Department of
Forest and Rangeland Stewardship

F624: Fire Ecology (Online)

Department of Forest and Rangeland Stewardship
Warner College of Natural Resources

COURSE SYLLABUS

Instructor:	Dr. Jeff Carroll
E-Mail (preferred):	cjwcarroll@gmail.com
Term:	Spring 2023
Class time and location:	Online
Communication Policy:	I attempt to reply as quickly as I can to emails
Office hours:	AM: TBD; PM: Wednesday 7-8 MT. Both sessions will be via MS Teams. Other Hours by appointment.
Course credits:	3 semester units

Course Overview

Fire is a fundamental and typically inevitable ecological process in most terrestrial ecosystems. Fire regimes (the combination of fire timing, behavior, and spatial patterning) vary spatially and temporally depending on vegetation, weather, climate, topography, and humans. In turn, variations in fire regimes affect what plants and animals are able to establish and grow in any one location. Plants and animals may exhibit a variety of adaptations that allow them to survive - and even thrive - in the presence of fire. Others do not. Throughout this course we will examine three ecological themes: how variations in fire behavior, spatial patterns, and timing affect individuals, species, and communities; the morphological, physiological, and behavioral traits that allow species to persist through or replace themselves after fire (or not); and how variations in vegetation structure and dynamics in combination with changes in weather, climate, geophysical factors, and human activities affect variations in how fire burns across landscapes and through time.

The first third of the course will cover what affects variation in fire regimes across environmental and climatic gradients and what evidence we can use to characterize and define fire regimes. The second third will review some specific evolutionary traits that plants and animals have to fire, and how fire affects community structure. In the final third, we discuss some current issues in fire ecology and fire management, especially focused on Rocky Mountain ecosystems but considering other ecosystems around the world, and how better understanding of fire ecology can help to inform natural resource management policies and actions. Recurrent themes through the semester include: spatial and temporal scales in fire regimes; evolutionary context and life history responses to variations in fire regime characteristics; methods for characterizing fire regimes; varying human and climate influences on fire regimes; and use of fire ecology understanding in natural resources management.

Course Objectives

By the end of the course, students should be able to:

- Define and use terminology, methods, and concepts common in fire ecology and fire science;
- Describe some plant and animal evolutionary responses to fire, and the tolerance (or intolerance) of plants and animals to fire as an ecological factor;
- Identify and interpret how variations in characteristics of fire regimes are used in natural resources management and ecological restoration;

- Apply fire ecology evidence and concepts to help define objectives for management for sustainable ecosystems, especially in light of current issues of climate change, human land use, and invasive species.

Course Prerequisites

Basic ecology.

Course Format

The main format for the course is to discuss and evaluate two to three published papers on select topics in fire ecology during most weeks. Since this is a graduate-level course, I consider this to some extent to be a "journal club" to help increase your critical thinking and ability to interpret, evaluate, incorporate, and question existing knowledge. Most weeks during the semester will start with two to three relatively short lectures to provide some background on the topic of the week, followed by discussion of the papers chosen. Class participants will be expected to have read each paper in detail; not only will we be looking for what a paper has to offer for bettering our understanding of fire ecology but also what additional questions it raises concerning science needs or management implications. The geographic focus of most of the lectures and readings is on western North America, although concepts and facts will be relevant to other areas of the world.

Course evaluation

Your performance in the course will first consist of your active participation in weekly online discussions. My goal with these discussions is for everyone to think about and respond to the lectures, readings, and other material presented each week. All 15 weeks of the semester will include discussion sections, and your participation is worth 10 points each week. Also I encourage everyone to not just post written comments in the discussion sections but also video responses; I think these add another dimension to our discussions and help us all to maintain our social interactions. Many of you taking this course already have quite a lot of experience in either fire management or other areas of natural resource management and I encourage everyone to post photos, personal experiences, links to videos or articles, or whatever you might think of interest to. I find the discussions very enjoyable and often learn quite a lot myself, and I trust everyone else will as well.

There are no exams or quizzes. There are, however, two major assignments during the semester, one due at the beginning of week 10 and the other due at the beginning of week 13. Both of these assignments will consist of 6 to 10 minute-long PowerPoint presentations to be uploaded and presented to rest of the class. The first is a description of the fire regime, some specific plant and animal fire ecology, and fire or other management concerns of an ecosystem of your choice. The second is a grant proposal to research some aspect of fire ecology in either the ecosystem you reviewed in the first assignment or another that you are familiar with (perhaps where you're working right now). Details and rubrics for these assignments are available on canvas.

Basis for Final Grade

Assignment	Grade points	Grade percentage
Weekly discussion participation (15 wks * 10 pts per wk)	150	~37%
Introductory video to class	20	~5%
Ecosystem fire regime presentation	120	~29%
Grant proposal presentation	120	~29%
Total:	**410**	**100%**

Final grades will be assigned based on a straight curve (90-100% = A; 80-89.9% = B; 70-79.9% = C; 60-69.9% = D; <60% = F).

Course Schedule

Module	Topic	Schedule & Assignments	Learning Objectives
1 1/17 - 1/22	**Introduction**	- Lecture: Ecology review and where fire ecology fits in - Lecture: Defining ecosystems - View and discuss: Several short videos of Colorado forest ecosystems and their fire/fuel characteristics	*- Define fire ecology and how it fits in with general ecology* *- Explore some basic ideas about fuels, vegetation structure, variations in fire behavior, and plant adaptations to fire with some examples from Colorado forests*
2 1/23 - 1/29	**Fire behavior**	- Lecture: Fire basics - Lecture: Fire behavior - Assignment: Record a video on your background (20 pts) - Read and discuss: 1. Bond and Keeley (2005) 2. Mutch (1970)	*- Identify components of: 1) the Fire Triangle, and 2) the Fire Behavior Triangle* *- Incorporate some broad ideas about fire effects on plants from an evolutionary standpoint*
3 1/30 - 2/5	**Energy and climate**	- Lecture: Global climate - Lecture: Local climate - Assignment: Send me your idea for fire regime presentation - Read and discuss: 3. Bond et al. (2005) 4. Jackson (2006)	*- Describe how and why climate and ecosystems vary both globally and locally* *- Incorporate changes in space and time into ecological thinking*
4 2/6 - 2/12	**Defining fire regimes I**	- Lecture: Fire regimes - Lecture: Fire climatology - Read and discuss: 5. Brown (2000) 6. Krawchuk & Moritz (2011)	*- Identify components of the Fire Regime Triangle* *- Define and describe climate teleconnections such as ENSO*
5 2/13 - 2/19	**Defining fire regimes II**	- Lecture: Dendrochronology - Lecture: Fire history - Read and discuss: 7. Brown & Wu (2005) 8. Whitlock et al. (2003)	*- Identify general methods of fire history reconstructions* *- Evaluate strengths and limitations of various lines of evidence used to characterize fire regimes*
6 2/20 - 2/26	**Evolution and the role of history**	- Lecture: Plant life histories - Lecture: Evolution & some historical context - Read and discuss: 9. Norris et al. (2015) 10. Weng & Jackson (1999)	*- Define water and light effects on plant life histories* *- Define basic evolutionary concepts* *- Explore paleoecological patterns using historical evidence*
7 2/27 - 3/5	**Fire as an evolutionary force I**	- Lecture: Plant adaptions - Lecture: Animal adaptions - Read and discuss: 11. Keeley et al. (2011) 12. Pausas (2015)	*- Describe basic plant and animal adaptations for either persisting through or recover after fire* *- Apply knowledge of fire regime characteristics to assess fire effects on specific plant or animal species*

8 3/6 – 3/12	**Fire as an evolutionary force II**	- Lecture: Communities - Lecture: Succession - Read and Discuss: 13. Pausas & Parr (2018) 14. Stevens et al. (2020)	*- Describe general concepts of ecological niches, succession, and plant and animal community assemblage*
3/11 - 3/19: Spring Break			
9 3/20 – 3/26	**Historical Range of Variability and ecological restoration**	- Lecture: Historical range of variability (HRV) - Lecture: Ecological restoration - Read and discuss: 15. Abatzoglou & Williams (2021) 16. Coop et al. (2020)	*- Apply use of HRV concept to ecosystem management* *- Identify instances of ecosystem impacts and changes in fire regime characteristics*
10 & 11 3/27 - 4/9	**Fire regime presentations**	- Student PowerPoint presentations of ecosystem fire regimes (120 pts)	*- Present what you have learned about a particular ecosystem and its fire ecology to the rest of the class* *- Discuss additional ecosystems and their fire ecology through fellow students' presentations*
12 4/10 – 4/16	**Fire management I**	- Lecture: Anthropogenic climate change - Lecture: Hayman Fire as a case study - Read and discuss: 17. Hessburg et al. (2019) 18. Fusco et al. (2021)	*- Identify components of current fire management in US in the context of fire ecology and potential impacts from climate change and invasive species* *- Analyze a case study of a recent wildfire in the context of what we have discussed in the class up until this point*
13 & 14 4/17 - 4/30	**Grant proposal presentations**	- Student PowerPoint presentations of research proposals (120 pts)	*- Present a proposal to research some aspect of fire ecology* *- Discuss research ideas presented by others and answer questions posed about your own proposal*
15 5/1 - 5/7	**Fire management II: The role of collaboration**	- Lecture: Collaborative forest and fire management - Read and discuss: 19. North et al. (2015) 20. Urgenson et al. (2016) 21. Schultz & Moseley (2019)	*- Discuss current concepts of collaboration and ecosystem management*

Important Dates to Remember, Spring 2023

Last Day to Add/Drop Classes Without an Instructor Override: Sun, January 22, 2023
Registration Closes: Wed, February 1, 2023
Withdrawal and Repeat/Repair Deadline: Fri, April 14, 2023
Fall 2023 Registration begins: Mon, April 3, 2022 (check RamWeb for specific access date and time)
Spring Recess: Sat, March 11 – Sun, March 19, 2023
Last Day to Process a University Withdrawal: Fri, May 5, 2023
Final Examinations: Mon-Fri, May 8-12, 2023

Library & Research Help

The CSU Libraries Help Desk provides research and technical assistance either in person at Morgan Library or by phone at 970-491-1841. Jocelyn Boice is the librarian supporting this course. Contact her by email at jocelyn.boice@colostate.edu or by phone at 970-491-3882 to ask questions or set up an appointment for in-depth research help.

Course Policies

Late Work
Late work will be accepted with half-off points up to one week late, unless you've contacted me first. One thing I've found with this online class is that since many class participants are working full-time, they may have work assignments that preclude timely review of the papers or uploading of presentations; please let me know any time that's the case and we can discuss options.

Grades of "Incomplete"
"Per university policy, an instructor may assign temporary grade of Incomplete to a student who demonstrates that he or she could not complete the requirements of the course due to circumstances beyond the student's control and not reasonably foreseeable. A student must be passing a course at the time that an Incomplete is requested unless the instructor determines that there are extenuating circumstances to assign an Incomplete to a student who is not passing the course. When an instructor assigns an Incomplete, he or she shall specify in writing using the Department Incomplete Grade Form the requirements the student shall fulfill to complete the course as well as the reasons for granting an Incomplete when the student is not passing the course. The instructor shall retain a copy of this statement in his or her grade records and provide copies to the student and the department head or his or her designee." (Section I.6 of the *Academic Faculty and Administrative Professional Manual*)

Disability Access
"Colorado State University is committed to providing reasonable accommodations for all persons with disabilities. Students with disabilities who need accommodations must first contact Resources for Disabled Students before requesting accommodations from the professor. Resources for Disabled Students (RDS; http://rds.colostate.edu/home) is located in room 100 of the General Services Building. Their phone is (970) 491-6385 (V/TDD). Students who need accommodations in this course must contact the professor at the beginning of the semester to discuss needed accommodations."

Academic Integrity
"The Department of Forest and Rangeland Stewardship takes academic integrity seriously. At minimum, academic integrity means that no one will use another's work as their own. The CSU writing center defines plagiarism this way:

> Plagiarism is the unauthorized or unacknowledged use of another person's academic or scholarly work. Done on purpose, it is cheating. Done accidentally, it is no less serious. Regardless of how it occurs, plagiarism is a theft of intellectual property and a violation of an ironclad rule demanding "credit be given where credit is due."
> Source: (Writing Guides: Understanding Plagiarism. http://writing.colostate.edu/guides/guide.cfm?guideid=17)

If you plagiarize in your work you could lose credit for the plagiarized work, fail the assignment, or fail the course. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog (under "Academic Integrity/Misconduct: http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/ .)

Of course, academic integrity means more than just avoiding plagiarism. It also involves doing your own reading and studying. It includes regular class attendance, careful consideration of all class materials, and engagement with the class and your fellow students. Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, we will ask to you sign the CSU Honor Pledge as part of completing all of our major assignments. While you will not be required to sign the honor pledge, we will ask each of you to write and sign the following statement on your papers and exams:
"I have not given, received, or used any unauthorized assistance.""

Personal note: I assume that since all students in this class are graduate students and professionals the above statement is highly unlikely to be relevant. However, owing to a past incidence in another class, please be aware I will occasionally run the Vericite software on assignments, purely at random.

Title IX Information

"CSU's Student Sexual Harassment and Violence policy, following national guidance from the Office of Civil Rights, requires that faculty follow CSU policy as a "mandatory reporter" of any personal disclosure of sexual harassment, abuse, and/or violence related experiences or incidents shared with the faculty member in person, via email, and/or in classroom papers or homework exercises. These disclosures include but are not limited to reports of personal relational abuse, relational/domestic violence, and stalking. While faculty are often able to help students locate appropriate channels of assistance on campus (e.g., see the CSU Health Network link below), disclosure by the student to the faculty member requires that the faculty member inform appropriate CSU channels to help ensure that the student's safety and welfare is being addressed, even if the student requests that the disclosure not be shared.

For counseling support and assistance, please see the CSU Health Network, which includes a variety of counseling services that can be accessed at: http://www.health.colostate.edu/. And, the Sexual Assault Victim Assistance Team is a confidential resource for students that does not have a reporting requirement and that can be of great help to students who have experienced sexual assault. The web address is http://www.wgac.colostate.edu/need-help-support."
Source: http://oeo.colostate.edu/title-ix-sexual-assault

Non-Discrimination Statement

"Colorado State University does not discriminate on the basis of race, age, creed, color, religion, national origin or ancestry, sex, gender, disability, veteran status, genetic information, sexual orientation, gender identity or expression, or pregnancy. The University complies with the Civil Rights Act of 1964, as amended, related Executive Orders 11246 and 11375, Title IX of the Education Amendments Act of 1972, Sections 503 and 504 of the Rehabilitation Act of 1973, Section 402 of the Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended, the Age Discrimination in Employment Act of 1967, as amended, The Pregnancy Discrimination Act of 1978, Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, the ADA Amendments Act of 2008, the Genetic Information Nondiscrimination Act of 2008, and all civil rights laws of the State of Colorado. Accordingly, equal opportunity of employment and admission shall be extended to all persons. The University shall promote equal opportunity and treatment in employment through a positive and continuing affirmative action program for ethnic minorities, women, persons with disabilities, and veterans. The Office of Equal Opportunity is located in 101 Student Services." Source: http://oeo.colostate.edu/non-discrimination-statement

My Goal

First and foremost, my goal is to provide an environment that encourages everyone to participate and learn together. I recognize that special circumstances and unforeseen events are part of life (particularly right now), and I ask you to bring any concerns you have to me, and I will do my best to accommodate any issues that arise. I am willing to make many things work, as I know that not everyone is in the same situation. So please let me know!