

INSTRUCTOR

Philip Higuera (he/him), Professor of Fire Ecology
Virtual Office: umontana.zoom.us/my/philip.higuera
Office Hours: Tuesday, Wednesday, 3:00-4:30 – by appointment
E-mail: philip.higuera[at]umontana.edu (Include "FORS 540" in subject)

COURSE OVERVIEW

Disturbance ecology is an integral part of global change, impacting all aspects of ecosystems, including critical connections within social-ecological systems. You simply cannot understand past, present, or future dynamics without including the critical roles of disturbance, including wildfires, insect outbreaks, heat waves, floods, and hurricanes. Disturbance ecology offers one way to frame these discussions and our understanding of contemporary and anticipated changes, placing them in the context of longstanding ecological processes.

This course draws on foundational literature to expose students to key concepts and theoretical frameworks in disturbance ecology. We focus on wildfire and fire ecology, but it is not exclusive of other key disturbances. After covering foundational literature, we read more recent literature from high-impact journals linking fire and disturbance ecology to contemporary research themes, including global environmental change, ecological feedbacks, and social-ecological resilience.

Learning Outcomes

1. Identify, understand, and critique fundamental concepts and theories in disturbance ecology and fire ecology, from foundational and contemporary literature.
2. Describe the controls and properties of fire in global ecosystems, and demonstrate familiarity with the core set of tools and datasets used to characterize fire activity.
3. Apply fundamental conceptual frameworks from disturbance ecology and fire ecology to contemporary research questions, including one's own thesis or dissertation research.
4. Improve communication and teaching skills, through discussions, presentations, and writing.

Course Organization

We will cover the following topics, roughly in this order, through in-class presentations, student-lead discussions of primary literature and topics, and guest speakers or attending local seminars.

Theme	Topics
Foundational Concepts and Theories	Disturbance as an Ecological Process Disturbance Regime Concept Functional Traits and Adaptations Theoretical Frameworks for Disturbance Processes in Space and Time
Biophysical Drivers & Patterns	Fire as a Fundamental Ecological Process Biophysical Drivers of Fire Behavior and Fire Regimes Disturbance Interactions, Fire and Ecological Feedbacks Fire, Climate, and People, in the Past, Present, and Future
Fire and Social-Ecological Systems	Indigenous Fire Use Social-Ecological Resilience to Fire and Changing Fire Regimes Mitigation of and adaptation to fire-catalyzed ecological transformation

Prerequisites

Graduate students come to this course with diverse backgrounds, but it is designed assuming an exposure to general ecology through at least one upper-level undergraduate (300-400 level) or graduate course. A lack of exposure to ecology can be made up for by exposure to fire science. If you lack exposure to either ecology or fire science, additional readings are recommended, from one of the suggested textbooks below.

Course Readings

We will draw mainly from primary literature from scientific journals, accessible via Moodle or online mechanisms (e.g., Google Scholar, Web of Science, when connected to the UM network).

The following books are not required but excellent sources as an introduction to fire ecology. If your graduate research is strongly focused on fire ecology, any one of these books would be a good addition to your bookshelf:

Agee, J. K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press, Washington, DC.
Baker, W.L. 2009. Fire Ecology in Rocky Mountain Landscapes. Island Press, Washington, DC.
Johnson, E. A. 1992. Fire and Vegetation Dynamics: Studies from the North American Boreal Forest. Cambridge University Press, Cambridge.
Scott, A.C. et al. 2014. Fire on Earth, An Introduction. John Wiley and Sons, Ltd., Oxford.

Computer Access

You thus need reliable internet access for class, in addition to accessing course materials and submitting assignments via Moodle.

Assignments

Weekly Readings

Readings are the foundation of the course and are assigned in the course calendar. We will read 2-4 papers a week ("Assigned Readings" column in the calendar), with readings presented in the order in which they should be read (top to bottom, for Tue. and Thur., respectively). Most weeks also include additional, optional readings ("Supplementary Readings" column in the calendar) that complement the assigned readings. The readings can be dense, so budget enough time to read carefully and critically, and to digest the information. A reasonable estimate is to budget, on average, 45-60 min. per paper.

Leading Paper Discussions

Throughout the semester, students will work in teams of 2-3 (depending on class size) to lead class discussion of selected papers, typically on Thursdays. Each student will be responsible for leading discussion approximately two times. As part of leading discussion, teams are required to meet with the instructor the prior week, to go over discussion questions and their in-class plan. *Details on leading discussions are in the document "LeadingDiscussionPapers" on Moodle.*

Final Paper

One half of the course grade is based on a final paper. The goal of this assignment is to help students integrate fire and disturbance ecology into a component of their ongoing graduate research, and advance in their graduate studies. As such, there is flexibility in what form this paper may take. For example, if your thesis or dissertation topic is tightly linked to a fire ecology topic, the paper could largely overlap with your thesis or dissertation proposal. If you are completing a thesis or dissertation chapter, and your work is well linked to a fire ecology topic, the paper could be a version of this chapter. If your research is not directly fire related, then the paper could take the form of a literature review, focused on a fire-related topic of your choice. *Final paper details are described in the document "FinalPaperGuidlines" on Moodle.*

Due dates:

Tue. 14 Feb., 5 pm – Topic: In $\leq$ 300 words, provide a preliminary title for and description of your final paper, including the format (e.g., research paper, research review, or proposal).

Tue. 14 March, 5 pm – Outline: Provide an updated title of your paper, the intended section headings within the paper, and a brief description of the key goals or content of each section. You may use bullet points for this outline, within each section.

Thur. 4 May, in class – Final Paper: As described above. Students will participate in a peer-review session and have the option of integrating feedback and submitting the paper by the following Monday (by 5 pm).

Expectations

As a graduate course, I expect students to attend class, to have completed assigned readings prior to class, and to participate actively in discussions. As a three-credit course, you should expect to spend an average of 6-9 hours outside of class on the course assignments. During weeks when you are leading class discussion or working on your final paper, you will be on the high end of this estimate, and otherwise you will be on the low end of this estimate.

Grading

This class is offered for a traditional letter grade, or credit/no credit option. Final grades will be based on the following point distribution:

Assignment	Points
Participation: attendance and discussion participation	20
Leadership of group discussions	30
Paper topic and paper outline	10
Final Paper	40
TOTAL	**100**

Break points between number grades and percentages will be based on the table below.

A = ≥ 93%	A- = 90-92%	
B+ = 87-89%	B = 83-86%	B- = 80-82%
C+ = 77-79%	C= 73-76%	C- = 70-72%
D + = 67-69%	D = 63-66%	D- = 60-62%
F = <60%		

COURSE POLICIES

Attendance

Absences will not be excused unless you have extenuating circumstances and have contacted me at least 48 hours in advance of the class. If you know you are going to miss a class, for whatever reason, I appreciate learning via a brief e-mail (but that does not imply the absence is excused).

Assignment due dates

Due dates are firm. Late assignments will not be accepted unless you have extenuating circumstances or have made arrangements with me at least 60 hours prior to the due date.

Out-of-class inquiries

I encourage you to see me if you have questions about course material or assignments. Coming to office hours is the best way to get questions answered. E-mail is typically less effective. If you do e-mail me, please *include "FORS 540" in the subject line* (as I teach more than one class, and this improves efficiencies). *Reply times will vary and may be up to 60 hours.*

Academic Honesty, Plagiarism, and Student Conduct

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with and adhere to the Student Conduct Code.

Academic dishonesty of any form is unacceptable and will be taken seriously by the instructor, the College of Forestry and Conservation, and the University of Montana. This includes plagiarism, when you copy materials from other sources without citing the source or copy someone's work, and cheating, copying material from other students during tests or quizzes. In both cases, you will fail the assignment/exam and the information will be passed on to the Dean of Students Office. It is your responsibility to be familiar with, and adhere to, the University's definition of plagiarism.

Students with Disabilities

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Office of Disability Equity (ODE). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with DSS, please contact DSS in Lommason 154 or 406.243.2243. We will work with you and DSS to provide an appropriate modification.

Course Withdrawal Deadlines

Important dates restricting opportunities to drop a course are listed on the Spring 2023 Official Dates and Deadlines calendar and summarized below:

February 6: Last day to drop classes on Cyberbear with refund.

February 7 – March 28: Drop requires form with instructor and advisor signature, $10 fee from registrar's office, and student will receive a "W" on transcript.

March 29 – May 5: Students are only allowed to drop a class under very limited and unusual circumstances. Drop requires advisor, instructor, and Dean's signatures, $10 fee, and student will receive a "WP" or "WF" on transcript.

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Leading Paper Discussions

The goal of paper discussions is to help place each reading into the broader context of the fields of fire and disturbance ecology, and evaluate the quality of the contribution to the literature. This requires not just reading the paper critically, but understanding the perspectives of the author(s) or research team, and the context within which the paper is published.

Responsibilities for discussion leaders

Students should meet with the instructor to discuss the reading(s), and their plan for the class, during office hours (or by appointment) one week prior to discussion.

1. **Develop 2-3 questions that you will provide to your classmates**, to help guide or focus the in-class discussion. These question should be posted on Moodle one week prior to the discussion date. Use the naming convention "Week X: Paper(s)" (e.g., Week 1: Picket and White (1985)). The questions should explicitly note what readings are called upon, and you should first share these questions with Phil (via e-mail and/or discussion during office hours) before posting them for the rest of the class.

2. **Develop an in-class activity based on the reading.** This should start with a brief presentation (e.g., c. 10-15 min.) addressing some of questions below ("Guidelines…"). Following this presentation the format of class may take different forms, for example, breaking up into smaller groups to address individual questions and then reporting back to the class, discussing the material in the larger group, developing a theoretical figure that links the work to other material, or something more creative.

3. **Lead the in-class discussion, after completing the brief presentation.**

Guidelines for leading in-class discussion or activity

The questions below are intended to help you place each reading into the broader context of literature in the fields of fire and disturbance ecology. This requires understanding the perspectives of the author(s) or research team, and the context within which the paper is published (e.g., journal, year of publication). You could accomplish some of these goals in your summary or in-class activity; your pre-class questions could likewise help address or prime discussion for some of these questions. Consider the following[1]:

[1]Adapted from Tom Veblen, CU Boulder, 2011

1. **Tell your classmates about the authors' professional backgrounds.**

   Check their website. Do they work in academia or in a state or federal agency? Where does most of their research take place – what ecosystems, regions, countries?

2. **What sub-disciplines and theoretical contexts best describe the authors?**

   For example, is most of their work in plant ecology, disturbance ecology, climate science, paleoecology, fire science, etc.

   Can you clearly identify a theoretical context associated with these particular authors?

   What types of tools or methodologies do these authors typically use? For example, do they use field-based measurements, simulations or statistical modeling, dendrochronology, paleoecology, manipulative experiments, etc.

3. **What is the quality of the journal this article is published in? Is it a "high-impact" journal targeted to a broad audience or a discipline- or region-specific journal?**

   ***Note**: for many papers the time devoted to topics 1-3 would be ≤ 5-10 minutes.*

4. **Briefly summarize the content of the article.**

   Be brief in your summary because you can assume that everyone has read the article. In many cases your summary might be quite similar to the abstract of the paper.

5. **Spend most of the time focused on assessing the contribution of the article.**

   Depending on the nature of the paper (e.g. review paper, local vs. global context, single site vs. meta analysis, etc.) the assessment will take a variety of forms but a few possibilities include:

   a. If it is an original research paper, we want to hear your critical evaluation of the research design. How well are the conclusions supported by the evidence? Are there concerns about assumptions underlying particular methods? If you don't feel that you have the personal expertise to critically evaluate the methodology, you can ask other people in the class for their opinions of the research design.

   b. Is the article pertinent to any current debates or controversies? Describe these debates and their histories. Are these long-standing debates (e.g. the relative influence of fuels vs. weather on fire activity) or are they new and rapidly evolving issues (e.g. is fire severity increasing today in the U.S. West)? Who are the people or schools of thought involved on different sides of such controversial issues?

   c. How does a particular article advance the inquiry on a particular research problem? Does it represent an advance in methodology, a new way to frame a question, an improved understanding of some mechanism or process, a novel integration across spatial or temporal scales, etc.?

d. Did the article help you identify some research questions or possibly methods that you might apply to your own research? For example, some of the readings cover topics at a global scale, but do they identify data gaps or needs for new research on particular mechanisms that you could pursue in your own research?

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Final Papers

The goal of this assignment is to help students integrate fire and disturbance ecology into a component of their ongoing graduate research, and advance in their graduate studies. As such, there is flexibility in what form this paper may take. For example, if your thesis or dissertation topic is tightly linked to a fire ecology topic, the paper could largely overlap with your thesis or dissertation proposal. If you are completing a thesis or dissertation chapter, and your work is well linked to a fire ecology topic, the paper could be a version of this chapter. If your research is not directly fire related, then the paper could take the form of a literature review, focused on a fire-related topic of your choice. *In total, the paper is worth 50% of the course grade.*

Topic

Any topic involving fire and disturbance ecology in some aspect is fair game. Your topic selection is due by the end of Tuesday on the fifth week of the semester. See me if you have any questions, want suggestions on literature, or would like to discuss different options.

Length

Your paper should be between 4000-8000 words (main text only). The former is the length of a "short paper" in most journals, and the latter is the size of a full-length paper or a full 15-page NSF proposal. In all cases, the length of the paper should be justified by the content.

Format

Use Times New Roman 12-point font, full 1-inch margins, and a consistent format for sections headings, in-text citations, and literature cited. The specific format may take two forms:

(a) For research or review papers, text should be double-spaced, with tables and figures placed after the literature cited section. For section headings and citation format, follow the format of the journal *Ecology* by default. Other journal formats are acceptable, if you are consistent. The goal is to apply formatting consistently, as needed for submitting a paper for publication.

(b) For research proposals, the text may be single spaced, with figures carefully placed within the text. The format for proposals can vary widely, depending on the target. Above all, select a professional formatting style and apply it consistently throughout document.

Bibliography and Citations

To organize your literature and follow a consistent format when writing, in this class and in your graduate career, I highly encourage you to use a reference-management software that supports "cite-while-you-write" functionality (e.g., EndNote [web-based version is free], Mendeley [free], or Zotero [free]). These programs help organize your literature, and they assure that all references cited are in your bibliography (and vice versa) in the correct format. It is easy to change formats too, if you end up publishing your paper in *Science* instead of *Nature*.

Format requirements are strict, so make sure you select and follow a format consistently

Rough Drafts

I am happy to review a rough draft of your paper and provide feedback if helpful, so long as you give me at least one week for turn around. If you submit a paper for rough-draft review, please use double-spaced text.

DUE DATES:

Upload documents via Moodle unless otherwise noted. Save your document using the following naming convention: "LastName_FirstName_AssignmentName" e.g., "Higuera_Philip_Topic."

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Tue. 14 March – Outline: Provide an updated title of your paper, the intended section headings within the paper, and a brief description of the key goals or content of each section. You may use bullet points for this outline, within each section.

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Grading Rubric

Content [20 pt]: The paper includes (a) a clear summary of existing knowledge on the topics, and (b) original thoughts or insights that are from the author, whether it is a review paper, a proposal, or a thesis or dissertation chapter. New thoughts and insights are presented as logical statements or arguments, based upon existing knowledge on the topic or results from a study.

Writing style [10 pt]: The text is organized logically, paragraphs contain clear topic sentences, and transition statements facilitate a smooth flow between paragraphs and sections. The text is free or typographical errors.

Format [10 pt]: The paper follows the format guidelines described above, including in-text citations and literature cited.